Large number of imported chikungunya cases in mainland France, 2014: a challenge for surveillance and response

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During the summer of 2014, all the pre-requisites for autochthonous transmission of chikungunya virus are present in southern France: a competent vector, *Aedes albopictus*, and a large number of travellers returning from the French Caribbean islands where an outbreak is occurring. We describe the system implemented for the surveillance of chikungunya and dengue in mainland France. From 2 May to 4 July 2014, there were 126 laboratory-confirmed imported chikungunya cases in mainland France.

In November 2013, locally acquired cases of chikungunya were laboratory-confirmed in the French Caribbean island of Saint Martin [1]. The chikungunya virus rapidly spread in the surrounding French territories (Martinique, Guadeloupe, Saint Barthélemy and French Guiana) in December 2013 and then in most of the islands of the Caribbean [2,3]. By 15 June 2014, there were more than 80,000 clinically compatible cases in the French Caribbean Islands, based on the estimation of the sentinel surveillance [4]. Given the epidemic situation in the French Caribbean, and due to the large amount of travel between mainland France and the Caribbean, it is expected that a large number of chikungunya cases will be imported to mainland France in 2014.

During the summer of 2014, all the pre-requisites for autochthonous transmission of chikungunya virus, and to a lesser extent, dengue virus, will then be present in southern France: a competent vector [5], a large number of viraemic travellers, and favourable climatic conditions for mosquito reproduction and viral replication in the mosquitoes. The likelihood of chikungunya transmission in mainland France is therefore particularly high.

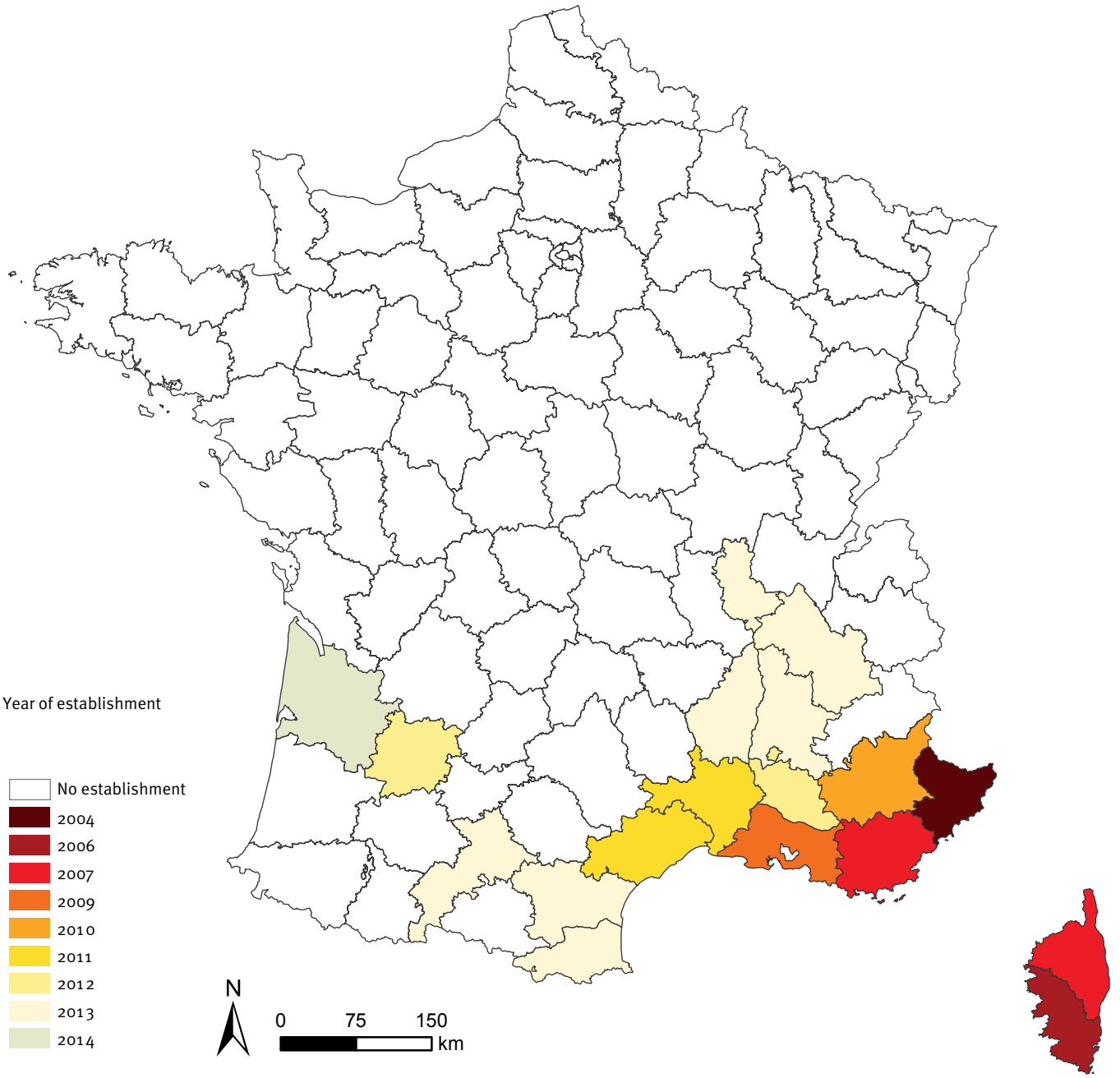
Surveillance of chikungunya and dengue in mainland France

