RAPID RISK ASSESSMENT

Dengue outbreak in Réunion, France

First update, 5 July 2018

Main conclusions and options for response

Since the beginning of 2018 and as of 24 June, 5 747 autochthonous cases of dengue have been reported in Réunion, with no fatal case directly attributable to dengue reported. Dengue virus (DENV) transmission in Réunion is not unexpected, but the current DENV-2 outbreak is larger compared with previous dengue outbreaks reported on the island over the last 15 years. *Aedes albopictus* mosquito is considered to be the principal vector. With the arrival of the southern-hemisphere winter in July, and based on the observed pattern of previous outbreaks on the island, this outbreak is expected to weaken in intensity as the climatic conditions will become less favourable for mosquito activity. However, no marked decline has been observed yet.

The probability of onward transmission of dengue fever in the European Union (EU) and the European Economic Area (EEA) Member States is associated with the importation of the virus by viraemic travellers into receptive areas, defined as a location with established and active competent vectors. *Aedes albopictus* is established in the southern part of the EU (more information about vector distribution is available from: https://ecdc.europa.eu/en/disease-vectors/surveillance-and-disease-data/mosquito-maps), and environmental conditions are currently favourable for vector activity. In addition, vector abundance is currently considered sufficient to permit autochthonous transmission of dengue virus and potentially generate local outbreaks.

When visiting areas where DENV is circulating, it is advised to take personal protective measures against mosquito bites to limit exposure to DENV; this applies equally to other *Aedes*-transmitted arboviruses. These measures can reduce the probability of importation of the virus into receptive areas of the EU/EEA.

During the season of high vector activity, early detection of imported dengue cases is essential to prevent the establishment of local transmission. The detection of an autochthonous case in receptive areas in the EU/EEA should trigger epidemiological and entomological investigations to assess the potential for onward transmission and guide vector control measures aimed at lowering the mosquito population density. Increased awareness among clinicians and travellers returning from areas with active dengue virus transmission, combined with adequate laboratory diagnostic capability, are instrumental for the early detection of travel-associated cases.

Travellers returning from areas where dengue virus transmission occurs should be advised to seek medical attention if presenting with symptoms compatible with dengue fever in the first two weeks after return. In order to contribute to reducing the probability of further local transmission, timely detection of cases is particularly relevant for those returning to areas where competent vectors are established. By the same token, symptomatic patients should be advised on how to apply personal protective measures against mosquito bites.

Suggested citation: European Centre for Disease Prevention and Control. Dengue outbreak in Réunion, France – First update, 5 July 2018. Stockholm: ECDC; 2018.

As no vaccines or prophylactic drugs are available, dengue fever prevention is based on protection against mosquito bites. *Aedes* mosquitoes have a diurnal biting pattern, both indoors and outdoors. Personal protection measures should be applied all day long, and especially during the hours of highest mosquito activity (mid-morning, late afternoon to sunset). Personal protective measures to reduce the risk of mosquito bites include the use of mosquito repellent in accordance with the instructions indicated on the product label, wearing long-sleeved shirts and long trousers, and using insecticide-treated mosquito bed nets. Those measures are essential in providing protection from mosquito bites in rooms that are not adequately screened or air-conditioned.

EU/EEA Member States should also consider applying safety measures to prevent the transmission of dengue virus through donations of substances of human origin (SoHO) from travellers returning from Réunion.

Source and date of request

ECDC internal decision, 28 June 2018.

Public health issue

This update of the risk assessment published on 16 April 2018 was triggered by the unusual size and duration of the current dengue fever outbreak driven by *Ae. albopictus*, a mosquito vector present in Réunion and widely distributed in the southern part of EU [1]. The current assessment addresses the public health significance of the event, particularly the likelihood of the introduction of DENV from Réunion, and potential subsequent transmission in EU Member States during the mosquito season in those countries.

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Disease background information

Dengue virus

Dengue is a mosquito-borne disease caused by dengue virus, a member of the *Flaviviridae* family. There are four antigenically distinct serotypes of dengue virus (DENV 1 to 4). The main mosquito vector is *Ae. aegypti* but other mosquitoes, including *Ae. albopictus*, have also been implicated in virus transmission. The virus is not transmitted directly from human to human, except in the case of blood transfusion, or organ and tissue transplantation from viraemic donors.

The majority of infections are either asymptomatic or result in a mild febrile illness. Symptoms include a sudden onset of febrile illness lasting an average of 2–7 days, usually characterised by severe headache, retro-orbital pain, arthralgia and a maculo-papular rash. The more severe and potentially deadly forms, classified as severe dengue, develop in less than 5% of patients [2].

A DENV infection can be identified through detection of the viral antigen NS1, the viral genome, or DENV-specific antibodies. In primary DENV infections, the NS1 antigen can be detected typically up to day 14 post onset of symptoms while in secondary infections it can be detected up to day five. Viral RNA usually can be detected up to day seven. Confirmation of infection based on routine serology only, is complicated by extensive cross-reactivity between the four serotypes and other flaviviruses (including Zika virus, yellow fever, West Nile virus, tick-borne encephalitis virus and Usutu virus, the latter three being endemic in parts of the EU/EEA) and related vaccines. In addition, an acute flavivirus infection might boost cross-reactive antibodies due to a previous infection with, or vaccination against, another flavivirus thereby interfering with a proper interpretation of serological tests. Serological diagnosis can be performed by detection of DENV-specific IgM antibodies five to six days after onset of symptoms or detection of a fourfold rise in DENV-specific IgG antibody titres on paired serum samples taken 14 days apart. In secondary dengue, IgM antibodies usually appear from day two post symptom onset [3,4]. Diagnostics for DENV are available in reference laboratories in 28 EU/EEA countries, with 25 countries offering molecular detection, 24 countries offering routine serology, and 10 countries offering virus neutralisation tests

(gold standard serological method). All countries with *Ae. albopictus* presence have DENV diagnostic capacity. A complete overview of DENV diagnostic capacity in the EU/EEA can be found in the EVD-LabNet directory [5].

