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Epidemiological and Clinical Profile of Influenza A (H1N1) Patients at Sir Takhtsinhji Hospital, Bhavnagar, Gujarat, India

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ABSTRACT
Background: The pandemic was officially declared by the World Health Organisation (WHO) on June 11, 2009. Compared to earlier pandemic viruses of this century, this virus has a low virulence but a unique, stronger transmission potential. This new virus was created by combining two gene segments from the Eurasian influenza A (H1N1) swine viral lineage with six gene segments from the triple reassortant swine-origin virus.
Methods: This retrospective record-based study was conducted among patients of all age groups who were hospitalized and suspected of H1N1 virus infection at the Virology Research and Diagnostic Laboratory (VRDL) of the Microbiology Department, Sir Takhtsinhji Hospital, Bhavnagar. A real-time reverse transcriptase polymerase chain reaction (RT-PCR) test was done to confirm infection and the clinical-epidemiological features of the disease were closely monitored.
Result: Out of 233 patients, 38 patients were positive, the highest number of positive cases were seen in September month, 14 cases. The highest positivity rate was seen in the age group of 0-5 years, with 12 cases (31.5%). 25 (65.8%) were male and 13 (34.2%) were female with Male female ratio of 1.9:1. The most common symptoms of the patients were fever 34 (89.5%) & cough 32 (84.2%) followed by breathlessness.
Conclusion: Our study identified a higher number of cases in males, with the majority reported from the rural area of Bhavnagar. The most frequent symptoms upon admission were fever and cough, followed by breathlessness. The survival rate among admitted H1N1 patients was 86.85%. Fewer patients had co-morbid conditions. Prompt diagnosis and treatment can help mitigate the severity of the disease.

Key-words: Bhavnagar, Fever, Influenza A (H1N1), oxygen therapy devices, Real-time reverse transcriptase polymerase chain reaction (RT-PCR)

INTRODUCTION
The influenza A (H1N1) virus was discovered in the western coastal region of North America in the first quarter of 2009, and between April and June of that year, it quickly expanded to other nations [1,2].

The WHO officially declared the outbreak on June 11, 2009 [2]. As of August 1, 2010, the H1N1/2009 virus had been confirmed in more than 214 countries, resulting in approximately 18,449 fatalities globally.[2] Compared to earlier pandemic viruses of this century, this virus has a low virulence but a unique, stronger transmission potential [3].

The first reported case of H1N1 in India occurred on May 16, 2009, at Hyderabad airport involving a 23-year-old who had travelled to the United States [4]. The virus rapidly spread to nearly all major cities across India.

H1N1 represents a viral illness caused by a newly modified strain of the influenza A virus subtype H1N1 that can infect humans. This new virus is a combination resulting from the reassortment of six gene segments from the triple reassortant swine-origin virus and two gene segments from the Eurasian H1N1 swine virus lineage [5].

The virus can evade host immune responses by utilising antigenic variation through antigenic drift and antigenic shift of hemagglutinin (HA) and neuraminidase (NA) proteins [6]. Seasonal outbreaks of the HA subtype are linked to antigenic drifts. Antigenic alterations in HA subtypes are linked to pandemics.

Globally, acute respiratory tract infections (ARTIs) rank among the leading causes of illness and mortality. Rapid and sensitive molecular assays are necessary for screening for influenza viruses, which are one of the main etiological agents during seasonal epidemics, and for promptly identifying epidemics [7].

MATERIALS AND METHODS

Research design- This retrospective record-based study was conducted among patients of all age groups who were hospitalized and suspected of H1N1 virus infection. The study was carried out at the Virology Research and Diagnostic Laboratory (VRDL) of the Microbiology Department, Sir Takhtsinhji Hospital, Bhavnagar from 1st January 2024 to 31st December 2024.

Inclusion criteria- Only those patients who fell into category C were subjected to a viral isolation test.

Exclusion criteria- Category A & B patients.

Methodology- According to the WHO classification of individuals with influenza-like illness (ILI) or categories A, B, and C, a suspected case of H1N1 virus infection was described. ILI was classified as a case that had at least one respiratory symptom, such as a sore throat, cough, or rhinorrhea, together with a fever of 38°C. A suspected patient who tested positive for H1N1 using real-time reverse transcription polymerase chain reaction is considered a confirmed case [8].

