Early Introduction and Delayed Dissemination of Pandemic Influenza, Gabon

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Active surveillance in health care centers in Gabon during 2009–2011 detected 72 clinical cases of pandemic (H1N1) 2009 (pH1N1). We found that pH1N1 virus was introduced in mid-2009 but spread throughout the country in 2010. Thus, Gabon was also affected by pH1N1.

In April 2009, a pandemic strain of influenza A (H1N1) (pH1N1) virus emerged in Mexico and the United States; the World Health Organization declared a pandemic alert on June 11, 2009 (1,2). This virus was responsible for a large outbreak with thousands of cases in the Reunion Islands and in several French tropical Pacific islands during July–October 2009 (3). The circulation and public health effects of pH1N1 virus are largely unknown in Africa, with the exception of South Africa and Kenya, which were heavily affected by disease outbreaks during 2009 and 2010 (4–6). Other pH1N1 cases were reported in several countries of North, West, and East Africa and in Madagascar (7,8).

In the humid tropical forest of Central Africa, a study demonstrated the circulation of influenza virus in Cameroon during 2007–2008 (9); another reported cases of pH1N1 in Cameroon in 2009 (10). A sentinel surveillance program for influenza in Kinshasa, Democratic Republic of the Congo, during 2009–2011 reported several cases of pH1N1 (11).

Gabon is a typical humid, tropical, forested country in Central Africa, with 1,517,685 inhabitants and a surface area of 270,000 km². The country has a short dry season during January–February, a long rainy season during March–May, a long dry season during June–September, and a short rainy season during October–December. We report the results of a large surveillance study for pH1N1 in Gabon during a 2-year period, July 2009–June 2011.

The Study

Surveillance for influenza-like illness (ILI) was performed during July 2009–June 2011 in the capital city of Gabon, Libreville, and in 3 other towns in rural Gabon (Franceville, Oyem, and Koulamoutou) (Figure 1). ILI was defined as fever (≥38°C) and runny nose, cough, or sore throat. Study participants were enrolled at 3 health care centers in Libreville and at the regional hospitals in the other towns; all patients who visited these health centers for ILI were systematically sampled. Individual oral consent was obtained from patients for nasal sampling.

Epidemiologic data (name, age, sex, and travel history during the month before onset) and clinical data were collected for each patient. Nasal swabs were sent each week to Centre International de Recherches Médicales de Franceville for analysis. Real-time reverse transcription PCR (RT-PCR) was used to detect pH1N1, seasonal influenza A (H1N1 and H3N2), and seasonal influenza B viruses (12). Specimens positive for pH1N1 virus were also tested by specific quantitative PCR for the following common respiratory viruses: adenovirus,
The number of influenza cases during the rainy seasons were higher than during the dry seasons. The number of cases of ILI increased during the 2 rainy seasons and decreased during the 2 dry seasons (Figure 2), which is consistent with a study showing an increase in ILI visits during rainy seasons in Senegal (13).

Among the 966 cases of ILI, 131 (13.6%) were determined to be caused by an influenza virus: 72 (55%) pH1N1, 8 (6%) seasonal influenza A (H1N1 and H3N2), and 51 (39%) influenza B (Table; Figure 2). No deaths caused by pH1N1 were reported during the study period. For the 72 patients infected with pH1N1 virus, median age was 2 years (range 2 months–49 years); 76.4% of these patients were <4 years of age, and 23.6% were 4–49 years of age. The M:F sex ratio was 1.02.

### Table. Demographic characteristics of patients and distribution of influenza viruses and other influenza-like illnesses, Gabon, July 2009–June 2011*

