Réunion, a sentinel territory for influenza surveillance in Europe

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In Réunion, a French overseas territory located in the southern hemisphere, increase in influenza activity is generally observed several months earlier than in Europe. Influenza activity is monitored in Réunion through a multi-source surveillance system including sentinel practitioners network, hospital emergency department, laboratory and mortality. Since 2009, three successive influenza epidemics occurred on the island. The largest was observed in 2009 while epidemics in 2010 and 2011 were much weaker. In terms of circulating strains, B viruses were predominant at the beginning of the 2009 epidemic but they were completely evicted once A(H1N1)pdm09 circulation started. In 2010, A(H1N1)pdm09 virus was predominant again, but a constant co-circulation of B viruses was observed. In 2011, A(H3N2) virus circulated. The same viruses were identified a few months later in mainland France in the respective seasons. Since 2009, virus circulation, epidemiological trends and health impact of influenza have been similar to those observed in Europe. Influenza surveillance in Réunion may therefore give reliable early information which should be considered apart from the surveillance in mainland France. Then, it might be even a more suitable predictor for Europe than other temperate southern hemisphere countries.

Introduction

Réunion, a French overseas territory with 840,000 inhabitants (2011 estimate [1]), is located in the southern hemisphere in the south-western Indian Ocean. It is 700 km east of Madagascar and 200 km south-west of Mauritius, above the Tropic of Capricorn. The island benefits from a healthcare system similar to mainland France and epidemiological surveillance has been developed by the regional office of the French Institute for Public Health Surveillance (Cire OI) based on the surveillance system of mainland France [2]. Despite the distance of 9,300 km between Réunion and France, the island is directly connected to Europe with four daily flights to France.

The interest of monitoring influenza in temperate southern hemisphere countries has been recently underlined because it may give an indication of what will happen in Europe during the following winter [3]. Because of its location and a surveillance system similar to the one in France, Réunion can also provide suitable information in terms of prevision. Indeed, as seasons are inverted compared with those in the northern hemisphere, increase in influenza activity is observed on the island during the 'austral' winter (June–July), i.e. several months before Europe. Information collected

