

RESEARCH ARTICLE

# 2009 Pandemic Influenza A (H1N1) — Epidemiological experience from Thrissur, Central Kerala

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## Abstract

We report our experience with 2009 influenza A (H1N1) pandemic in central Kerala, India, focusing on the overall epidemiological characteristics. The first case imported to central Kerala was confirmed on July 16<sup>th</sup>, 2009, and the first indigenous case was reported on August 23<sup>rd</sup>, 2009. Young adults were identified as the commonly affected population. The median age of the affected patients was 24 years and that of dead patients was 30 years. Of the patients, 6.7% required ventilator support and 4.1% died between April 2009 and March 2011; the deaths were mostly due to multiorgan failure. Female subjects were affected predominantly. Oseltamivir treatment was effective in the management of the cases. Public health measures helped control the spread of the epidemic, thereby reducing the fatalities and complications and protecting the young, productive population.

## Introduction

The emergence of a novel virus causing a global pandemic—the 2009 pandemic

influenza A (H1N1) viral strain—to which humans have no immunity led the World Health Organization (WHO) to declare the world's first ever public health emergency of international concern.<sup>1</sup> In India, the infection was first detected at Hyderabad airport on May 13<sup>th</sup>, 2009, in a 23-year-old man traveling from US to India; H1N1 positivity was confirmed three days later.<sup>2</sup> The Government of India advised affected persons to stay at home until they got better since the pandemic was widespread and recommended that laboratory testing be restricted to atypical and severe cases. When the infection is present in a household and there is a high epidemiological likelihood of a person having H1N1 influenza, it is not necessary to obtain swabs of all those affected.<sup>3</sup>

During the 2009-2010 wave of the pandemic, Kerala was affected as much as the other states of India, according to the data provided by the H1N1 Cell of the Health Services Department of Kerala. The first Case in Kerala was reported on June 24<sup>th</sup>, 2009, from Ernakulam District, imported from the United Kingdom. During the 2<sup>nd</sup> wave in 2010, Kerala and Maharashtra were the 2 states predominantly hit by the pandemic resurgence.<sup>4</sup> The disease was deemed 'notifiable' on August 26<sup>th</sup>, 2009, by the Government of Kerala. Kerala was one of the worst affected states in India, most probably due to the population density and

the overcrowding in the cities.<sup>4</sup> Since Kerala had faced major threats during both the waves of infection, a study on the spread of this novel virus in the state's population is imperative.

Only a few studies have been published from India and, especially, Kerala. Therefore, a study to document the epidemiological features from the central part of Kerala will be beneficial to elucidate the epidemiology of the pandemic influenza in this part of the world. We studied the epidemiological characteristics of the population affected by the 2009 pandemic influenza A (H1N1) between 2009 and 2011 in Thrissur district, Kerala.

#### **Methods**

The study was descriptive in nature. We obtained data from the District Medical Officer (DMO), Thrissur, Kerala, who documented all the data regarding H1N1 according to guidelines of the Ministry of Health and Family Welfare (MOHFW). Data on the following which included case definition, categorization of cases (A, B, C), sample collection, handling of human clinical samples, and school surveillance. According to the Revised Guidelines of MOHFW published on August 14<sup>th</sup> 2009, category A constituted patients with mild fever plus cough/sore throat with or without body ache, headache, diarrhea, and vomiting; they do not require oseltamivir or testing for H1N1. Category B included patients with high-grade fever and severe

sore throat, in addition to all the signs and symptoms included under Category A; these patients require home isolation and oseltamivir. Category B also included high-risk groups such as children aged less than 5 years; pregnant women; persons aged 65 years or older; patients with co-morbidities like lung disease, heart disease, liver disease, kidney disease, blood disorders, diabetes, neurological disorders, cancer, HIV/AIDS; and patients on long-term cortisone therapy. Patients in category B do not require H1N1 testing. Patients Category C comprises patients with any of the following signs and symptoms in addition to those included in categories A and B: breathlessness, chest pain, drowsiness, fall in blood pressure, sputum mixed with blood, bluish discoloration of nails, irritability among small children, refusal to accept feed, and worsening of underlying chronic conditions. All the patients in category C require H1N1 testing, immediate hospitalization, and treatment with oseltamivir. Chemoprophylaxis was administered to household contacts as per the policy decision by the Government according to the severity of the disease and comorbidities. The data at the District Medical Office Data Base were well documented. All government and private hospitals in the district sent data related to this infection daily to the District Medical Office, as ensured by the H1N1 Officer-in-charge of the District Medical Office. A unique Clinical and

