Global Influenza Hospital Surveillance Network

Burden of Influenza in Hospitalized Mexican Patients During the 2018-2019 Season

Guillermo M. Ruiz-Palacios,[1] M. Lourdes Guerrero,[1] Agustín de Colsa-Ranero,[2] Alejandra Aquino,[2] Andrés Hernandez,[3] Yuri Roldan-Aragón,[4] Juan Carlos Tinoco,[5] Juan Pablo Ramírez-Hinojosa,[6] Patricia Vidal,[6] Sarbelio Moreno-Espinosa,[7] Ana E. Gamiño-Arroyo,[7] Emilia C. Ruiz-Hernández,[8] Norma E. Rivera,[9] José Gabriel Najera-Cancino,[10] Arturo Galindo-Fraga,[1] Hilda Ortega-Gallegos,[1] Pilar Ramos-Cervantes[1] , Violeta Ibarra-González[1], Julia Martínez-López[1], Luis García-Andrade,[1] Jesús A. Domínguez-Diaz,[1] on behalf of the Global Influenza Hospital Surveillance Network-Mexico.

[1]Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán, Mexico City; [2]Instituto Nacional de Pediatría, Mexico City; Instituto Nacional de Enfermedades Respiratorias, México City; [4]Hospital General Dr. Aurelio Valdivieso, Oaxaca; [5]Hospital General de Durango and Hospital General 450, Durango, México; [6]Hospital General Dr. Manuel Gea González, Mexico City; [7]Hospital Infantil de México Federico Gómez, Mexico City; [8]Hospital General de Tapachula, Chiapas, México; [9]Hospital Regional de Alta Especialidad Oaxaca, México; [10]Hospital Regional de Alta Especialidad Ciudad Salud, Tapachula, Chiapas, México.

Site presentation

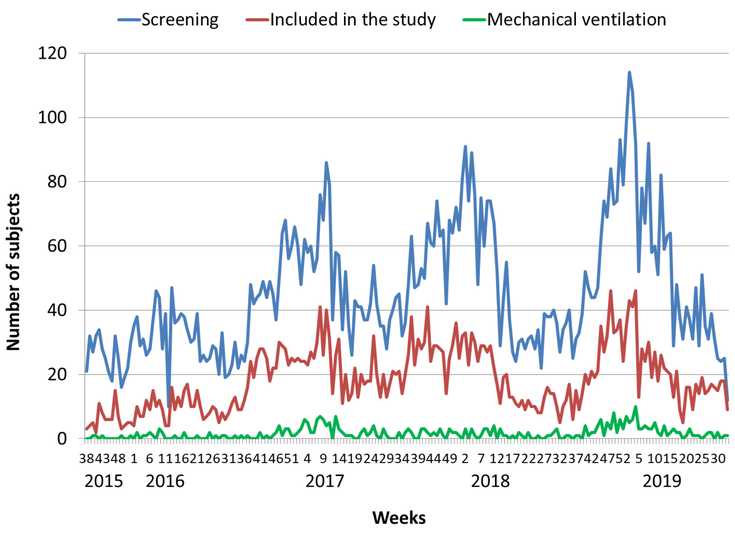
To establish the Mexico branch of the GIHSN, 11 hospitals have been included since September 2015, 5 in the Mexico City area and 6 in the following Mexican States: Durango, Oaxaca and Chiapas. Potential study patients are assessed throughout the whole calendar year. Influenza season is defined as the first two weeks in which influenza is being identified and there is a continuous increase thereafter. The end of the season occurs with the decline of influenza positive cases followed by two-influenza-free weeks. Hospitalized patients ≥I month of age (no upper age limit) are eligible for the study.

Methods

Hospitalized, non-institutionalized patients residing in a pre-defined hospital catchment area, reporting symptoms of a predefined set of conditions described as possibly associated with a recent influenza infection within 7 days prior to admission and not having been discharged from a hospital in the previous 30 days are included in the study. Trained doctors and nurses collect relevant information by a combination of face-to-face interview of patients and attending physicians, and by reviewing clinical records. Nasopharyngeal swabs are collected from all patients meeting the inclusion criteria and tested by reverse transcription-polymerase chain reaction (RT-qPCR) for influenza and a multiplex PCR (Respifinder®) for other viruses and bacteria. Influenza-positive samples are sub-typed. Patients are considered vaccinated if they had received the current season's influenza vaccine at least 14 days before symptom onset. The study was approved by a Central Research Ethics Committee. Informed written consent/assent when appropriate is required for enrollment.

