Emerging Problems in Infectious Diseases

On the Spread of the Novel Influenza A (H1N1) Virus in Mexico

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Abstract

A novel influenza A H1N1 virus of swine origin is responsible for the influenza epidemic affecting Mexico, the United States of America (USA), and 39 other countries. While the origin of this emerging pathogen remains uncertain, an increase in the reported incidence of respiratory diseases was noted during March 2009 at the town of La Gloria, in the southeastern state of Veracruz, Mexico. So far, this is the first community in which a case of novel influenza A H1N1 virus has been identified. Further cases were rapidly detected in other areas of Mexico and elsewhere. Initially, the atypical respiratory disease outbreak caused great uncertainty posing a challenge to the Mexican health system. Control measures such as social distancing, timely medical care, and personal hygiene have so far proven effective in containing the outbreak, resulting in a decline of the number of new cases. To the best of our knowledge, it appears that the virus might not be as virulent or contagious as previously thought. Here we provide a description of the influenza epidemic spread in Mexico. As the virus disseminates worldwide, there is concern about the possibility of a new reassortment resulting in a more pathogenic strain that will pose a threat for every country. The influenza epidemic provided lessons that underscore the importance of epidemiologic surveillance and preparedness. Further investigation to address questions about this new virus and conditions for its spread is warranted.

Key Words: influenza A H1N1, Mexico, epidemiology, pandemic

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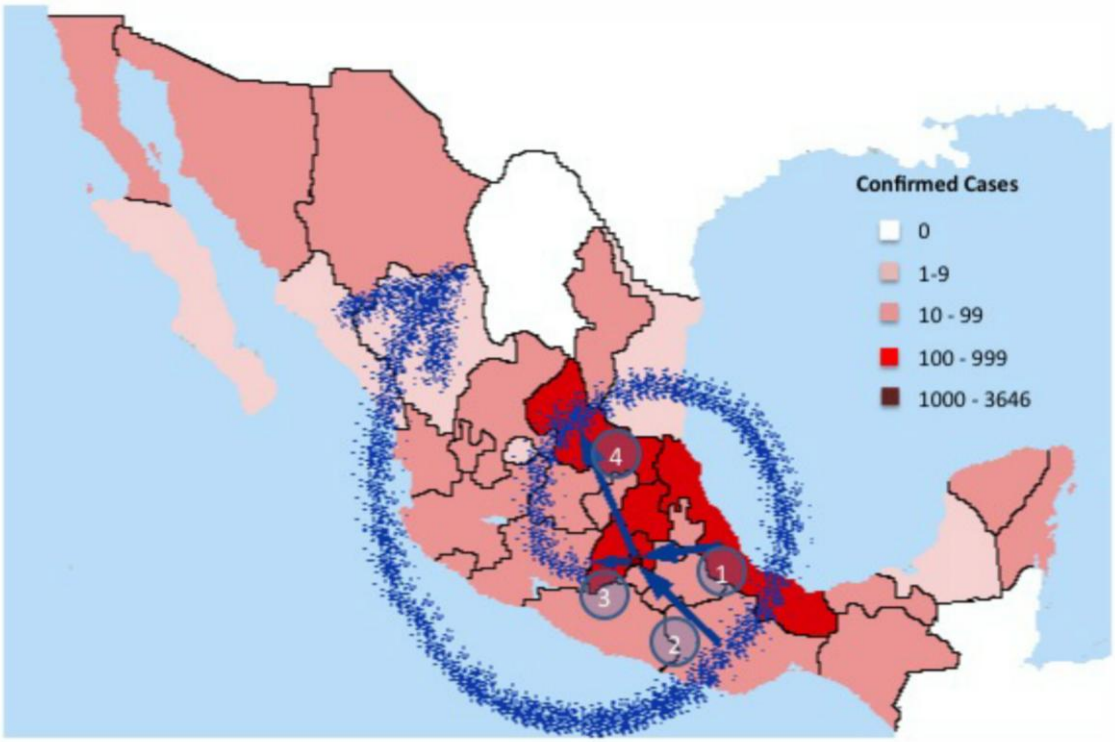
Background