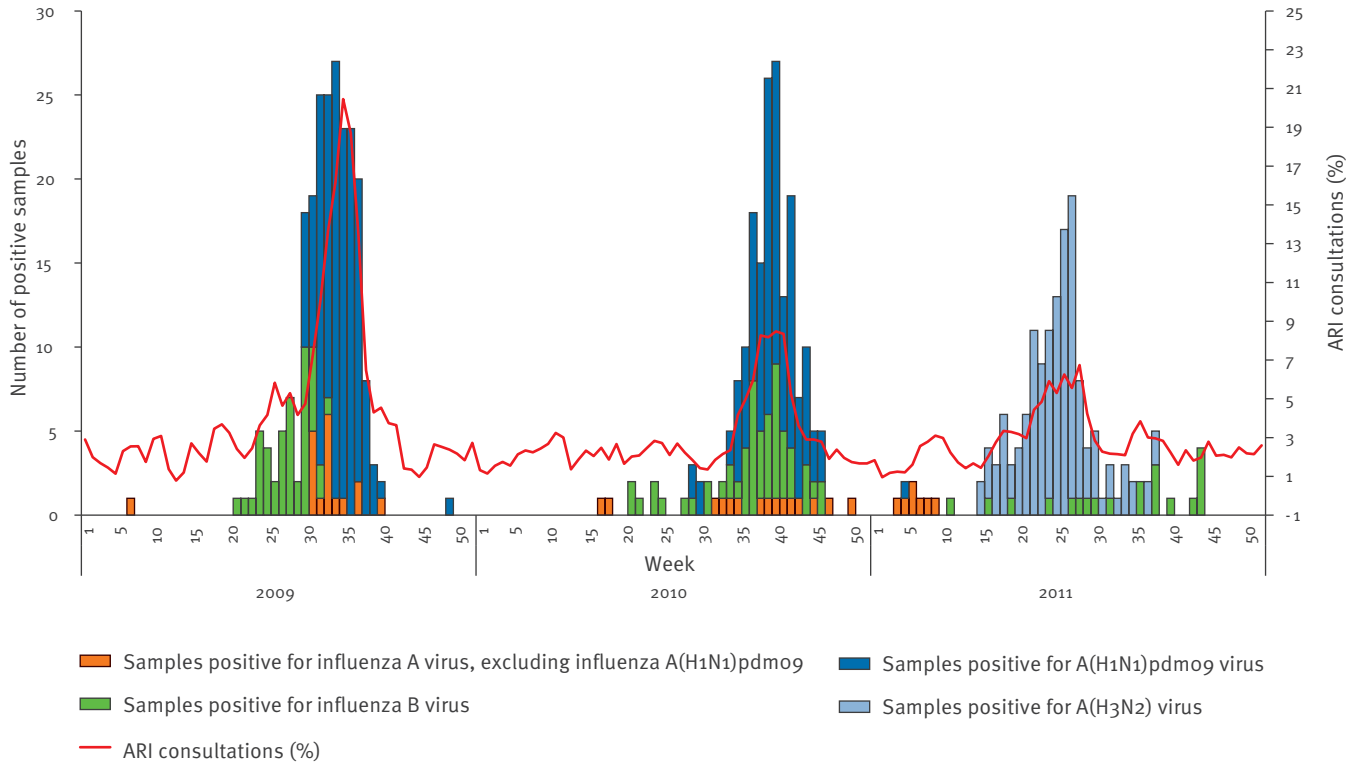
TABLE 1

Indicators collected continuously through influenza surveillance system, Réunion, France

Source	Indicators	Frequency	Starting year
Mortality records	• Total number of deaths • Number of death certificates with mention of influenza • Death in intensive care units and detection of influenza virus (PCR for influenza)	Daily	2006 2008 2009
Emergency departments and hospital wards	• Total number of emergency room visits • Emergency room visits for acute respiratory infections (number and percentage) • Severe cases of influenza (number, severity and outcome)	Daily	2009
Sentinel practitioners	• Total number of consultations • Consultations for influenza syndrome (number and consultation rates)	Weekly	1996
Reference hospital laboratory	• Total number of samples for influenza analysis • Number of positive tests for influenza virus (PCR for influenza virus) • Type of influenza virus (PCR for influenza virus)	Weekly	1998

Figure

Weekly consultations for acute respiratory infections and number of samples positive for influenza viruses, Réunion, France, 2009–2011



ARI: acute respiratory infection.
Source: sentinel practitioner network.

can thus be the same as that observed in Europe a few months later.

The aim of this paper is to present the main results from the surveillance system for influenza in Réunion from 2009 to 2011 in order to assess whether this territory should be considered as an interesting sentinel for influenza surveillance.

Methods

In Réunion, influenza activity has been monitored since 1996 through a sentinel practitioner network [4]. During the influenza A(H1N1)pdm09 pandemic, a multisource surveillance system has been developed [2] to complete this sentinel network. Indicators continuously collected through this surveillance system are summarised in Table 1. Statistical analysis is carried out using Stata and Excel.

Epidemiological and virological surveillance of acute respiratory infections by the sentinel practitioner network

Forty general practitioners and two paediatricians participate in the influenza sentinel network (4.9% of the total general practitioners). They are located all over the island and report on a weekly basis their total number of consultations and the number of acute respiratory infections (ARI) according to the following case definition: sudden onset of fever >38° C, cough, associated or not with other symptoms (breathing difficulty, headache, etc.). Weekly ARI consultation rates are calculated and monitored in order to follow the epidemiological situation of influenza. Furthermore, every physician of the sentinel network is expected to collect a nasal swab from the first two patients of the week presenting with ARI symptoms with an onset of less than three days. This sampling allows surveillance of the viruses circulating in Réunion. Swabs are tested by RT-PCR influenza in the reference hospital laboratory (CHU, Réunion).