Patients with severe dengue can recover without sequelae if diagnosed early and treated appropriately. There is currently no vaccine available for dengue fever, and treatment of the disease is symptomatic and supportive. More information on dengue fever is available in the ECDC dengue fever factsheet.

Mosquito vectors

Ae. aegypti is considered the main primary vector for dengue virus transmission. *Ae. aegypti* is not present in the continental EU, but the species is established around the Black Sea and in several EU Overseas Counties and Territories (OCTs) such as Madeira and several islands in the Caribbean region (e.g. Martinique and Guadeloupe). Of note, this species was introduced to Fuerteventura, Canary Islands, in 2017. For more information on *Ae. aegypti*, see the ECDC factsheet for experts [6] and the map on the current distribution of *Ae. aegypti* in the EU/EEA (June 2018) [7].

Ae. albopictus is competent for all four dengue virus serotypes, but it is considered less competent to DENV infection than *Ae. aegypti* [8]. From an epidemiological historical perspective, there are only a limited number of dengue outbreaks described that were sustained by *Ae. albopictus*. Therefore, this mosquito species is considered as a less efficient dengue virus epidemic vector than *Ae. aegypti* [8]. However, *Ae. albopictus* might act as a driver of an epidemic in areas where *Ae. aegypti* is absent or its population is too low to be considered having an epidemiological importance [9]. For instance, outbreaks likely to have been driven by *Ae. albopictus* in the past include earlier outbreaks in the main islands of Japan; in Hawaii; and in the city of Guangzhou, Guangdong Province, China, a location where *Ae. aegypti* is reported to be absent [9-13].

In Réunion, dengue virus transmission is driven by *Ae. albopictus*. The vector is widespread below 800 meters of altitude, particularly in anthropised areas [14]. *Ae. albopictus* is the dominant species while *Ae. aegypti* persists only as residual populations, mainly found in natural habitats, such as ravines located on the west coast [15,16]. The mosquito population shows seasonal variation throughout the year, with the highest density in the humid season from December to April, but can remain active all year long [17]. The local *Ae. albopictus* populations are historically known to be competent for the transmission of dengue virus and chikungunya virus, with a vector capacity for dengue virus able to support seasonal transmission as illustrated by recurrent episodes of transmission (see Annex 1) [18]. Between 2004 and 2017, between 10 and 228 probable and confirmed autochthonous dengue fever cases were reported annually (Annex 2). Before this period, only one large dengue outbreak in Réunion was documented in the literature: the 1977–78 outbreak had an estimated overall attack rate of 300 cases per 1 000 inhabitants; DENV-2 was the suspected associated serotype [19,20].

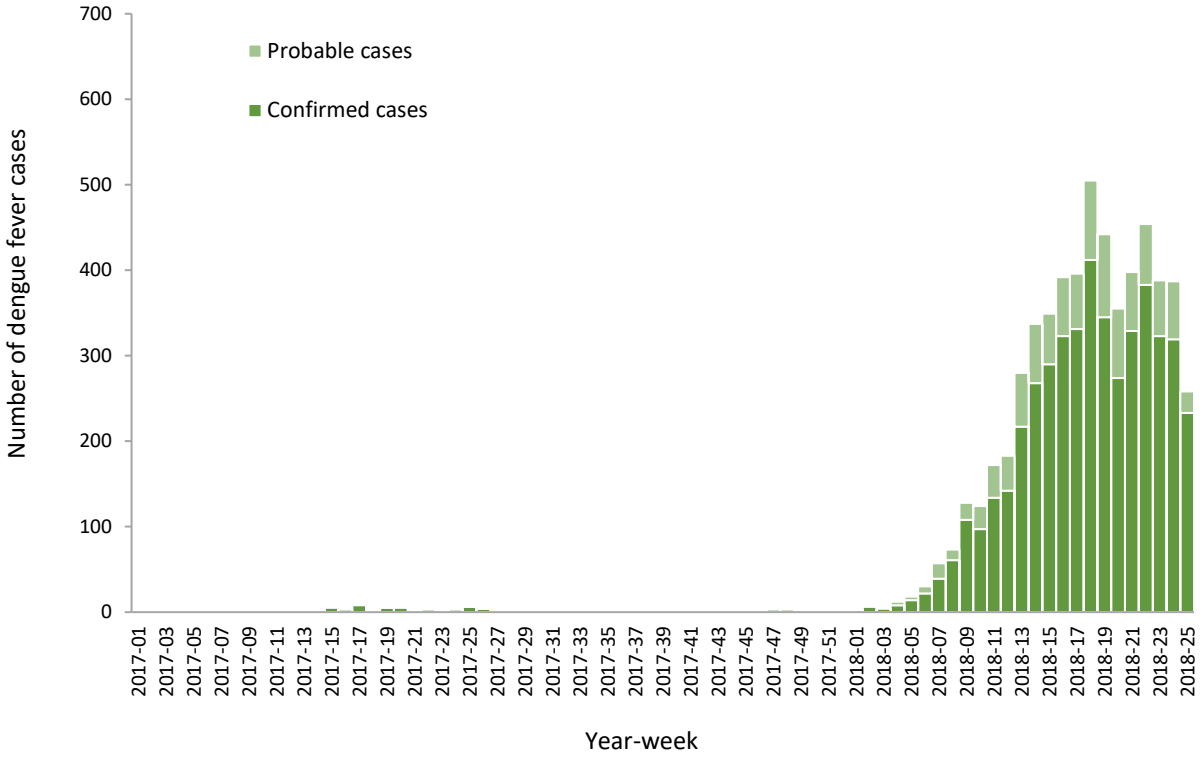
Since the 1990s, *Ae. albopictus* has become increasingly present in the EU. It is currently established in the southern part of the EU (see Annex 1 for a detailed map) where the vector is active in the summer and early autumn. This is illustrated by sporadic events of transmission of dengue virus and chikungunya virus driven by *Ae. albopictus* in the southern EU. (See Annex 1 of the ECDC Rapid Risk Assessment, Cluster of autochthonous chikungunya cases in France – 23 August 2017) [21].