| Patient and illness data | Influenza virus types | Total no. patients |
|--------------------------|-----------------------|--------------------|
|                          | pH1N1 | A | B | pH1N1 + A + B | Other† |
| Sex, no. patients        |       |   |   |              |        |
| M                        | 33    | 4 | 23 | 60          | 427    | 487 |
| F                        | 39    | 4 | 28 | 71          | 408    | 479 |
| Median age, y (range)    | 2 (2 mo–49 y) | 45 (9–50 y) | 2 (3 mo–41 y) | 2 (2 mo–50 y) | 1.58 (10 d–82 y) | 1.66 (10 d–82 y) |
| Age group, no. patients  |       |   |   |              |        |
| 0–23 mo                  | 30    | 0 | 20 | 50 | 444 | 494 |
| 2–4 y                    | 25    | 0 | 17 | 42 | 219 | 261 |
| >4 y                     | 17    | 5 | 10 | 32 | 147 | 179 |
| Illness, by year and town|       |   |   |              |        |
| 2009                     |       |   |   |              |        |
| Libreville               | 3 (33) | 6 (67) | 0 | 9 | 12 | 21 |
| Franceville              | 1 (50) | 1 (50) | 0 | 2 | 0 | 2 |
| Koulamoutou              | 0 | 0 | 0 | 0 | 0 | 0 |
| Oyem                     | 0 | 1 (100) | 0 | 1 | 1 | 2 |
| Total                    | 4 (33) | 8 (67) | 0 | 12 | 13 | 25 |
| 2010                     |       |   |   |              |        |
| Libreville               | 16 (70) | 0 | 7 (30) | 23 | 224 | 247 |
| Franceville              | 1 (3) | 0 | 34 (97) | 35 | 135 | 170 |
| Koulamoutou              | 15 (94) | 0 | 1 (6) | 16 | 42 | 58 |
| Oyem                     | 11 (85) | 0 | 2 (15) | 13 | 105 | 118 |
| Total                    | 43 (49) | 0 | 44 (51) | 87 | 506 | 593 |
| 2011                     |       |   |   |              |        |
| Libreville               | 11 (92) | 0 | 1 (8) | 12 | 165 | 177 |
| Franceville              | 6 (60) | 0 | 4 (40) | 10 | 43 | 53 |
| Koulamoutou              | 2 (50) | 0 | 2 (50) | 4 | 32 | 36 |
| Oyem                     | 6 (100) | 0 | 0 | 6 | 76 | 82 |
| Total                    | 25 (78) | 0 | 7 (22) | 32 | 316 | 348 |
| Total                    | 30 (68) | 6 (14) | 8 (18) | 44 | 401 | 445 |
| Franceville              | 8 (17) | 1 (2) | 38 (81) | 47 | 178 | 225 |
| Koulamoutou              | 17 (85) | 0 | 3 (15) | 20 | 74 | 94 |
| Oyem                     | 17 (85) | 1 (5) | 2 (10) | 20 | 182 | 202 |
| Total                    | 72 (55) | 8 (6) | 51 (39) | 131 | 835 | 966 |

*Values are no. (%) cases except as indicated. pH1N1, pandemic (H1N1) 2009; A, seasonal influenza A; B, seasonal influenza B.
†Influenza-like illnesses other than pH1N1 or seasonal influenza A or B. Age data were missing for 32 patients in this category.

respiratory syncytial virus, human metapneumovirus, parainfluenzavirus (PIV) 1–4, enterovirus, rhinovirus, parechovirus, and human coronavirus (HCoV; strains OC43, 229E, NL63, and HKU1). Testing protocols are available on request from the authors. Patients who had laboratory-confirmed influenza were contacted several months after diagnosis to determine outcome.

Nasal swab specimens were collected from 966 patients with influenza-like symptoms during July 2009–June 2011: 445 from Libreville, 202 from Oyem, 94 from Koulamoutou, and 225 from Franceville (Table). Median patient age was 1.66 years (range 10 days–82 years); 81% of these patients were <4 years of age, and 19% were 4–82 years of age. The M:F sex ratio was 1.02. The number of cases of ILI increased during the 2 rainy seasons and decreased during the 2 dry seasons (Figure 2), which is consistent with a study showing an increase of the number of influenza cases during the rainy seasons in Senegal (13).
arrival in Franceville from France, which was also heavily affected by pH1N1 during this time.