Hospital emergency departments and surveillance of severe cases of influenza

There are four emergency departments in Réunion. In all of them, a computerised medical file is filled in during each medical consultation, regardless of the diagnosis. Medical files are automatically extracted and transmitted daily to the French Institute for Public Health Surveillance (InVS, Paris, France). The regional office (Cire OI) can then monitor daily number of visits for all causes including ARI. In addition to this surveillance, all severe influenza cases observed in Réunion are reported by clinicians to the Cire OI through a standardised form including epidemiologic, demographic

TABLE 2

Comparison of circulating influenza viruses, Réunion and mainland France, influenza seasons[a] during 2009–2012

Location	2009		2010/11		2011/12	
	Epidemic period	Influenza virus isolated	Epidemic period	Influenza virus isolated	Epidemic period	Influenza virus isolated
Réunion	Week 30 to week 42 (2009)	• A(H1N1)pdm09 • B	Week 35 to week 47 (2010)	• Predominantly A(H1N1)pdm09 • B	Week 16 to week 30 (2011)	• Predominantly A(H3N2) • B
Mainland France	Week 43 to week 52 (2009)	• A(H1N1)pdm09 • B	Week 51 (2010) to week 7 (2011)	• Predominantly A(H1N1)pdm09 • B	Week 6 to week 14 (2012)	• Predominantly A(H3N2) • B • Occasionally A(H1N1)pdm09

[a] In the southern hemisphere the influenza season is between May and October. In the northern hemisphere it is during the winter months.

and clinical data. A severe case of influenza is defined as a patient with a laboratory-confirmed influenza infection (positive RT-PCR for influenza virus) admitted for more than 24 hours to an intensive care unit (ICU) or as a patient who died.

Mortality surveillance

The National Institute for Statistics (Institut National de la Statistique et des Etudes Économiques, Insee) conducts the administrative recording of deaths from all causes in France. For several years, Insee has been monitoring and centralising daily mortality in France including Réunion. In case of an influenza epidemic on the island, we analyse this total number and excess of deaths from all causes. This system is completed by analysis of all death certificates received by the regional public health authority that mention 'influenza'. These certificates are recorded as influenza-associated deaths. Electronic death certification which is being implemented in France is being used by the Intensive Care Department of Saint-Denis Hospital, and is analysed in real time by the Cire.

Results

Data from the physician sentinel network and from virological surveillance for 2009–2011 are presented in the Figure.

Since 2009, three successive influenza epidemics occurred in Réunion. The largest was observed in 2009, with consultation rates for ARI reaching 21%. In 2010 and especially in 2011, epidemics were much weaker with a maximal percentage of ARI of 8.5% and 6.7%, respectively. The three of them started during the southern hemisphere winter (between June and August), and lasted between 8 and 10 weeks. Numbers of visits from emergency rooms show the same pattern of consultation rates of sentinel network [4-5].

Regarding circulating strains, B viruses were predominant at the beginning of the 2009 epidemic, but they were rapidly evicted once A(H1N1)pdm09 circulation started (Table 2).

In the 2010 influenza season in Réunion, the pandemic virus was predominant again, but a constant co-circulation of B viruses was observed. In 2011, the A(H3N2) virus has been circulating almost exclusively; A/Victoria/210/2009 strain was notably identified. No A(H1N1)pdm09 circulation was detected and only few instances of B virus circulation were identified. During the three influenza seasons, the same viruses were identified in mainland France, except in 2011/12 when A(H1N1)pdm09 was occasionally identified.

During the influenza A(H1N1)pdm09 pandemic in 2009, the Réunion surveillance system showed a nine-week epidemic period, with a peak of consultation rate for ARI during week 35 (24–30 August 2009). The number of patients with A(H1N1)pdm09 infection who consulted a physician was estimated at 66,915 (cumulative attack rate: 8.26%) [3]. After 2009, epidemic periods of influenza were observed in Réunion but they were weaker.

Characteristics of severe cases during 2009-2011 are presented in Table 3.

Chronic respiratory disease was the most common comorbidity every year. The non-negligible proportion of obese patients has to be noted, as well as the presence of one pregnant woman in 2009 and two in 2010, without any other risk factor for severity. In 2010, a particularly high severity among patients hospitalised in ICU could be observed: all 14 patients needed respiratory assistance. Half of them needed extracorporeal membrane oxygenation or high frequency oscillation. Half of the patients hospitalised in ICU died.