Upper respiratory tract specimens, including nose and throat swabs, were obtained with plastic-shafted dacron swabs immersed in viral transport medium (VTM). RNA was extracted using the viral RNA extraction kit, the sample was lysed and digested with lysate and protease, and RNA was released into the lysate.

Transfer to the adsorption plate and filter column. RNA is adsorbed and removed with filtration. After washing off the proteins and impurities, RNA was finally eluted with low salt buffer.

Amplification and detection for each RNA isolate were done on Biorad CFX 96 RealTime PCR equipment using primers and probe sets for Influenza A, Influenza B and H1N1 testing. Detection of genes INF-A, INF-B and H1N1 are at 510 nm, 555 nm & 510 nm wavelength respectively. CT cut-off for each fluorescent channel:

❖ Viral gene at Ct ≤ 40 interprets as Viral RNA Positive.
❖ Internal Control (IC) Ct ≤ 35 interprets as Internal control Positive.

In this study, we looked back at all swine flu cases that were suspected or confirmed during an outbreak in Bhavnagar. Beginning in January 2024, comprehensive records of every patient who visited swine flu outpatient departments, swine flu wards, and screening centres were kept.

According to guidelines issued by the Ministry of Health and Family Welfare in August 2009, any patient who visited the swine flu ward or OPD and was clinically suspected of being H1N1 positive was assigned to one of three groups. They were as follows:

In the year 2024 from 1st January 2024 to 31st December 2024, a total of 233 cases of suspected H1N1 were tested at VRDL of the Microbiology Department, Sir Takhtsinhji Hospital, Bhavnagar Hospital.

Case record forms were filled with various pieces of information, including gender, religion, place of residence, age, pregnancy status, co-existing diseases, outcome status, and presenting symptoms and signs upon admission. Additional details, such as the length of hospital stay, the time between symptom onset and hospital admission or diagnosis, and other relevant factors, were also recorded.
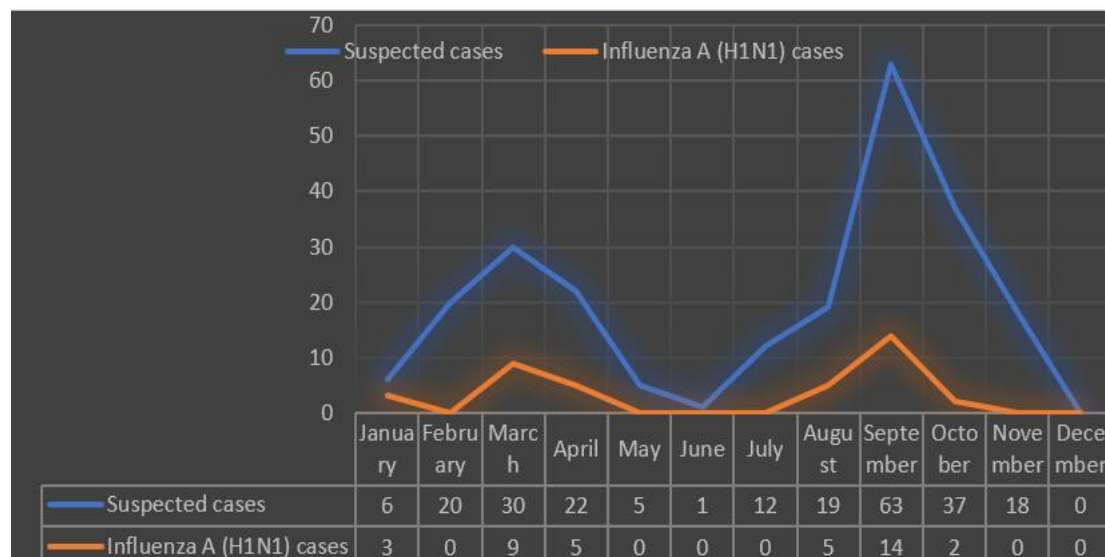
Table 1: Guidelines on the categorization of H1N1

Category	Clinical features and recommendations
A	Mild fever, headache, diarrhoea, vomiting, and a sore throat or cough, with or without body aches. No testing for H1N1 is required in such patients.
B	i. Above signs and symptoms plus high-grade fever and severe painful throat ii. Addition of symptoms and indicators plus one or more of the following conditions: Children under five years old Women who are pregnant Over 65 years of age Possessing HIV, cancer, heart, liver, kidney, or lung ailments, blood disorders, diabetes, or neurological issues Prolonged cortisone.
C	In addition to A and B symptoms and indicators, patients may also exhibit one or more of the following: Chest pain, bluish discolouration, low blood pressure, sleepiness, and dyspnoea small children's irritability and refusal to eat food deterioration of underlying long-term illnesses.