Event background information

In 2017, the dengue outbreak in Réunion peaked in late April (week 17), with 72 confirmed and 22 probable autochthonous cases [22]. Between the end of July (week 31) and the end of the year, only sporadic autochthonous cases were reported, mainly in the commune of Saint-Paul, supporting a possible residual low transmission level during the southern-hemisphere winter (June to September) [23].

The epidemic curve of autochthonous cases of dengue fever in Réunion since January 2017 is presented in Figure 1 [24].

Figure 1. Number of autochthonous cases of dengue in Réunion, by week of onset (week 1–2017 to week 25–2018)

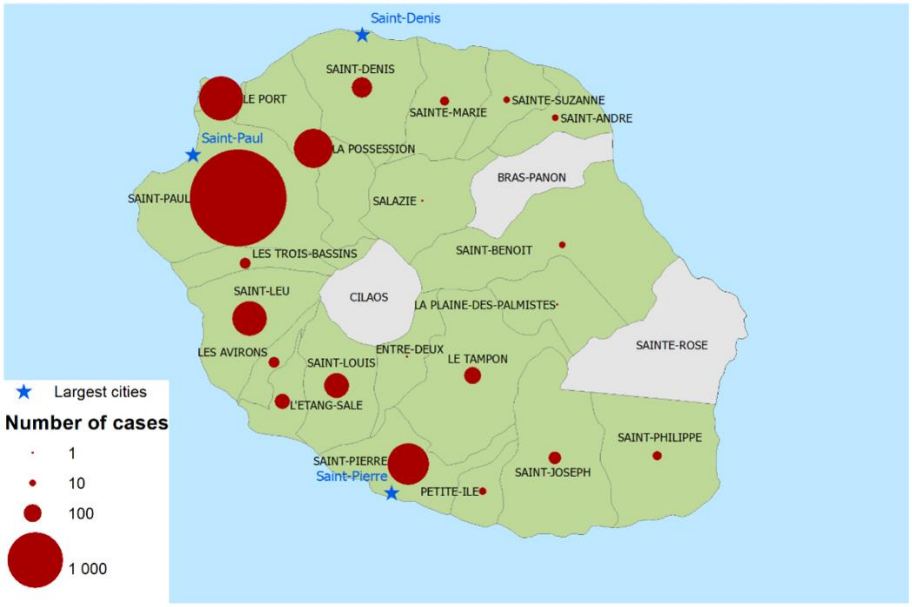


Source: Adapted from 'Surveillance de la dengue à la Réunion. Point épidémiologique au 3 juillet 2018', Cire océan Indien. Santé publique France (2018) [24]. Incomplete data for week 25.

Since the beginning of 2018 and as of 24 June, 5 747 autochthonous cases of dengue have been reported in Réunion [24]. One fatal case was reported as indirectly related to dengue. Of these cases, 259 were reported between 18 and 24 June 2018 [24]. The circulating serotype is DENV-2. The main vector of infection implicated in this outbreak is considered to be *Ae. albopictus.*

As of 24 June 2018, the municipality of Saint-Paul, one of the most populated areas in the island, reported 52% of the total number of cases (n=2 989) [24]. Additional cases in the western part of the island were reported in the communes of Le Port (n=629, 11% of total), La Possession (n=480, 8% of total) and Saint-Leu (n=382, 7% of total). In the southern part of the island, the majority of the cases were reported from Saint-Pierre commune (n=543, 10% of total). Four communes, namely Saint Paul, Le Port, La Possession and Saint Leu, reported an overall incidence rate over 100 dengue cases per 10 000 inhabitants (January 2018 to 24 June 2018).

Figure 2. Geographical distribution of autochthonous cases of dengue in Réunion, data from January 2018 to 24 June 2018



Source: Adapted from: Surveillance de la dengue à la Réunion. Point épidémiologique au 3 juillet 2018', Cire océan Indien. Santé publique France (2018) [24].