Consecutive influenza seasons: 2015-2019

Patients screened, enrolled in the study and admitted to the ICU/required invasive respiratory support in the GIHSN-Mexico, 2015-2019



Influenza seasons and predominant strains in Mexico, 2015-2019

Confirmed Influenza cases and deaths in sentinel hospitals in Mexico, 2010-2019

Data reported to the Mexico National Epidemiology Influenza Reporting System

Season	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019
Predominant subtype	H3N2	H1N1	H3N2	H1N1	H3N2	H1N1	H1N1	H3N2	H1N1
Influenza cases	3133	7267	2840	8974	2752	9270	5934	3510	6518
Influenza Deaths	43 (1.3%)	343 (4.7%)	49 (1.7%)	1104 (12.3%)	82 (2.9%)	674 (7.2%)	508 (8.5%)	152 (4.3%)	745 (11.4%)

Data reported by sentinel sites participating in the GIHSN-Mexico

Influenza cases						82	156	159	226
Influenza Deaths						6 (7.3%)	13 (8.3%)	10 (6.3%)	39 (17.2%)

Results form the 2018-2019 influenza season

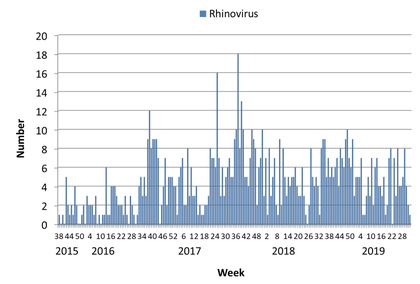
A total of 2227 hospitalized patients with community acquired respiratory illness were assessed for eligibility during the 2018-2019 season. Of them, 866 (39%) met selection criteria and consented participation: 441 (51%) patients were ≥5 years old and 425 (49%) patients were <5 years old. In the ≥5 years old group 244 (55%) were male; in the <5 years old group 220 (52%) were male.

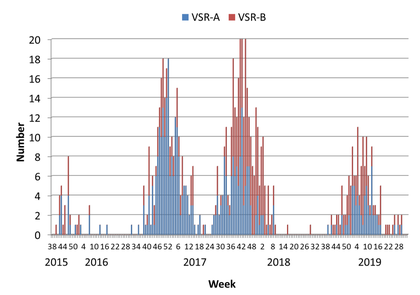
Of 866 enrolled patients, 226 (26%) tested positive for influenza. Influenza subtype A(H1N1)pdm09 predominated during the season [163 (70%) cases], followed by influenza A(H3N2) [16 (7%) cases] and non-typeable influenza A [7 (3%) cases]. Influenza B tested positive in 45 (19.5%) patients; of them 20 (9%) were subtype B-Yamagata, 15 (7%) B-Victoria and 10 (4%) non-typeable influenza B.

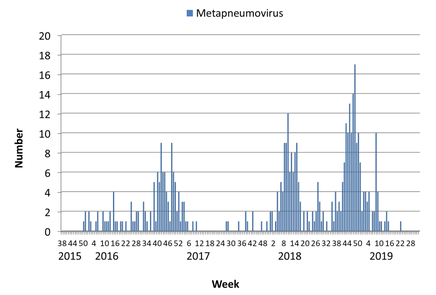
Among influenza positive patients there were 49 (22%) admissions to the ICU, 70 (31%) required invasive mechanical ventilation and 39 (17%) died; 85% of the patients were not vaccinated.

The table and the graphs below show the cumulative frequency and seasonal distributions of respiratory viruses in hospitalized patients participating in the study.