Epidemiological Data Entry Performa was used for H1N1 Influenza patients. It contained the patients' socio-demographic profile; clinical signs and symptoms; exposure history; sample collection details; investigation; treatment administered; and details about the doctor, hospital, district, and state. Throat swabs were obtained from all individuals who met the interim definition for a suspected case of recent-onset influenza-like illness (ILI). Diagnostic testing was performed at 3 accredited laboratories in India. Real-time polymerase chain reaction (PCR) was used to detect and characterize the pandemic influenza A (H1N1) virus. No attempt was made to differentiate the pandemic and non-pandemic strains. Data from all patients were then compiled, analyzed at the District level, sent to the State level, and forwarded to the Government of India authorities.

The data from these records were collected after obtaining the permission of the concerned authority, and the study protocol was approved by the Ethical Committee. Data were collected for the period between April 2009 and March 2011 (to include both the waves of the pandemic) and analyzed using SPSS version 16. The following variables were studied: age (with special focus on children and elderly), gender, history of international travel, contact history, clinical features, home isolation, hospital stay, comorbidities, complications (including history of

pregnancy, respiratory failure, and requirement of ventilator support), screening, confirmation by lab diagnosis, mortality, occurrence of infection in contacts and health care workers, oseltamivir treatment, and its resistance.

### Results

We assessed the events during the 2 years from the emergence of the pandemic in April 2009 and its 2 waves.

The index case reported was of a 9-year-old male child who arrived from United Kingdom and was admitted on July 14<sup>th</sup>, 2009, at District Hospital, Thrissur; the first indigenous case, reported on August 23<sup>rd</sup>, 2009, was of a 9-year-old girl.

The overall epidemiological findings are summarized in Tables I, II, III and IV.

**Table I: Clinical characteristics of patients with H1N1 influenza**

Variables	Number
Patients screened	9149
Patients with lab testing	1523
Patients with RT-PCR positivity	343
Mean hospital stay	5 days (2–7 days)
Total deaths	14

**Table II: Year-wise details of patients screened and treated for H1N1 influenza between April 2009 and March 2011**

Variables	2009	2010	2011	Total
Patients screened	1108	7590	451	9149
Swabs sent	538	936	49	1523
Total quarantine	2054	7460	438	9952
Hospital quarantine	247	628	12	887
Patients administered prophylaxis	1159	84	0	1243

Patients administered treatment	708	7181	438	8327
Number of Deaths	3	11	0	14

A total of 1523 subjects were tested for H1N1, and 22.5% (343) tested positive. The highest number of cases and mortalities were observed in 2010 (78.6%).

**Table III: Distribution of characteristics of patients with H1N1 from Thrissur district during the 2 years of the pandemic**

Distribution of characteristics		
Age of patients	Adults: 80%	Children: 20%
Gender of patients	Male: 43%	Female: 57%
Median age of patients	24 years (1–73 years)	n = 343
Median age of dead patients	30 years (4–63)	Female, 64%
Median age of pregnant patients	24 years (19–32)	n = 40
Transmission history	24% international travel	76% indigenous

Individuals aged 20–30 years were the most affected, and the female population was more predominantly affected than the male population, with the male to female ratio of patients being 1:1.3.

**Table IV: Mortality details of patients with H1N1 during the 2 year period**

Mortality characteristics		Sex	
No. of children	2 (14%)	F = 2	Pregnant woman = 1
No. of adults	10 (71%)	F = 6 M = 4	
No. of elderly	2 (14%)	F = 1 M = 1	
Total	14	F = 9 M = 5	<b>M:F Ratio = 1:1.7</b>

The total number of cases with ILI admitted was 887 (hospital quarantine, 9%), and 9065 were quarantined at home. Of the total patients quarantined, 453 (4.5%) were students. Students from 23 schools were under surveillance, and 39 students (aged 5 to 18 years) were confirmed to have pandemic influenza. Due to exposure, 439 students were administered oseltamivir. The total number of patients who received treatment was 8327. In Thrissur district, 20 treatment centers were equipped for the management of pandemic influenza.

**Clinical features:** Fever (95%), sore throat (45%), running nose (55%), cough (75%), shortness of breath (20%), diarrhea (1%), vomiting (7%), headache (40%), and body pain (32%) were the commonly reported

symptoms. In the majority of the cases, there was no history of pre-existing conditions such as diabetes, heart and lung disease, cancer, obesity, HIV, and TB; 6% of the patients had diabetes and hypertension. The mean duration of hospitalization was 5 days. There were no reports of oseltamivir resistance.