Few weeks have elapsed since an increased incidence of atypical respiratory illness raised concern in Mexico and the United States. As it turned out, the illness was an outbreak of influenza caused by a novel influenza virus designated A H1N1, a strain which is a reassortant of swine, avian and human influenza viruses [1]. This is a new virus that has not been seen previously in either humans or animals [2]. As the global knowledge about this widespread infection increases, some questions have been answered. For example, outside of Mexico the outbreak does not appear to be so severe, neither in terms of infectiousness nor regarding the virulence of the virus. It is also known that there are significant changes in both the hemagglutinin and neuraminidase proteins of the new virus [2]. However, there are several aspects that still remain elusive, such as why deaths from the illness have primarily occurred in young, healthy adults while most influenza strains produce the worst symptoms in young children, the elderly, and others with weaker immune systems. In spite of our previous experiences with influenza epidemics, the emergence of this new strain proved to be difficult to contain and within the viral genetic sequence there is at least the potential for a severe pandemic. Here we provide a retrospective description of the influenza epidemic in Mexico in the light of the lessons learned.

The Beginning of the Outbreak

An increase in the reported incidence of respiratory diseases in the central part of the country was noted during March 2009. The town of La Gloria, Perote, in the state of Veracruz, was the first community in which an influenza-like disease outbreak was identified. From March 10 through April 6, a total of 591 flu cases were reported, affecting 25% of the local population. However, there were neither hospitalizations nor deaths reported [3]. At the same time, the National Institute of Respiratory Diseases in the Federal District reported severe cases of pneumonia among young and otherwise healthy adults accounting for several hospitalizations. Additionally, the state of San Luis Potosi reported an unusually high number of acute respiratory disease cases (see Figure 1). Initially, an intensification and prolongation of the influenza

Figure 1. Geographical distribution of all confirmed cases of influenza A H1N1 detected in Mexico from March 11-June 9, 2009. The colors refer to the number of confirmed cases of influenza A H1N1 in the States of the Mexican Republic. Source: Current situation of the influenza epidemic in Mexico. Minister of Health, Mexico. June 9, 2009.



season due to a B strain was considered as a potential cause [4].

On April 13, 2009, health officials were notified of an isolated case of a diabetic woman in Oaxaca who developed an atypical pneumonia and died within a few days. The etiologic agent in this case was originally suspected to be a coronavirus. As time passed, however, authorities became more suspicious about the increased incidence of respiratory disease and began considering a possible link between this patient's death, the cluster of severe respiratory disease in young adults, and the influenza outbreak occurring simultaneously in three different parts of the country. Finally, concern about an unusual respiratory disease outbreak with a novel agent triggered increased surveillance throughout the country on April 17, 2009.

Determination of a novel influenza virus in human samples

A total of 43 respiratory specimens were obtained from symptomatic patients from La Gloria, identifying three influenza strains: H3N2, B and a non-typeable influenza A strain [4]. The latter came from a five-year-old child who developed flu-like symptoms on April 1, 2009. The sample from the woman who died in Oaxaca also turned out to contain an undetermined influenza A strain. On April 23, 2009, Mexican officials learned from the Public Health Agency of Canada and the CDC in Atlanta that a novel influenza A H1N1 virus was identified in both samples, a strain genetically similar to that previously isolated from patients in California [5].

Influenza H1N1 virus composition

Analyses performed on the swine influenza virus isolated from California and Texas revealed that three quarters of the viral gene segments arose from the North American swine influenza strains circulating since 1998 in the Midwestern United States [6,7]. The other two genes encoding neuraminidase and matrix proteins were closely related to genes of viruses obtained in Eurasia. There is uncertainty about where the virus reassortment occurred. One possibility is that the virus may have mixed during the import and export of swine between countries. Indeed, the import of swine from the USA to Asian countries such as Korea has accounted for the spread of Midwestern viruses to Asia [6]. As more data becomes accessible, the evolution of this gene

reassortment may be clarified.