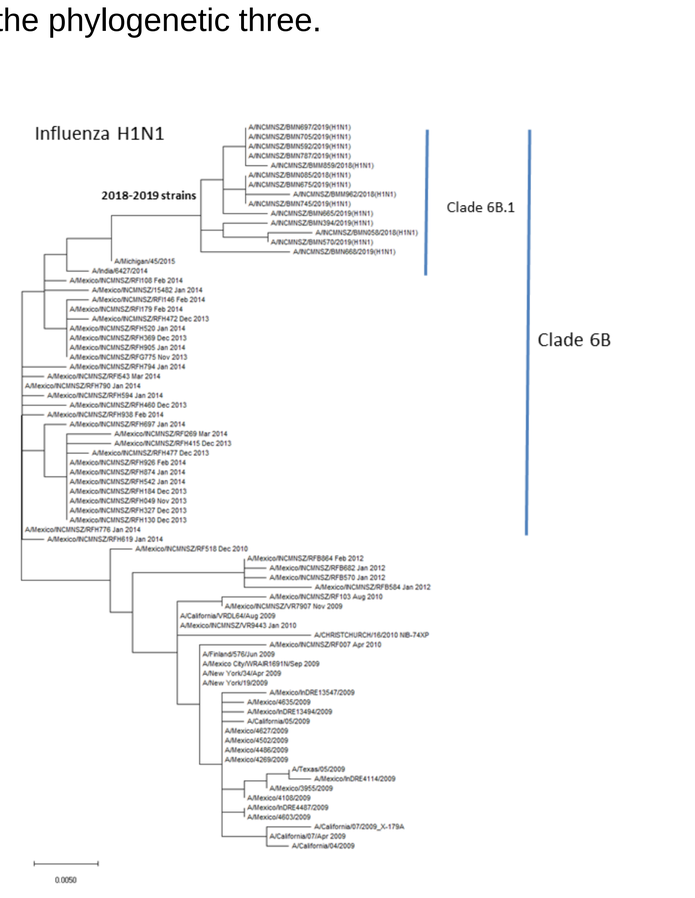
Pathogen	Number (%)
Adenovirus	47 (1.3)
Bocavirus	47 (1.3)
B. pertussis	13 (0.3)
Chlamydophila pneumoniae	0
Coronavirus	80 (2.1)
Influenza	463 (12.4)
Legionella	1 (0.1)
Metapneumovirus	274 (7.3)
Mycoplasma pneumoniae	5 (0.1)
Parainfluenza	185 (4.9)
VSR	453 (12.1)
Rhinovirus	643 (17.2)
Co-infections (≥2 pathogens)	697 (18.7)
Negative	824 (22.1)

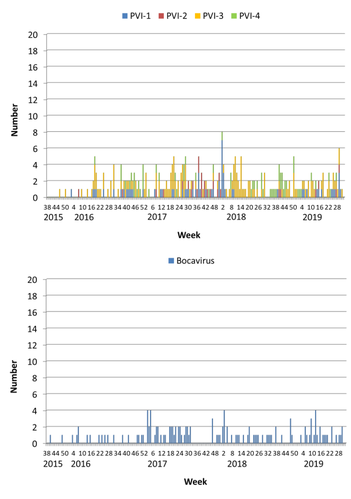


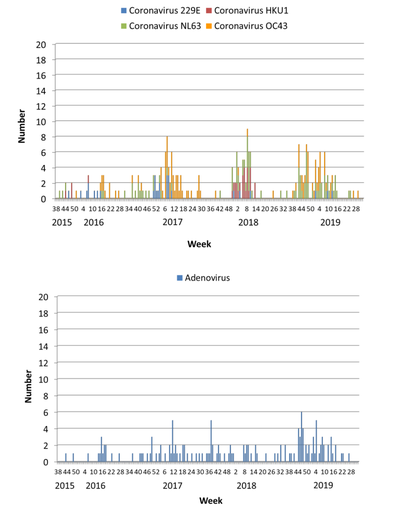




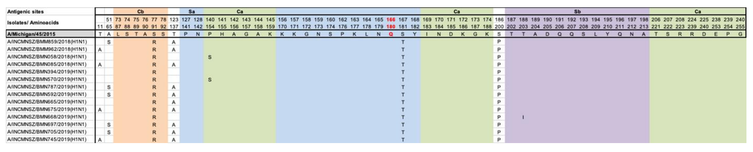
The phylogenetic tree (shown below) is based on the hemagglutinin (HA) genes of influenza A(H1N1) collected during consecutive seasons; genetic differences are compared to the A/California/04/2009 consensus sequence. Amino acid substitutions delineating major branches are shown. Date of collection follows names of viruses. Clade 6B.1 predominated during the 2018-2019 season. Amino acid substitutions are shown in the table below the phylogenetic three.







Antigenic Regions Aligment
Influenza A H1N1 pmd. Segment 4 (Haemmaglutinin)



Key aspects & challenges

The GIHSN-Mexico has successfully implemented a hospital surveillance system for severe influenza and other respiratory viruses. Data obtained provides an indication of changes in the epidemiology of severe influenza, and potentially contributes to the refinement of clinical care guidelines and policy.

Challenges include: the sustainability of the surveillance system and timely dissemination of the results to the scientific community and public health agencies.

Funding:
Sites outside Mexico City: The Foundation of Influenza Epidemiology Mexico City sites: Sanofi-Pasteur Mexico
Laboratory: National Institutes of Health, Mexico Ministry of Health

Contact:
Guillermo M. Ruiz-Palacios, MD., FIDSA.
Emeritus Professor and Head of the Department of Infectious Diseases
Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán
Phone +52-55-5655-8186; e-mail: gmrps@unam.mx