On 27 March 2018, local authorities decided to activate level 3 of the ORSEC (Organisation de la Réponse de Sécurité Civile) plan to enhance response activities. Alert level 3 corresponds to a 'low intensity epidemic'. The current response activities include the following measures: intensification of vector control (integrated and multi-sectoral vector control measures), reinforcement of communication to the public and healthcare workers and mobilisation of additional resources. More information is available in a local bulletin entitled 'Point de situation: zones concernées & chiffres-clé' [25].

The French Blood Bank (Etablissement Français du Sang) implemented systematic individual nucleic acid testing (NAT) of blood donations on 3 April 2018 to complement its SoHo measures, including reinforced post-donation follow-up, red blood cell quarantine for 72 hours, and pathogen attenuation of the platelets and plasma supply from continental France. Blood collection is interrupted in the affected area (Saint-Paul area). In other French departments, blood donors should be deferred for 28 days after returning from Réunion.

ECDC risk assessment

The ongoing dengue epidemic in Réunion has an unusual magnitude compared with previous dengue outbreaks reported since 2004. The high number of cases reported every week indicates that the outbreak is still ongoing. In addition, the fact that cases are reported from almost all communes of the island indicates widespread transmission. The western part of the island is the one most affected, with a moderate level of transmission in several foci.

Based on previous dengue fever outbreaks caused by *Aedes* mosquitoes in Réunion, transmission is expected to persist up to the beginning of the southern-hemisphere winter (July–September); however, a marked decline has not yet been observed. It should be noted that sporadic DENV-2 cases were reported during the inter-epidemic period in 2017, supporting possible transmission even during the austral winter on the island and a potential new outbreak during the austral summer 2018–2019.

While dengue outbreaks occur regularly in many tropical countries, most outbreaks are sustained by *Ae. aegypti* mosquitoes, its primary vector, which is not established in the continental EU. The fact that the implicated vector in the ongoing outbreak in Réunion is *Ae. albopictus* increases the likelihood of sustained local transmission in the continental EU.

To date, there is no evidence of local genetic adaptation of dengue virus to *Ae. albopictus* in Réunion, which could lead to enhanced virus transmission to the *Ae. albopictus* mosquito population in Réunion or the continental EU. While the large outbreak observed in Réunion demonstrates a marked vectorial capacity of the current circulating DENV-2 serotype in the *Ae. albopictus* population, further genetic, molecular and entomological investigations remain of interest to better describe and assess transmission characteristics.

According to data (2011 and 2016) from the International Air Transport Association (IATA), an average of 500 000 people travel from Réunion to the EU/EEA every year. The most popular travel periods are i) December–January and ii) July–August, when between 40 000 to 50 000 people travel to EU/EEA Member States every month, mostly to mainland France. Due to the ongoing outbreak characteristics in Réunion and recent travel-associated dengue

cases returning from Réunion, travellers visiting areas with current DENV transmission in Réunion should be made aware of the ongoing outbreak and be advised to strictly apply personal protective measures to reduce exposure to mosquitoes bites.

Introduction and further transmission in the continental EU/EEA

The likelihood of introduction of the virus to the continental EU/EEA is linked to the number of viraemic travellers returning while the likelihood of sustained transmission is linked to the presence of an established, active and abundant competent vector population.

In 2016, 2 705 imported dengue cases were reported to The European Surveillance System (TESSy), highlighting the noticeable frequency of travel-associated dengue cases reported by EU/EEA countries. Information on suspected country of infection was available for 1 504 of these cases. The most frequently reported suspected countries of infection were Asian countries: Thailand (21%), Indonesia (18%) and India (12%). France reported one imported case from Réunion.

To date in 2018, 57 imported cases have been notified in *Aedes*-active areas in France, 21% of which were imported from Réunion and 35% from Thailand. The likelihood of introduction of DENV to continental EU/EEA countries is considered to be low. The current outbreak in Réunion would, to some extent, increase the level of likelihood of introduction of DENV to the EU/EEA through viraemic travellers, especially in mainland France.

Environmental conditions in southern EU are currently favourable for vector activity as vector abundance is sufficient to allow the autochthonous transmission of dengue virus, which could potentially lead to a local outbreak. This was exemplified by the chikungunya outbreaks in Italy in 2007 and 2017 and sporadic autochthonous cases of DENV and/or CHIKV reported in France and in Croatia (see Annex 1 of athe 2017 ECDC Rapid Risk Assessment: Cluster of autochthonous chikungunya cases in France – 23 August 2017) [21]. With regard to dengue, all reported events of transmission corresponded to sporadic cases or limited clusters of cases and always occurred during the season of high vector activity.

Therefore, the likelihood of local transmission of DENV in these areas is considered to be moderate.

Outside the continental EU, the EU Overseas Countries and Territories (OCTs) and Outermost Regions (ORs), with established populations of *Ae. aegypti,* remain vulnerable to dengue epidemics, as demonstrated by recurrent dengue fever outbreaks in the Caribbean region and the outbreak in Madeira in 2012 [26,27].

Dengue and safety of substances of human origin

DENV can be transmitted through infectious substances of human origin (SoHO) donated by asymptomatic, viraemic donors. Transmission of DENV through transfusion of erythrocytes, platelets and plasma [28-33] as well as through kidney [34,35], liver [35-37], heart [35] and bone marrow [38,39] transplantation have been reported in the past. The precise level of risk of DENV transmission through SoHO cannot be adequately assessed due to the small number of cases reported. The rarity of reported SoHO-transmitted dengue cases could be partly explained by under-recognition and under-diagnosis of this disease in many endemic countries around the world.