Statistical Analysis- Data were entered in Microsoft Excel 2007 and analyzed using descriptive statistics. The data available for each specific variable were used for the analysis. Categorical variables were expressed as frequencies and percentages

Ethical approval - Approval for the study was obtained by the institutional ethics committee, Government Medical College & Sir Takhtsinhji Hospital, Bhavnagar, Gujarat, India dated 22/04/2025.

RESULTS

A total of 233 patients with suspected H1N1 were evaluated during the study period. 38 were positive out of 233 suspected of H1N1. Month-wise analysis of H1N1 activity revealed suspected and positive cases were showing a maximum rise during September month, with 14 positive cases followed by March month, 9 positive cases (Fig. 1).

	January	February	March	April	May	June	July	August	September	October	November	December
Suspected cases	6	20	30	22	5	1	12	19	63	37	18	0
Influenza A (H1N1) cases	3	0	9	5	0	0	0	5	14	2	0	0

Fig. 1: Seasonal distribution of H1N1 cases

The ages of the confirmed H1N1 cases ranged from zero to one hundred. The H1N1 positivity rate was highest, with 12 cases (31.5%) in the age group of 0–5 years followed by 61–70 years with 8 (21.0%) and 41–50 years age group with 5 (13.15%) positive H1N1 cases (Fig. 2).
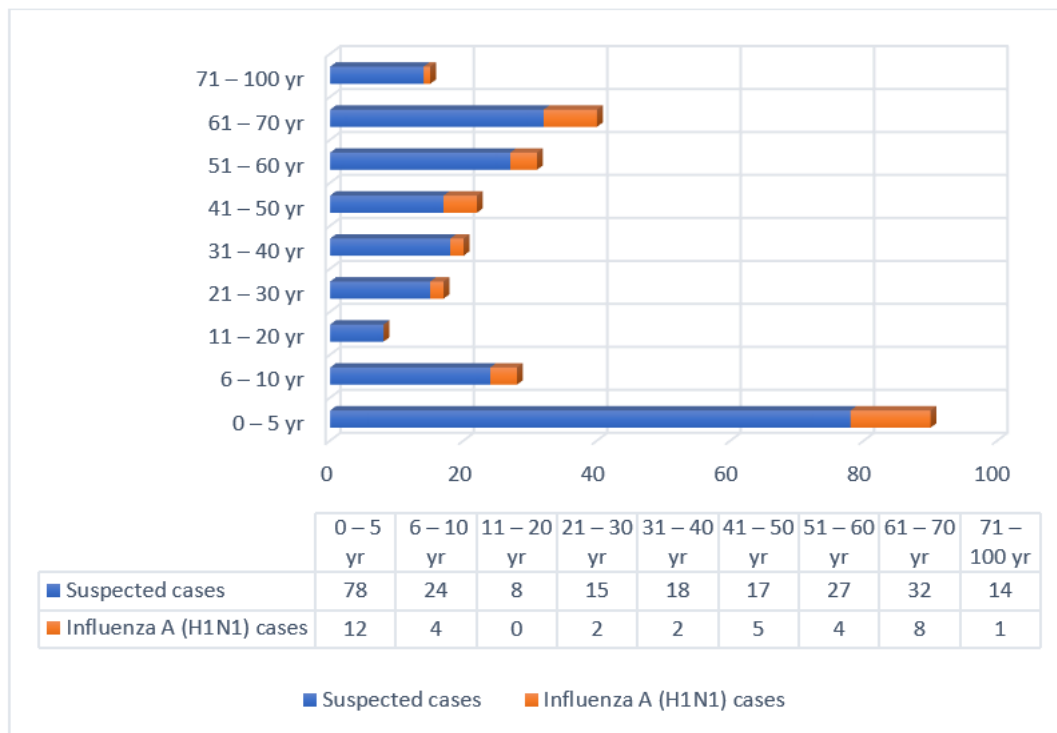
	0 − 5 yr	6 − 10 yr	11 − 20 yr	21 − 30 yr	31 − 40 yr	41 − 50 yr	51 − 60 yr	61 − 70 yr	71 − 100 yr
Suspected cases	78	24	8	15	18	17	27	32	14
Influenza A (H1N1) cases	12	4	0	2	2	5	4	8	1