The Origin of the Virus

Currently, the origin of this new virus and how it came to disseminate in North America remains unclear. The first documented cases appeared within weeks of each other in March in the United States and Mexico [11]. While most of the acute respiratory illness outbreak in La Gloria remains undiagnosed, no severe cases were observed and only one child and one woman (apparently unrelated) had a positive test for the A H1N1 strain [12]. Moreover, according to the results of the influenza surveillance project conducted by health officials from March 29 to May 1 2009 in La Gloria, there was no evidence of influenza-like disease either among the 16,125 swine at the pig breeding farm nearby or among the hogs owned by the locals [13]. Also, no influenza-like symptoms have yet been documented among the farm workers or in the community [12]. Interestingly, the first two confirmed cases of Influenza A H1N1 virus in Mexico were isolated in Veracruz and Oaxaca, states known for their high migration rates. Indeed, San Luis Potosi, in which there were atypical influenza cases documented as early as April 17, 2009, is, considered the corridor for migration [4]. Given that the earliest confirmed case in California was a nine-year-old girl who developed influenza-like symptoms on March 28, 2009, and that, according to the CDC, she had been in contact with close relatives who had exhibited influenza-like symptoms before March 25 who were not tested [7], the possibility exists that influenza A H1N1 virus had its origins in close travel between the United States and Mexico.

On April 26, 2009, Canada became the first nation in which virus infection outside of Mexico and the United States was reported [16]. To make matters more puzzling, 220 swine infected with the influenza A H1N1 virus were recently found in a pig breeding farm in Alberta, Canada [8]. On May 2, the Canadian Food Inspection Agency stated that the pigs most likely were exposed to the virus from a Canadian who returned from a trip to Mexico on April 12. The farm worker, who exhibited influenza-like symptoms, went back to work at the farm two days later. Two weeks after the worker's return, the hogs developed influenza-like symptoms such as fever and poor appetite [9,10]. Intriguingly, this would be the first time that swine virus transmission to humans and then back to pigs has been observed [11]. Surprisingly, it was later announced that the farm worker tested negative for the A H1N1 virus [8,14]. Hence, it may be worthwhile to rule out the presence of antibodies against the H1N1 virus strain in this contractor, in an effort to clarify whether this was a case of human-to-swine transmission or the opposite. This evidence involving influenza A H1N1 virus-infected swine again raises the possibility that close travel between Canada and Mexico played a role in origin of this novel virus's emergence [15].

Regardless of the origin of the A H1N1 virus, at sustained human-to-human transmission has now occurred in North America warranting the WHO to raise the global pandemic alert to phase 5 in a scale of 6, meaning a pandemic is imminent. As of June 9, there were 25,288 confirmed cases and 139 deaths worldwide with Mexico accounting for the 24.19% of the cases and 77.7% of the deaths [17]. According to the Mexican Health Ministry, there have been 6,241 confirmed cases in Mexico, including 108 deaths as of June 9, 2009 [18]. About a half of the deceased patients were women (51,9%), while 77 deaths (71.3%) occurred in young people aged 20 to 54]19). Currently there is no explanation as to why young people might have been more affected. An increased immune response in young adults that might provedetrimental for the organism may be involved. On the other hand, delayed medical care related to minimization of symptoms among young adults may play a role as well.

Conclusions

Though the number of new cases has been decreasing in Mexico, there is still concern about the probability of a new reassortment with other viruses of either human or animal hosts that could result in a more pathogenic strain. There is concern that the farther the virus spreads, the more likely that it will reassort again, posing a threat for every nation [20]. It is very important, therefore, to consider that actions concerning influenza A H1N1 need to be based on fact and science, following the recommendations of public health officials. Additionally, further education and preparation of health care workers and first responders is critical to deal with an influenza pandemic, particularly regarding the performance of specific and sensitive diagnostic assays that effectively detect positive cases. Finally, a lesson that we learned from this influenza outbreak is that such an emergency can only be dealt with if a well-established public health and surveillance program is available that allows for an appropriate response

following the recommendations of health officials and recognized experts in the field of influenza virology. Therefore, government authorities must consider that every measure of response has a cost-benefit ratio that should be carefully analyzed, particularly in the light of health benefits such as immunization programs that seem to provide significant hope for suppressing the long-term impact of this newly emergent virus.

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