Chikungunya and dengue are mosquito-borne viral diseases, transmitted by *Aedes* mosquitoes, in particular *Aedes aegypti* and *Aedes albopictus*, the latter being present in Europe [6,7]. Since it was identified in 2004 in the French administrative district of Alpes-Maritimes, *Ae. albopictus* has continued to spread in southern France [8,9].

Since 2006, in response to *Ae. albopictus* establishment in southern France, the French Ministry of Health has implemented a dengue and chikungunya preparedness and response plan to monitor and prevent the risk of dissemination of the two viruses in mainland France [10]. Because the two diseases present a number of similarities regarding the clinical and entomological

Figure 1

Establishment of *Aedes albopictus*, by administrative district and year, mainland France, 2004–2014



Source: IGN-GéoFLA, 1999: French Institute for Public Health Surveillance (Institut de Veille Sanitaire, InVS), 2014.

features, a common system has been set up comprising entomological and epidemiological surveillance.

Entomological surveillance for chikungunya and dengue

The entomological surveillance is operated by public local structures of mosquito control, under the coordination and responsibility of the Ministry of Health.

The presence and the spread of *Ae. albopictus* is monitored using ovitraps placed along the French Mediterranean coastline and land inwards along motorways. Traps are checked at least monthly for presence of *Ae. albopictus* eggs. Mosquitoes and eggs are not tested routinely for the presence of dengue and chikungunya viruses.

The administrative districts, according to the year of establishment of *Ae. albopictus*, are shown in Figure 1: from one district in 2004, *Ae. albopictus* has become established in 18 administrative districts in six regions (Provence-Alpes-Côte d'Azur, Corsica, Languedoc-Roussillon, Rhône-Alpes, Aquitaine, Midi-Pyrénées) in 2014.

Epidemiological surveillance for chikungunya and dengue

A suspected case is defined as a person with acute fever (>38.5 °C) and joint pains (chikungunya) or at least one of the following symptoms: headache, retro-orbital pain, joint pains, myalgia or lower back-pain (dengue), not explained by another medical condition. For both diseases, cases are confirmed by serology (IgM positive or a fourfold increase in IgG titre) or detection of viral nucleic acids in plasma by real-time reverse transcription polymerase chain reaction (RT-PCR), or for dengue, a positive dengue nonstructural protein 1 (NS1) antigenic test.