Other transmission factors include the hypothetical enhancement of DENV replication and DENV virulence in the saliva of the mosquito, the presence of protective antibodies among transfusion recipients or in co-transfused antibody-positive blood components [29]. Further data are needed to assess the risk of DENV transmission thorough SoHO more precisely.

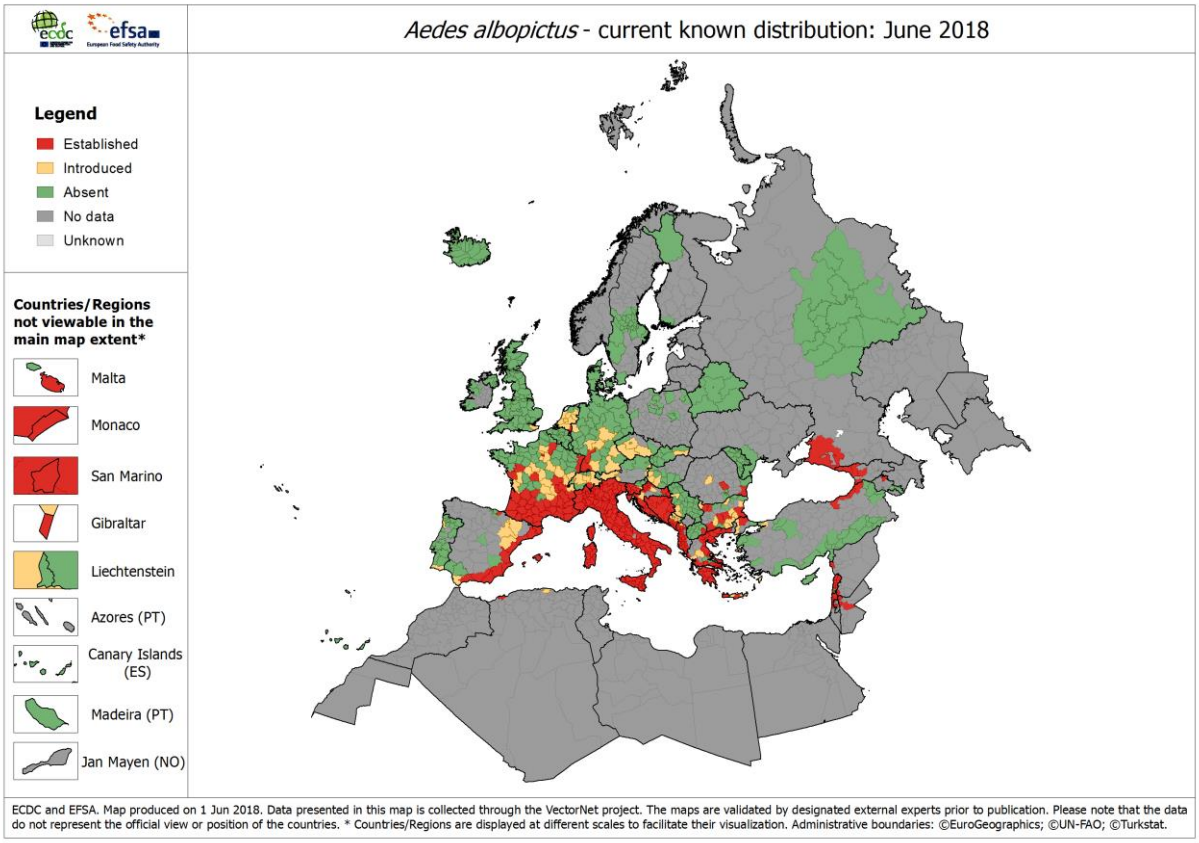
To prevent transfusion-transmitted DENV infection, blood donors should be deferred for 120 days after full recovery from clinical dengue [40]. In affected areas, donors with flu-like symptoms should be deferred for 28 days after the resolution of symptoms [40]; alternatively, donations should be quarantined for 72 hours and released upon the information of absence of symptoms in the donor.

Donation screening using nucleic acid testing (NAT) is the main tool to reduce the risk of transmission in affected areas when deferrals may potentially affect supply. For plasma and platelets donations, pathogen-reduction technology may also be considered. Post-donation information should be reinforced. Potential asymptomatic donors whose travel histories place them at risk of dengue infection should be deferred for 28 days upon return to non-endemic areas [40].

Donors of organs, cells and tissues living or coming from dengue-affected areas should be tested for the presence of viral RNA using NAT [41,42]. Organs from viraemic donors should not be used without consulting a transplant infectious disease expert [41].

Annex 1

Figure 3. Distribution of *Aedes albopictus* in the EU/EEA and neighbouring countries, June 2018



Source: Ae. albopictus*, current known distribution: June 2018* [7]

Annex 2

Table 1. Dengue transmission events with more than 10 cases in Réunion between 2004 and 2017

Years	Start month	End month	Number of cases*	Prevalent dengue serotype	Source
2004	April	June	228	1	[43]
2006–2007	December	October	1 in 2006, 27 in 2007	1	[44]
2008	January	July	33	1	[44]
2010	March	May	18	3	[45]
2012	February	July	31	1 and 3	[46]
2013	February	July	21	1 and 3	[47,48]
2014	March	August	29	1	[49]
2015–2016	October	July	231	1,2 and 3	[50]
2017–2018	February	Underway†	5 747	2	[24]

*Note: * = confirmed and probable dengue cases; † = as of 17 June 2018.*
In 2011, only two confirmed sporadic cases were reported: one in May and one in September [51] .