The first 2 autochthonous cases were diagnosed on November 26, 2009 (cases 3), 1 week after the second imported case of pH1N1, during the short rainy season. Subsequently, 29 autochthonous cases were detected in Libreville, 17 in Oyem, 17 in Koulamoutou, and 7 in Franceville (Table). Libreville was the first town with detected pH1N1 cases during the rainy season and also had the highest number of pH1N1 cases (Table). The first autochthonous case was detected in Oyem in early June 2010; during the 2010 short rainy season, several pH1N1 cases were detected in Oyem, indicating pH1N1 virus dissemination throughout Gabon by that time. A total of 85% of the influenza cases in Oyem were pH1N1 (Table). A similar pattern of pH1N1 was observed in Koulamoutou and Franceville during the short rainy season (Figure 2, panels D, E). The percentage of pH1N1 among all influenza cases in Franceville increased from 3% in 2010 to 60% in 2011 (Table). We detected no cases of influenza, including pH1N1, in the provinces of Oyem and Koulamoutou during the first half of 2010.

Seasonal influenza A was diagnosed in Gabon only during September–December 2009: 6 cases in Libreville, 1 case in Oyem, and 1 case in Franceville. During the short rainy season in 2010, the incidence of influenza B increased: 8 cases in Libreville, 2 cases in Oyem, 3 cases in Koulamoutou, and 38 cases in Franceville (Figure 2; Table). We detected no cases of co-infection with pH1N1 virus and either seasonal influenza A or influenza B viruses.

Conclusions
Our data suggest that pH1N1 virus was introduced in Gabon just before July 2009, during the first pandemic peak in the Americas and Europe. However, this early introduction did not result in continuous virus circulation in the rest of the country until the short rainy season in 2010. Only during the 2011 season was there a noteworthy increase in case numbers compatible with a pandemic wave, suggesting a notable time lag relative to that for other countries. Our findings indicate that rural tropical countries such as Gabon may serve as reservoirs for later spread of pH1N1 virus within the country and into other countries (14,15).

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References
1. Novel Swine-Origin Influenza A (H1N1) Virus Investigation Team; Daswood FS, Jain S, Finelli L, Shaw MW, Lindstrom S, Garten RJ, et al. Emergence of a novel swine-origin influenza A (H1N1) virus in humans. N Engl J Med. 2009;360:2605-15. http://dx.doi.org/10.1056/NEJMoa0903810
2. World Health Organization. World now at the start of 2009 influenza pandemic. Geneva: The Organization; 2009.

3. D’Ortenzio E, Renault P, Jaffar-Bandjee MC, Gauzere BA, Lagrange-Xelot M, Fouillet A, et al. A review of the dynamics and severity of the pandemic A(H1N1) influenza virus on Reunion Island, 2009. Clin Microbiol Infect. 2010;16:309–16. http://dx.doi.org/10.1111/j.1469-0691.2010.03171.x

4. Archer B, Cohen C, Naidoo D, Thomas J, Makunga C, Blumberg L, et al. Interim report on pandemic H1N1 influenza virus infections in South Africa, April to October 2009: epidemiology and factors associated with fatal cases. Euro Surveill. 2009;14:19369.

5. Waiboci LW, Lebo E, Williamson JM, Mwiti W, Kikwai GK, Njuguna H, et al. Viral shedding in patients infected with pandemic influenza A(H1N1) virus in Kenya, 2009. PLoS ONE. 2011;6:e20320. http://dx.doi.org/10.1371/journal.pone.0020320

6. Osoro EM, Munyua P, Muthoka P, Gikundi S, Njenga MK, Lifumo S, et al. Hospitalized patients with pandemic (H1N1) 2009, Kenya. Emerg Infect Dis. 2011;17:1744–6. http://dx.doi.org/10.3201/eid1709.100992

7. Ensorink M. Worries about Africa as pandemic marches on. Science. 2009;325:662. http://dx.doi.org/10.1016/S1526-0542(03)00024-1

8. Vijaykrishna D, Smith GJ, Pybus OG, Zhu H, Bhatt S, Poon LL, et al. Long-term evolution and transmission dynamics of swine influenza A virus. Nature. 2011;473:519–22. http://dx.doi.org/10.1038/nature10004

9. Forrest HL, Webster RG. Perspectives on influenza evolution and the role of research. Anim Health Res Rev. 2010;11:3–18. http://dx.doi.org/10.1017/S1466252310000071

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