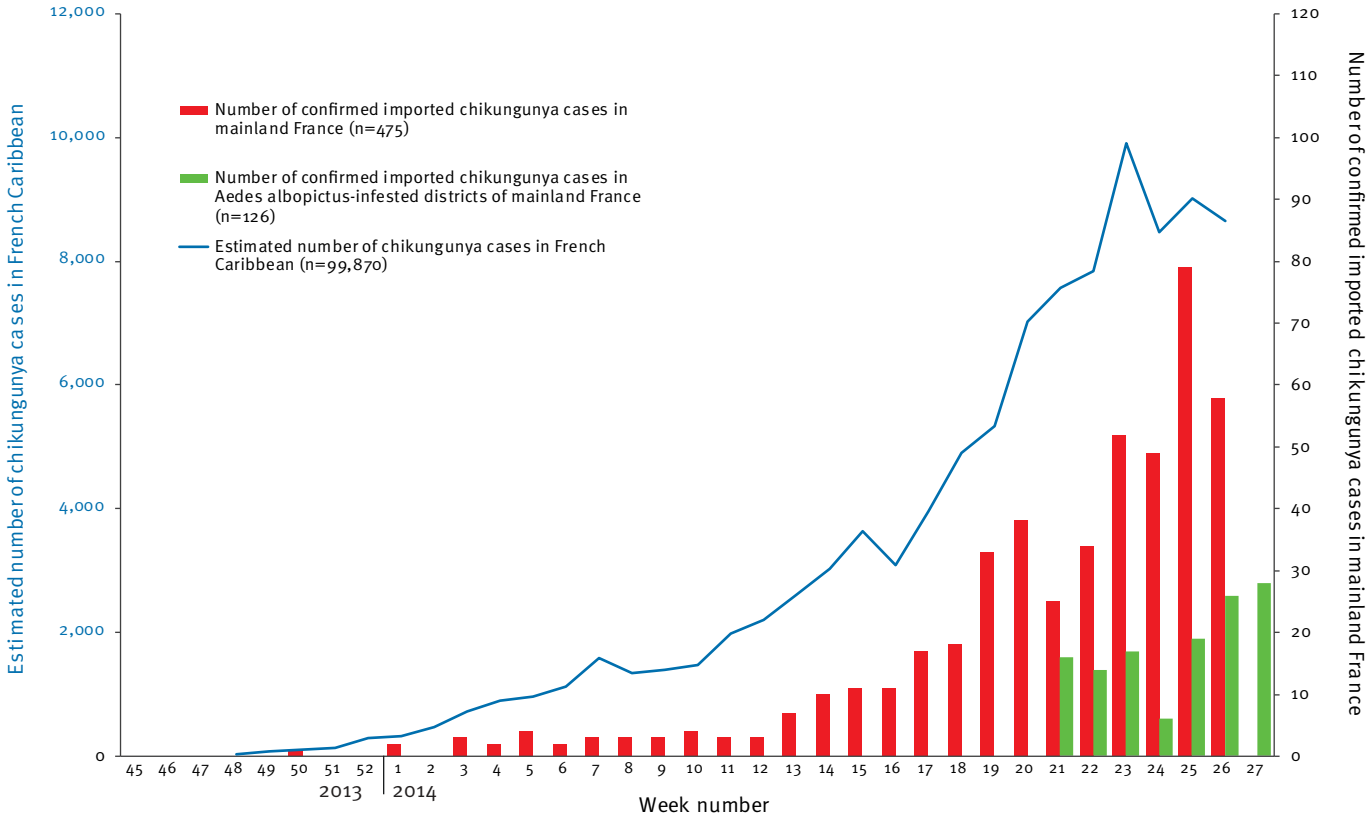
The surveillance system aims to prevent or to contain autochthonous transmission of dengue and chikungunya, and comprises three components:

- nationwide year-long mandatory notification of laboratory-confirmed cases of chikungunya and dengue;
- seasonal enhanced surveillance in the administrative districts where the vector is established. From May to November, when the vector is active, all suspected imported cases must be immediately reported to the regional health authorities (Agences Régionales de Santé, ARS). Appropriate vector control measures are then implemented within 200 metres of the places visited by the patients during the likely viraemic period (from the day before until seven days after the onset of symptoms [11]), without waiting for laboratory confirmation of the infection;
- daily reporting from a network of laboratories of the results of chikungunya and dengue serological or RT-PCR tests to the French Institute of Public Health Surveillance (Institut de veille sanitaire, InVS). This catches cases who have not been reported through the notification system and the seasonal enhanced surveillance, and thus serves to improve the completeness of reporting of the surveillance system.

The notification of a laboratory-confirmed locally acquired case triggers immediate epidemiological and entomological investigations, in order to assess the

Figure 2

Laboratory-confirmed imported chikungunya cases in mainland France[a], laboratory-confirmed imported chikungunya cases in *Aedes albopictus*-established districts in mainland France during the period of vector activity[b] and estimated number of clinically compatible chikungunya cases in the French Caribbean[c]



[a] Per week, week 45 2013 to week 26 2014 (1 November 2013 to 27 June 2014), source: laboratory network. Data for week 26 2014 are not yet consolidated and are not available for week 27 2014.

[b] Per week, weeks 18 to 27 2014 (2 May to 4 July 4 2014), source: enhanced surveillance.

[c] Per week, week 48 2013 to week 26 2014 (25 November 2013 to 29 June 2014). Data are not available for week 27 2014, source: French Caribbean sentinel surveillance.

Table 1

Suspected and laboratory-confirmed cases of chikungunya and dengue, by region involved in seasonal enhanced surveillance, mainland France, 2 May–4 July (weeks 18 to 27) 2014

Regions	Number of administrative districts where Aedes albopictus is established	Resident population in administrative districts where the vector is established[a]	Number of suspected cases	Number of laboratory-confirmed imported cases		Number of laboratory-confirmed autochthonous cases	
				Chikungunya	Dengue	Chikungunya	Dengue
Provence-Alpes-Côte d'Azur	5	4,777,464	121	43	17	0	0
Corsica	2	314,486	4	0	0	0	0
Languedoc-Roussillon	4	2,592,890	55	28	6	0	0
Rhône-Alpes	4	3,764,718	76	27	12	0	0
Aquitaine	2	1,794,528	31	14	5	0	0
Midi-Pyrénées	1	1,260,226	63	14	7	0	0
Total	**18**	**14,504,312**	**350**	**126**	**47**	**0**	**0**

[a] Source: French national institute of economic and statistical information (Institut national de la statistique et des études économiques, INSEE

autochthonous transmission and to guide vector control measures. The investigation and control measures include: (i) active case finding in the neighbourhood of the case's residence and in other areas visited by the case; (ii) recommending personal protection measures for the viraemic patient; (iii) encouraging health professionals to screen suspected cases; (iv) carrying out perifocal vector control activities, within 200 metres of the case's residence, including destruction of mosquito breeding sites and spraying targeted at adult mosquitoes; (v) giving information to the public about personal protection and reduction of mosquito breeding sites.

Chikungunya cases in mainland France

Throughout mainland France, 475 laboratory-confirmed imported cases of chikungunya were notified through the laboratory network from 1 November 2013 (the month of confirmation of the first cases in Saint Martin) to 27 June 2014 (Figure 2), whereas during the whole of 2011 and 2012, there were 33 and 17 cases, respectively.