Fig. 2: Age wise distribution of H1N1 cases

Among 38 positive cases, 25 (65.8%) were male and 13 (34.2%) were female with Male female ratio of 1.9:1 (Fig. 3).
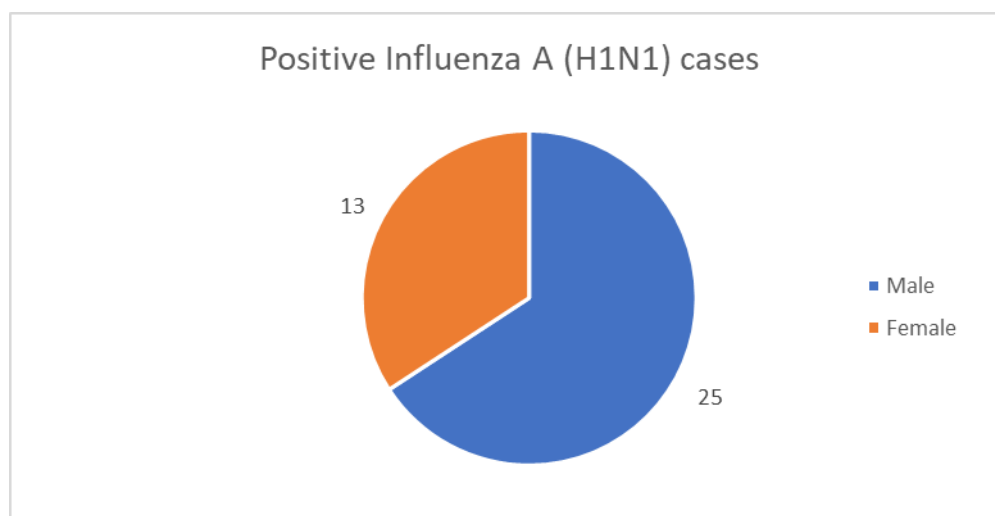

Fig. 3: Sex-wise distribution of H1N1 cases

The clinical features of the confirmed H1N1 infected cases showed that Fever and Cough were the most common symptoms in 34 (89.5%) & 32 (84.2%) respectively followed by Breathlessness in 33 (86.8%) patients. 6 (15.78%) patients had other underlying conditions like CNS involvement. Whereas sore throat and rhinorrhea were fewer common symptoms. Other co-morbid conditions like Hypertension, Diabetes mellitus, and ischemic heart disease were also noted in low frequency. 17 (44.73%) out of 38 positive H1N1 patients required Oxygen therapy devices 3 (17.64%) patients required Nasal prongs, 2 (11.76%) with non-re-breathing masks (NRBM), 4 (23.52%) with BiPap (Bilevel Positive Airway Pressure), 8 (47.05%) with Ventilator support. During this period, 5 deaths occurred due to H1N1 which is suggestive of a case Fatality Rate of 13.15% (Table 2).

Table 2: Hospitalization details of patients

Symptomatic details	No. of Suspected cases (%) (n=233)	No. of Confirmed Positive H1N1 (%) (n=38)
Symptoms of patients		
Fever	147 (63.1%)	34 (89.5%)
Cough	121 (51.9%)	32 (84.2%)
Sore throat	79 (33.9%)	11 (28.9%)
Breathlessness	131 (56.2%)	33 (86.8%)
Diarrhea	6 (2.5%)	1 (2.63%)
Fever with altered sensorium	35 (15.1%)	2 (5.26%)
Rhinnorhea	55 (23.6%)	9 (23.6%)
Associated co-morbid conditions (n=38)		
Hypertension	_	4 (10.52%)
Diabetes mellitus	_	6 (15.78%)
Ischemic heart disease	_	3 (7.89%)
Oxygen therapy devices (n=38)		
Nasal prongs	_	3 (17.64%)
Non re-breathing mask (NRBM)	_	2 (11.76%)
BiPap (Bilevel Positive Airway Pressure)	_	4 (23.52%)
Ventilator support	_	8 (47.05%)
Total	_	17 (44.73%)