Disclaimer

ECDC issued this risk assessment document on the basis of an internal decision in accordance with Article 10 of Decision No 1082/13/EC and Article 7(1) of Regulation (EC) No 851/2004 establishing a European Centre for Disease Prevention and Control. In the framework of ECDC's mandate, the specific purpose of an ECDC risk assessment is to present different options on a certain matter with their respective advantages and disadvantages. The responsibility on the choice of which option to pursue and which actions to take, including the adoption of mandatory rules or guidelines, lies exclusively with the EU/EEA Member States. In its activities, ECDC strives to ensure its independence, high scientific quality, transparency and efficiency. This report was written under the coordination of an Internal Response Team at ECDC. All data published in this risk assessment are correct to the best of our knowledge on 26 June 2018. Maps and figures published do not represent a statement on the part of ECDC or its partners on the legal or border status of the countries and territories shown.

References

1. European Centre for Disease Prevention and Control. Dengue outbreak in Réunion, France - 16 April 2018. Stockholm: ECDC, 2018.
2. European Centre for Disease Prevention and Control (ECDC). Factsheet about dengue fever 2018 [cited 2018 Jul 3]. Available from: https://ecdc.europa.eu/en/dengue-fever/facts/factsheet.
3. Goncalves A, Peeling RW, Chu MC, Gubler DJ, de Silva AM, Harris E, et al. Innovative and New Approaches to Laboratory Diagnosis of Zika and Dengue: A Meeting Report. J Infect Dis. 2018 Mar 13;217(7):1060-8.
4. Muller DA, Depelsenaire AC, Young PR. Clinical and Laboratory Diagnosis of Dengue Virus Infection. J Infect Dis. 2017 Mar 1;215(suppl_2):S89-S95.
5. EVD-LabNet. EVD-LabNet directory search. Rotterdam: EVD-LabNet secretariat; 2018 [cited 2018 Apr 10]. Available from: https://www.evd-labnet.eu/evd-labnet-directory-search?species=996-dengue-virus.
6. European Centre for Disease Prevention and Control. *Aedes aegypti* - Factsheet for experts 2018 [cited 2018 Jul 4]. Available from: https://ecdc.europa.eu/en/disease-vectors/facts/mosquito-factsheets/aedes-aegypti.
7. European Centre for Disease Prevention and Control and European Food Safety Authority. Exotic mosquitoes: Distribution maps Stockholm: ECDC; 2018 [cited 2018 Jul 4]. Available from: https://ecdc.europa.eu/en/disease-vectors/surveillance-and-disease-data/mosquito-maps.
8. Lambrechts L, Scott TW, Gubler DJ. Consequences of the expanding global distribution of Aedes albopictus for dengue virus transmission. PLoS Negl Trop Dis. 2010;4(5):e646.
9. Gratz NG. Critical review of the vector status of Aedes albopictus. Medical and veterinary entomology. 2004 Sep;18(3):215-27.
10. Tsuda Y, Maekawa Y, Ogawa K, Itokawa K, Komagata O, Sasaki T, et al. Biting Density and Distribution of Aedes albopictus during the September 2014 Outbreak of Dengue Fever in Yoyogi Park and the Vicinity of Tokyo Metropolis, Japan. Jpn J Infect Dis. 2016;69(1):1-5.
11. Kutsuna S, Kato Y, Moi ML, Kotaki A, Ota M, Shinohara K, et al. Autochthonous dengue fever, Tokyo, Japan, 2014. Emerg Infect Dis. 2015 Mar;21(3):517-20.
12. Effler PV, Pang L, Kitsutani P, Vorndam V, Nakata M, Ayers T, et al. Dengue fever, Hawaii, 2001-2002. Emerg Infect Dis. 2005 May;11(5):742-9.
13. Luo L, Jiang LY, Xiao XC, Di B, Jing QL, Wang SY, et al. The dengue preface to endemic in mainland China: the historical largest outbreak by Aedes albopictus in Guangzhou, 2014. Infect Dis Poverty. 2017 Sep 22;6(1):148.
14. Boyer S, Foray C, Dehecq JS. Spatial and temporal heterogeneities of Aedes albopictus density in La Reunion Island: rise and weakness of entomological indices. PLoS One. 2014;9(3):e91170.
15. Delatte H, Paupy C, Dehecq J, Thiria J, Failloux A, Fontenille D. *[Aedes albopictus* , vecteur des virus du chikungunya et de la dengue à la Réunion : biologie et contrôle.]2008; 15(1):[3-13 pp.]. Available from: https://hal-pasteur.archives-ouvertes.fr/pasteur-01696240/document.
16. Bagny L, Delatte H, Quilici S, Fontenille D. Progressive decrease in Aedes aegypti distribution in Reunion Island since the 1900s. J Med Entomol. 2009 Nov;46(6):1541-5.
17. Gouagna LC, Dehecq JS, Fontenille D, Dumont Y, Boyer S. Seasonal variation in size estimates of Aedes albopictus population based on standard mark-release-recapture experiments in an urban area on Reunion Island. Acta Trop. 2015 Mar;143:89-96.
18. Vazeille M, Mousson L, Martin E, Failloux AB. Orally co-Infected Aedes albopictus from La Reunion Island, Indian Ocean, can deliver both dengue and chikungunya infectious viral particles in their saliva. PLoS Negl Trop Dis. 2010 Jun 8;4(6):e706.
19. Coulanges P, Clercy Y, Jousset F, ., Rodhain F, Hannoun C. [Dengue at Reunion: isolation of a strain at the Pasteur Institute of Madagascar]. Bull Soc Pathol Exot Filiales. 1979;72(3):205-9.
20. Kles V, Michault A, Rodhain F, Mevel F, Chastel C. [A serological survey regarding Flaviviridae infections on the island of Reunion (1971-1989)]. Bull Soc Pathol Exot. 1994;87(2):71-6.
21. European Centre for Disease Prevention and Control. Cluster of autochtonous chikungunya cases in France – 23 August 2017. Stockholm.2017 [cited 2018 Mar 31]. Available from: https://ecdc.europa.eu/sites/portal/files/documents/RRA-Chikungunya-France-revised-Aug-2017.pdf.
22. Cire océan Indien. Santé publique France. Surveillance de la dengue à la Réunion. Point épidémiologique au 9 avril 2018. Saint Denis, La Réunion.2018 [cited 2018 Apr 12]. Available from: http://invs.santepubliquefrance.fr/Publications-et-outils/Points-epidemiologiques/Tous-les-numeros/Ocean-Indien/2018/Surveillance-de-la-dengue-a-la-Reunion.-Point-epidemiologique-au-9-avril-2018.
23. Cire océan Indien. Santé publique France. Surveillance de la dengue à la Réunion. Point épidémiologique au 3 avril 2018. Saint Denis, La Réunion.2018 [cited 2018 Apr 3]. Available from:

http://invs.santepubliquefrance.fr/fr/Publications-et-outils/Points-epidemiologiques/Tous-les-numeros/Ocean-Indien/2018/Surveillance-de-la-dengue-a-la-Reunion.-Point-epidemiologique-au-3-avril-2018.

24. Cire océan Indien. Santé publique France. Surveillance de la dengue à la Réunion. Point épidémiologique au 3 Juillet 2018. Saint Denis, La Réunion.2018 [cited 2018 Jul 6].
25. Agence régionale de Santé OI. Point de situation : zones concernées & chiffres-clé Saint Denis, La Réunion2018 [cited 2018 Jul 4]. Available from: https://www.ocean-indien.ars.sante.fr/point-de-situation-zones-concernees-chiffres-cle.
26. Torres JR, Orduna TA, Pina-Pozas M, Vazquez-Vega D, Sarti E. Epidemiological Characteristics of Dengue Disease in Latin America and in the Caribbean: A Systematic Review of the Literature. J Trop Med. 2017;2017:8045435.
27. European Centre for Disease Prevention and Control. Surveillance, prevention and control of dengue in Madeira: lessons learnt after the 2013 ECDC mission 2013 [cited 2014 Mar 19]. Available from: https://ecdc.europa.eu/en/news-events/surveillance-prevention-and-control-dengue-madeira-lessons-learnt-after-2013-ecdc.
28. Chuang VW, Wong TY, Leung YH, Ma ES, Law YL, Tsang OT, et al. Review of dengue fever cases in Hong Kong during 1998 to 2005. Hong Kong Med J. 2008 Jun;14(3):170-7.
29. Tambyah PA, Koay ES, Poon ML, Lin RV, Ong BK. Dengue hemorrhagic fever transmitted by blood transfusion. N Engl J Med. 2008 Oct 2;359(14):1526-7.
30. Stramer SL, Linnen JM, Carrick JM, Foster GA, Krysztof DE, Zou S, et al. Dengue viremia in blood donors identified by RNA and detection of dengue transfusion transmission during the 2007 dengue outbreak in Puerto Rico. Transfusion. 2012 Aug;52(8):1657-66.
31. Levi JE, Nishiya A, Felix AC, Salles NA, Sampaio LR, Hangai F, et al. Real-time symptomatic case of transfusion-transmitted dengue. Transfusion. 2015 May;55(5):961-4.
32. Oh HB, Muthu V, Daruwalla ZJ, Lee SY, Koay ES, Tambyah PA. Bitten by a bug or a bag? Transfusion-transmitted dengue: a rare complication in the bleeding surgical patient. Transfusion. 2015 Jul;55(7):1655-61.
33. Matos D, Tomashek KM, Perez-Padilla J, Munoz-Jordan J, Hunsperger E, Horiuchi K, et al. Probable and possible transfusion-transmitted dengue associated with NS1 antigen-negative but RNA confirmed-positive red blood cells. Transfusion. 2016 Jan;56(1):215-22.
34. Tan FL, Loh DL, Prabhakaran K, Tambyah PA, Yap HK. Dengue haemorrhagic fever after living donor renal transplantation. Nephrology, dialysis, transplantation : official publication of the European Dialysis and Transplant Association - European Renal Association. 2005 Feb;20(2):447-8.
35. Rosso F, Pineda JC, Sanz AM, Cedano JA, Caicedo LA. Transmission of dengue virus from deceased donors to solid organ transplant recipients: case report and literature review. The Brazilian journal of infectious diseases : an official publication of the Brazilian Society of Infectious Diseases. 2018 Jan - Feb;22(1):63-9.
36. Gupta RK, Gupta G, Chorasiya VK, Bag P, Shandil R, Bhatia V, et al. Dengue Virus Transmission from Living Donor to Recipient in Liver Transplantation: A Case Report. Journal of clinical and experimental hepatology. 2016 Mar;6(1):59-61.
37. Saigal S, Choudhary NS, Saraf N, Kataria S, Mohanka R, Soin AS. Transmission of dengue virus from a donor to a recipient after living donor liver transplantation. Liver transplantation : official publication of the American Association for the Study of Liver Diseases and the International Liver Transplantation Society. 2013 Dec;19(12):1413-4.
38. Rigau-Perez JG, Vorndam AV, Clark GG. The dengue and dengue hemorrhagic fever epidemic in Puerto Rico, 1994-1995. The American journal of tropical medicine and hygiene. 2001 Jan-Feb;64(1-2):67-74.
39. Punzel M, Korukluoglu G, Caglayik DY, Menemenlioglu D, Bozdag SC, Tekgunduz E, et al. Dengue virus transmission by blood stem cell donor after travel to Sri Lanka; Germany, 2013. Emerg Infect Dis. 2014 Aug;20(8):1366-9.
40. European Directorate for the Quality of Medicines and Healthcare. Guide to the preparation, use and quality assurance of blood components 19th. ed. Strasbourg2017 [cited 2018]. Available from: https://www.edqm.eu/en/blood-transfusion-guide.
41. European Directorate for the Quality of Medicines and Healthcare. Guide to the quality and safety of organs for transplantation 6 the ed. Strassbourg2016 [cited 2018]. Available from: https://www.edqm.eu/en/organs-tissues-and-cells-technical-guides.
42. European Commission. COMMISSION DIRECTIVE 2006/17/EC of 8 February 2006 implementing Directive 2004/23/EC of the European Parliament and of the Council as regards certain technical requirements for the donation, procurement and testing of human tissues and cells 2006 [cited 2018]. Available from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32006L0017.