From 2 May to 4 July 2014, of 350 suspected cases who were notified to the regional health authorities, 126 were laboratory-confirmed imported cases of chikungunya and 47 laboratory-confirmed imported cases of dengue were detected in the *Ae. albopictus*-established districts (Table 1 and Figure 2). A large majority of the laboratory-confirmed imported cases of chikungunya arrived from the French Caribbean (85% (107/126), as shown in Table 2). More than 80% of cases (n=103) were in an *Ae. albopictus*-established district while potentially viraemic (the remaining 20% were diagnosed retrospectively). No autochthonous case has been confirmed to date. More information and updated surveillance results are provided on the InVS website [4].

Discussion

From 2006 to 2013, the number of laboratory-confirmed imported cases of chikungunya reported in *Ae. albopictus*-established districts from May to November ranged from 2 to 6 [4]. From 2 May to 4 July 2014, the number of laboratory-confirmed imported cases of chikungunya was much higher (126) than in previous years, as a consequence of the chikungunya outbreak in the Caribbean region.

Although no autochthonous case has been confirmed to date in 2014, the conditions required for autochthonous transmission of the chikungunya virus are met: the population in mainland France is immunologically naive to the virus; a competent vector exists, *Ae. albopictus* [5] and its distribution has been constantly and rapidly spreading for the past 10 years [10]; and the probability of introduction of the virus by travellers coming from affected areas is high. The possibility of occurrence of autochthonous transmission of arboviruses has been demonstrated in the recent past in southern France, with the identification of two autochthonous dengue cases in 2010 and one in 2013, as well as two autochthonous chikungunya cases in 2010 [12-14].

Passenger traffic between mainland France and Martinique and Guadeloupe is high, with more than 2.5 million plane passengers in 2013 [15]. During this summer of 2014 – when the mosquito is active – large numbers of travellers will return from the French Caribbean islands where an outbreak is currently occurring. Among them, a high proportion will possibly be viraemic upon their arrival, increasing the probability of the occurrence of autochthonous cases of chikungunya in the administrative districts where *Ae. albopictus* is established, and increasing the risk of a chikungunya outbreak in mainland France.

Table 2

Laboratory-confirmed chikungunya cases imported to mainland France, by place of origin, as of 4 July (week 27) 2014

Place of origin	Number of cases imported to mainland France
Guadeloupe	70
Martinique	36
Haiti	10
Dominican Republic	3
Tonga	1
Sierra Leone	1
Saint Martin	1
Indonesia	1
Côte d'Ivoire	1
Costa Rica	1
Cambodia	1
Total	**126**

Source: seasonal enhanced surveillance system, mainland France.

The preparedness and response plan developed in mainland France since 2006 has proved to be effective for the early detection of cases and implementation of vector control measures to prevent or contain autochthonous transmission of dengue and chikungunya viruses. However, it is currently challenged by the increased number of imported chikungunya cases. It is thus crucial to maintain a high level of mobilisation of all actors within the surveillance system. They are also an important source of information for the general population, to encourage the use of personal protection against mosquito bites and control of mosquito breeding sites.

The challenge that we face is to avoid the establishment of a local cycle of transmission in mainland France and, beyond, in other European areas where competent vectors are also present.

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Conflict of interest

None declared.

Authors' contributions

Marie-Claire Paty coordinates the chikungunya and dengue surveillance system at the national level. Brigitte Helynck and Marie-Claire Paty co-drafted the manuscript. Caroline Six, Francis Charlet, Guillaume Heuzé, Amandine Cochet, Axel Wiegandt, Jean Loup Chappert, Dominique Dejour-Salamanca, Anne Guinard, Pauline Soler, Véronique Servas, Martine Vivier-Darrigol, Martine Ledrans are responsible at regional level for the surveillance and epidemiological investigations. Monique Debruyne, Oriane Schaal and Isabelle Leparc-Goffart are in charge of virological analysis and transmit the results on a daily basis to the surveillance teams. Charles Jeannin is an entomologist in charge of entomological investigations and mosquito control activities. Bruno Coignard reviewed the final document for accuracy. All authors contributed to the review of the manuscript and approved the final version.

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