Out of 38 cases, the majority cases of positive H1N1 cases seen from Bhavnagar Municipal Corporation area were 12 (31.57%) followed by Sihor 6 (15.78%), Ghogha and Botad were 4 (10.52%), Palitana and Mahuva were 2 (5.26%) followed by Umarala and Talaja were 1 (2.63%) case each. 6 cases were from other districts. Positive H1N1 cases from the Bhavnagar Municipal Corporation area were 12 (31.57%) and from rural areas were 20 (52.6%) (Table 3).

Table 3: Geographical area / Village / District distribution of Cases

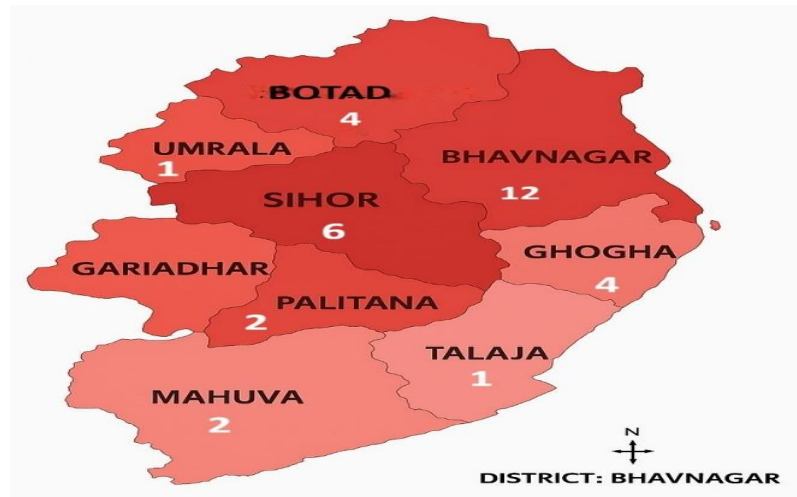| Geographical area-wise distribution of Cases	No. of Confirmed Positive H1N1 (%) (n=38)
Bhavnagar Municipal Corporation (BMC)	12 (31.57%)
Bhavnagar rural area	20 (52.6%)
Other districts	6 (15.83%)
Ahmedabad	3 (7.89%)
Amreli	2 (5.26%)
Somnath	1 (2.63%)

Fig. 4: Distribution of H1N1 cases in Bhavnagar district

DISCUSSION

In May 2009, Hyderabad, Telangana, announced the country's first H1N1 case [9]. On August 3, 2009, the first 2009 H1N1 case was recorded in the Gujarat state [10]. In the year 2024, a total of 233 suspected patients with Influenza symptoms were hospitalized and tested for H1N1 infection, out of which 38 (16.3%) samples were found to be Positive at Sir Takhtsinhji Hospital, Bhavnagar. In South Asia, seasonal influenza often begins in the pre-winter months and disappears as summer arrives, which is from August to March [11]. In our study, Positive cases rise during September month (14 cases), the Monsoon era followed by March month (9 cases), which is comparable with a study conducted by Tripathy *et al.* [12].

The first peak began in February or March, during the winter season, while the second peak, which was dominating, was seen in August or September, during the post-monsoon season. Other studies also show increased influenza activity during the monsoon and post-monsoon seasons [13-15]. The first surge began in February-March, during the cold and low solar radiation season, with a downward tendency in the number of cases between April to June, when it was dry and sunny, indicating increased influenza activity in cold temperatures and low solar radiation. [16-18].

In our study, the highest of Positive H1N1 cases were found in the age range 0–5 years of age group were 12 (31.5%), followed by 61–70 years with 8 (21.0%) and 41–50 years with 5 (13.15%) which is comparable with a study done by Jain *et al.* [16] but most common affected age group varies in other studies done by Chudasama *et*

al. (25-44 years) [18], Rana *et al.* (13–45 years) [19] and Namera *et al.* (30-49 years) [20] was to be more affected.