43. Pierre V, Thiria J, Rachou E, Sissoko D, Lassale C, P. R. Epidémie de dengue 1 à la Réunion en 2004. [Dengue 1 outbreak in Réunion in 2004]. Journées de veille sanitaire. 2005 [cited 2018 Apr 8]. Available from: http://invs.santepubliquefrance.fr/publications/2005/jvs_2005/poster_13.pdf.

44. D'Ortenzio E, Balleydier E, Baville M, Filleul L, Renault P. [Dengue fever in the Reunion Island and in South Western islands of the Indian Ocean]. Med Mal Infect. 2011 Sep;41(9):475-9.

45. Cire océan Indien. Santé publique France. Surveillance de la dengue à la Réunion. Point épidémiologique - N°32 au 18 mai 2010. Saint Denis, La Réunion.2010 [cited 2018 Apr 3]. Available from: http://www.invs.sante.fr/content/download/17600/111139/version/20/file/pe_rm_deng_32_180510.pdf.

46. Cire océan Indien. Santé publique France. Situation de la dengue et du chikungunya : bilan 2012 à la Réunion et dans l'océan Indien. Point épidémiologique au 14 février 2013. Saint Denis, La Réunion.2013 [cited 2018 Apr 3]. Available from: http://invs.santepubliquefrance.fr/fr/content/download/58427/236571/version/37/file/pe_chik_deng_reunion_140213.pdf.

47. Cire océan Indien. Santé publique France. Situation de la dengue à La Réunion. Point épidémiologique au 29 juillet 2013. Saint Denis, La Réunion.2013 [cited 2018 Apr 3]. Available from: http://invs.santepubliquefrance.fr/fr/content/download/72107/271351/version/27/file/pe_dengue_reunion_290713.pdf.

48. Cire océan Indien. Santé publique France. Surveillance des arboviroses à la Réunion. Point au 20 novembre 2013. Saint Denis, La Réunion.2013 [cited 2018 Apr 3]. Available from: http://invs.santepubliquefrance.fr/fr/content/download/80114/292118/version/54/file/pe_arbovirus_reunion_201113.pdf.

49. Cire océan Indien. Santé publique France. Surveillance des arboviroses à La Réunion. Point épidémiologique au 28 novembre 2014. Saint Denis, La Réunion.2014 [cited 2018 Apr 3]. Available from: http://invs.santepubliquefrance.fr/fr/content/download/99415/358075/version/37/file/pe_arbo_reunion_281114.pdf.

50. Cire océan Indien. Santé publique France. Les arboviroses à la Réunion et Mayotte. Bilan de l'année 2016. Saint Denis, La Réunion.2016 [cited 2018 Apr 3]. Available from: http://invs.santepubliquefrance.fr/fr/content/download/133547/478716/version/43/file/pe_arbo_rm_160117.pdf.

51. Cire océan Indien. Santé publique France. Situation de la dengue et du chikungunya à la Réunion et dans l'océan Indien. Point au 29 décembre 2011. Saint Denis, La Réunion.2011 [cited 2018 Apr 3]. Available from: http://invs.santepubliquefrance.fr/fr/content/download/26544/141851/version/13/file/pe_dengue_reunion_291211.pdf.