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**A tree hiding a forest: an outbreak of influenza and shigellosis in a gold miner camp in the tropical forest of French Guiana, March 2013**

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**Abstract :**

In March 2013, in French Guiana, there was an infectious disease outbreak with diarrhoea and a respiratory syndrome in a gold miner camp in the forest. Since one patient had died, and given the possibility of emerging pathogens, 11 patients with severe symptoms were hospitalised in Cayenne hospital, and epidemiological, clinical examination and microbiologic data were investigated. Results showed that in fact there was no single pathogen. H1N1 influenza virus infections associated with many parasitic, bacterial or viral co-infections with notably 3 cases of diarrheal disease caused by *Shigella flexneri* and 7 cases of ankylostomiasis.

The presence of these pathogens and their association reflect the precarious health conditions and significant overcrowding in existing camps. The severity of the clinical picture presented was primarily due to co-infection. The diversity of parasitic, viral and bacterial co-infections indicates the complexity of delivering medical care to the remote illegal goldmines.

**Introduction :**

The Amazon basin is at high risk for emerging or re-emerging infectious diseases.<sup>1</sup> It's also a region where the problem of mobile and socially precarious populations, such as miners, poses a real challenge for health care.

There are many illegal gold mines in French Guiana. Sanitary conditions in these sites are poor.

**Results :**

In early March 2013, one sick gold miner died as he was being transferred from an illegal gold mine in the forest to the nearest health care center in Maripasoula. The following day, several patients (all living in the same gold mine) came to the same health center with a syndrome including fever, diarrhoea and respiratory signs. Given the possibility of a contagious disease, patients were isolated in a Maripasoula's health center. Eleven patients with a severe clinical condition were transferred to Cayenne by helicopter and admitted in the Cayenne hospital. We here report the result of the epidemiological, clinical and microbiological investigation of hospitalized patients.

All patients were from the same gold mine (Eau-claire) in southern French Guiana. Most frequently the initial symptoms were cough (n=10/90%), diarrhoea (n=10/90%) and fever (n=8/72%).

The average delay between the onset of symptom and admission was 6.4 days. Physical examination reported a high proportion of bilateral pneumonia (n=10/90%) complicated in 3

cases by hypoxemia. Most patients also had diarrhoea with metabolic complications including hyponatremia in 4 cases.

Microbiological investigations revealed concurrent influenza and shigellosis with positive PCR for type A(H1N1)pdm09 Influenza in the sputum of 6 patients associated with an infection by serotype 2a *Shigella flexneri* isolated in stool cultures in 3 cases without any antimicrobial resistance. Microbiological screening also reported many other parasitic, viral or bacterial co-infections with an average of 2 co-infections confirmed by case. All patients recovered with an average 11 days of hospitalisation.

### **Discussion :**

A(H1N1)pdm09 pandemic strain circulates widely, notably, in South America.<sup>2,3</sup> It mostly affects young adults with moderate clinical severity.<sup>3</sup> However, the prevalence of severe illness and mortality due to H1N1 is higher in socially disadvantaged populations.<sup>4</sup> It is also not surprising to report infection due to *Shigella flexneri* in French Guiana which is endemic in developing countries and in neighboring Brazil.<sup>5,6</sup> Despite the endemicity of both influenza viruses and *Shigella spp.*, in the Amazon, data on their co-infection and the large proportion of other associated infectious disease are lacking. Indeed, we report many other confounding and intricately infections (ankylostomiasis, malaria due to *Plasmodium vivax*, leishmaniasis due to *Leishmania Guyanensis*, discovery of HIV infection, pneumococemia), which needed specific and individualised therapy. For example stool examination revealed widespread ankylostomiasis (7 of 11 positive cases). On the other hand our result (one case of acute malaria and hyperactive malarial splenomegaly) confirmed the necessity of systematic research of malaria in endemic region. Presence of shigellosis and ankylostomiasis infection reflects promiscuity and poor hygienic condition in the illegal gold mines. Indeed, the epidemiological investigation revealed the utilisation of untreated river water, sometimes

taken downstream of dejections, probably leading to oro-fecal contamination. There was a long delay before medical care was received with an average of 6.4 days after the onset of symptoms. This delay is due to multifactorial problems: geographical distances, transport difficulties, risk of deportation out of the french territory for each trip, poor knowledge of health facilities. However, there were no deaths in hospitalised patients or in patients admitted in the health care center in Maripasoula.

Medical assessment of socially precarious populations in tropical area is complicated. It is dangerous to stop clinical and microbiological evaluation at the first diagnosis and establish a single treatment in an outbreak context. On the other hand, geographic isolation, illegal activities and the mobility of this population make it difficult to implement hygiene and health care. Inventing ways for prevention and care to reach these populations living in remote areas beyond the reaches of the law is a real public health challenge.<sup>7</sup>

The deep divisions between the public health view and the law enforcement view suggest that no time soon will the health system reach the miners where they work.

This outbreak attracted quite a lot of media and political attention because it affected illegal immigrants and there was initial speculation about an emerging single “unknown infectious agent” from the forest.<sup>8</sup> The present report shows that in a context of multiple infections it was crucial to consider the possibility that an apparent stereotypical clinical syndrome was in fact due to a combination of pathogens.

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