In our study, males were affecting more (65.8%) as compared to females (34.2%) which is comparable with the study done by Chudasama *et al.* (50.5%) [18] and Prasad *et al.* (60%) [21] but a study done by Namera *et al.* and Al-Lawati *et al.* shows higher positive Influenza H1N1 cases of female sex [20,22]. This difference may be attributed to differences in socio-demographic characteristics in the community surveyed.

In our study, Fever (89.5%) and Cough (84.2%) were the most common symptoms followed by Breathlessness (86.8%) patients, similar common presenting symptoms were observed in the study done by Namera *et al.* and Prasad *et al.* [20,21].

The overall Case Fatality Rate (CFR) in our study was 13.15 percent, whereas Domadia *et al.* [23] reported a CFR of 22.4% in Jamnagar and Patel *et al.* [24] reported a CFR of 5.9% in Surat City in 2015. It was 19.9% in another study conducted by Rana *et al.* [19] during the 2009 Gujarat pandemic.

CONCLUSIONS

In our study, more cases were found in males and most cases were reported from Bhavnagar rural area. The most common presenting symptoms among cases at the time of admission were Fever and cough followed by breathlessness, with a survival rate of 86.85% among those admitted. patients of Influenza A (H1N1). Less number of patients had Co-morbid disease. Early diagnosis and treatment may reduce the severity of the disease.

CONTRIBUTION OF AUTHORS

Research concept- Dr. Avani Dodiya, Dr. Saklainhaider Malek

Research design- Dr. Avani Dodiya, Dr. Saklainhaider Malek

Supervision- Dr. Saklainhaider Malek, Dr. Kairavi Desai

Materials- Dr. Avani Dodiya

Data collection- Dr. Avani Dodiya

Data analysis and Interpretation- Dr. Avani Dodiya, Dr. Saklainhaider Malek

Literature search- Dr. Avani Dodiya, Dr. Saklainhaider Malek

Writing article- Dr. Avani Dodiya

Critical review- Dr. Saklainhaider Malek, Dr. Kairavi Desai

Article editing- Dr. Avani Dodiya

Final approval- Dr. Saklainhaider Malek, Dr. Kairavi Desai

REFERENCES

[1] Dawood FS, Jain S, Finelli L, Shaw MW, Lindstrom S, Garten RJ, Gubareva LV, Xu X, Bridges CB, Uyeki TM. Emergence of a novel swine-origin influenza A (H1N1) virus in humans. N Engl J Med., 2009; 360(25): 2605–15. doi: 10.1056/NEJMoa0903810.

[2] WHO. Pandemic (H1N1) 2009 - update 112 [Internet]: WHO; 2009. Available from: http://www.who.int/csr/don/2010_08_06/en/index.html.

[3] Outbreak of swine-origin influenza A (H1N1) virus infection — Mexico, March–April 2009 [Internet]. Available from: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm58d0430a2.htm.

[4] John TJ, Moorthy M. 2009 pandemic influenza in India. Indian Pediatr. 2010; 47: 25–31.

[5] Antigenic and genetic characteristics of swine-origin 2009 A (H1N1) influenza viruses circulating in humans [Internet]. Available from: http://www.sciencemag.org/content/325/5937/197.abstract.

[6] Mandell G, Bennett J, Dolin R. Mandell, Douglas, and Bennett's principles and practice of infectious diseases. 6th ed. Philadelphia: Elsevier Churchill Livingstone; 2004. Available from: Principles and Practice of Infectious Diseases Online - 6th Edition | Elsevier Shop.

[7] Agrawal AS, Sarkar M, Chakrabarti S, Rajendran K, Kaur H, Mishra AC, et al. Comparative evaluation of real-time PCR and conventional RT-PCR during a 2 year surveillance for influenza and respiratory syncytial virus among children with acute respiratory infections in Kolkata, India, reveals a distinct seasonality of infection. J Med Microbiol., 2009; 58(12): 1616–22. doi: 10.1099/jmm.0.011304-0.

[8] Interim WHO Guidance for the Surveillance of Human Infection with Swine Influenza A(H1N1) Virus, 27 April 2009. Available from: https://www.who.int/csr/disease/swineflu/WHO_case_definitions.pdf.