Discussion

Since 2009, the surveillance system of influenza in Réunion allows to have a good and real-time view of the epidemiological situation through monitoring a large range of indicators [5-8]. The epidemiological situation of the pandemic influenza in 2009 has been described in other temperate countries of the southern hemisphere [9] and showed that the epidemiological pattern in Réunion compared well with that of other

TABLE 3

Characteristics of severe influenza cases[a], Réunion, France, 2009–2011

Characteristic	2009 (n=24)	2010 (n=14)	2011 (n=8)
Sex (female)	13	8	3
Mean age in years (range)	38 (0–75)	43 (19–76)	52 (0–76)
Risk factors / comorbidities			
Chronic respiratory disease	10	6	3
Obesity[b]	3	5	3
Diabetes	3	3	2
Pregnancy	1	2	0
Age ≥65 years	4	2	0
Cardiac disease	4	1	4
Immunodeficiency	1	1	0
None	4	0	2
Indicators or signs of severity			
Acute respiratory distress syndrome	13	14	3
Respiratory assistance[c]	15	13	3
Extracorporeal membrane oxygenation[d]	3	5	1
High frequency oscillation[e]	0	2	0
Death	5	7	1

[a] Patients with a biologically-confirmed influenza infection admitted to an intensive care unit.

[b] Body mass index >30.

[c] The patient undergoes assisted ventilation by mechanical pump and endotracheal intubation.

[d] Application of a life support system that circulates the blood through an oxygenating system, which may consist of a pump, a membrane oxygenator, and a heat exchanger.

[e] High frequency oscillation ventilation is the delivery of small tidal volumes to the infant at fast frequencies. Both Inspiration and expiration are active, therefore reducing the likelihood of gas trapping.

temperate southern hemisphere countries such as New Zealand [10], South Africa [11], Australia [12-14], with A(H1N1)pdm09 virus circulating predominantly. This pattern was indicative for what was going to happen in the forthcoming influenza season in the northern hemisphere. In 2010, a weaker epidemic was observed with also a non-negligible number of severe cases [15]. Similar patterns were then observed in Europe [16], confirming that surveillance of influenza in Réunion can also provide useful data to anticipate what can be expected a few months later in northern hemisphere countries in terms of dynamics, severity and circulating viruses. During the last three years, our epidemiological data identified obesity and diabetes as risks factors of severe form of influenza. This was confirmed a few months later in Europe [17,18].

During the 2011 season, we did not observe any A(H1N1)pdm09 circulation, which is very specific to our island since all the other southern hemisphere countries detected it [19]. In Réunion, the A(H3N2) virus circulated almost exclusively whereas it was not the predominant influenza A subtype in any temperate southern hemisphere countries considered as sentinels for the northern hemisphere [3]. A few months later, in France, Ireland, Spain and the United Kingdom, the influenza season 2011/12 started during the last weeks of 2011 and has been dominated by influenza A(H3) viruses with minimal circulation of influenza A(H1N1)pdm09 and B viruses [20]. Since 2009, virus circulation, epidemiological trends and health impact in Réunion were therefore similar to those observed in Europe. It confirms that Réunion might be even a more suitable predictor for Europe than other southern hemisphere countries.

In conclusion, influenza surveillance in Réunion may give reliable timely information which should be considered apart from the surveillance in mainland France. In addition to data from other southern hemisphere temperate countries, influenza surveillance in Réunion should be taken into consideration in order to make predictions of what can be expected in the corresponding winter season in northern hemisphere countries.

Furthermore, this information can be very useful for epidemiological surveillance in the Indian Ocean. An international network was initiated in 2006 by the Indian Ocean Commission: the epidemiological surveillance and alert control (SEGA - Surveillance Epidémiologique Gestion des Alerte) [21]. One of its objectives is to exchange epidemiological information on influenza

surveillance. Real-time data on the epidemiological situation of influenza and circulating viruses are therefore available through this network for Comoros, Réunion, Madagascar, Mauritius and Seychelles.

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