[9] Kulkarni PS, Raut SK, Dhere RM. A post-marketing surveillance study of a human live-virus pandemic influenza A (H1N1) vaccine (Nasovac®) in India. Hum Vaccin Immunother., 2013; 9(1): 122–24.

[10] Government of India, Ministry of Health and Family Welfare. Consolidated Status of Influenza A H1N1 [Internet]. [Last accessed on 2010 Feb 28]. Available from: http://www.mohfw-h1n1.nic.in.

[11] George KS. Diagnosis of influenza virus. Methods Mol Biol., 2012; 865: 53–69. doi: 10.1007/978-1-61779-621-0_4.

[12] Tripathy SK, Mishra P, Dwibedi B, Priyadarshini L, Das RR. Clinico-epidemiological study of viral acute encephalitis syndrome cases and comparison to nonviral cases in children from Eastern India. J Glob Infect Dis., 2019; 11(1): 7–12. doi: 10.4103/jgid.jgid_26_18.

[13] Rasmussen SA, Jamieson DJ, Macfarlane K, et al. Pandemic influenza and pregnant women: summary of a meeting of experts. Am J Public Health, 2009; 99 Suppl 2: S248–54. doi: 10.2105/AJPH.2008.152900.

[14] Balaganesakumar SR, Murhekar MV, Swamy KK, Kumar MR, Manickam P, et al. Risk factors associated with death among influenza A (H1N1) patients, Tamil Nadu, India, 2010. J Postgrad Med., 2013; 59(1): 9–14. doi: 10.4103/0022-3859.109481.

[15] Campbell A, Rodin R, Kropp R, et al. Risk of severe outcomes among patients admitted to hospital with pandemic (H1N1) influenza. CMAJ. 2010; 182(4): 349–55. doi: 10.1503/cmaj.091823.

[16] Jain S, Kamimoto L, Bramley AM, et al. Hospitalized patients with 2009 H1N1 influenza in the United States, April–June 2009. N Engl J Med., 2009; 361: 1935–44. doi: 10.1056/NEJMoa0906695.

[17] Yokota RT, Skalinski LM, Igansi CN, et al. Risk factors for death from ic (H1N1) 2009, southern Brazil.

Emerg Infect Dis., 2011; 17(8): 1467–71. doi: 10.3201/eid1708.101233.

[18] Chudasama RK, Verma PB, Amin CD, Gohel B, Savariya D, Ninama R. A two-wave analysis of hospitalizations and mortality from seasonal and pandemic 2009 A (H1N1) influenza in Saurashtra, India: 2009–2011. Ann Med Health Sci Res., 2013; 3: 334–40. doi: 10.4103/2141-9248.117929.

[19] Rana H, Parikh P, Shah AN, Gandhi S. Epidemiology and clinical outcome of H1N1 in Gujarat from July 2009 to March 2010. J Assoc Physicians India, 2012; 60: 95–97.

[20] Namera HK, Gohil VS, Matariya ZR, Jahangirporia DN, Nimavat NK, et al. Clinico-epidemiological characteristics of Influenza A (H1N1) confirmed cases admitted in various hospitals of Rajkot City, Gujarat (January 2015 to May 2015). Healthline J Indian Assoc Prev Soc Med., 2016; 7(2): 1–6.

[21] Prasad H, Puranik S, Kadam D, Sangle S, Borse R, et al. Retrospective analysis of necropsy findings in patients of H1N1 and their correlation to clinical features. J Assoc Physc India, 2011; 59: 498–500.

[22] Al-Lawati J, Al-Tamtami N, Al-Qasmi A, Al-Jardani A, Al-Abri S, et al. Hospitalised patients with Influenza A (H1N1) in the Royal Hospital, Oman: experience of a tertiary care hospital, July–December 2009. Sultan Qaboos Univ Med J., 2010; 10(3): 326–34.

[23] Domadia K, Chatterjee IS, Chatterjee SS, Bhuva D, Mehta MN. Clinical-epidemiological profile of Influenza A H1N1 cases at a tertiary care institute of Western India. Indian J Appl Res., 2015; 5: 657–59.

[24] Patel PB, Patel MJ, Patel K, Jadawala H, Prasad R, Bansal RK. Health care seeking interval and fatality rate in Swine Flu (H1N1) epidemic in Surat City. Natl J Community Med., 2015; 6(1): 25–39.