Five doctors, 3 medical students, and 7 hospital staff were confirmed to have influenza A (H1N1); all of them received treated and recovered completely.

Twenty-three patients with severe illness required ICU admission for mechanical ventilation, and 14 patients died due to multiorgan failure, one of whom had seizures. Sixty-one percent of the patients requiring ventilator support died. The

percentage of patients who required ventilator support was 6.7%.

### Discussion

In this study, we attempted to document the epidemiological characteristics of the H1N1 pandemic influenza from Thrissur district during the past two years. Morbidity and mortality in central Kerala were lower than those reported from other parts of the country and abroad. The population mainly affected was the young adults (20–30 years), and females outnumbered males with male to female ratio being 1:1.3 among patients and 1:1.7 among deaths. The male to female ratios reported from Maharashtra and Kolkata were 1.3:1 and 1.2:1, respectively.<sup>5,6</sup>

The median age of the affected population was 24 years. Subjects aged 20–30 years were the most affected; which was different from those reported in previous reports, *i.e.*, 16–60 years,<sup>5</sup> 20–40 years,<sup>7</sup> and 15–34 years.<sup>8</sup> Mortality and positive test results were observed more frequently in female patients than in male patients. Twenty percent of the cases were of children below 12 years of age. Twenty-four percent of the patients had reported an international travel history, and indigenous cases were reported one and a half months after the detection of the index case. Of the 9149 screened individuals, 8327 received oseltamivir treatment, which included affected patients

and their contacts. The pattern of symptoms exhibited by the patients agree with that reported from different parts of India.<sup>5,6,7,8</sup> In our study, 22.5% of the lab-tested cases were found to be positive, as against 23.5% from another study in India.<sup>6</sup>

Early diagnosis and treatment may have resulted in reduced mortality during these 2 years (only 14 deaths; 4.1%). Ventilator support was required for 23 patients (6.7%) and 39% survived. The median age among the deaths was 30 years, and 64% were female subjects, including one pregnant woman. Six percent of the patients had the comorbidities diabetes and hypertension, which is lower than that reported from other parts of India and included chronic obstructive pulmonary disease and cardiovascular disease.<sup>7,8</sup> The cause of death was multiorgan failure in all the cases. Mortality among the patients requiring mechanical ventilation was reported to be 58%, and one possible contributing factor for death could be delayed admission and delayed initiation of oseltamivir and also multi system organ failure.<sup>9</sup> Pregnant women were reported to have increased risk to more severe outcomes.<sup>10</sup> The median length of stay in critical care was 5 days. In England, the risk of hospitalization with pandemic influenza A (H1N1) was concentrated in the young and those with pre-existing conditions.<sup>11</sup> In our study, the range of hospitalization was found to be 2 to

7 days, and the median hospital stay was 5 days.

The emergence of pandemic influenza A (H1N1) in 2009 had a disproportionate impact on school-age children. In more than half of the reported cases of H1N1 influenza from the United States, the affected patients were children younger than 18 years.<sup>12</sup> Our data revealed that from the 23 schools surveyed during this 2-year period, only 39 students (11.4%) tested positive for H1N1.

A case-control study to identify the risk factors of the pandemic H1N1 2009 influenza revealed only a slight association between various socioeconomic indicators and hospitalization.<sup>13</sup> Epidemiological inequality has been clearly examined in some investigations on from the 2009 H1N1 pandemic.<sup>14</sup>

Oseltamivir resistance has not been reported in any part of India so far, and therefore, it remains the drug of choice in patients with influenza A infection. Oseltamivir was highly effective in treating patients and preventing infection in exposed health care personals and contacts. No difference was noted in the effectiveness of oseltamivir in the first and second phases of the epidemic.

*Limitations:* Data pertaining to the education and occupation of the affected population were not available for analysis,

which is a weakness of our study. Another limitation is that infection with non-pandemic strains could not be accounted for because of the lack of subtyping in all cases. Further, data regarding non-hospitalized patients were not available for analysis, and therefore, we could not compare hospitalized and non-hospitalized patients.

The study sample was a cross-section of the entire Kerala state population, and therefore, the findings can be generalized to the population of the State.

## Conclusions

Influenza A (H1N1) generally affected the healthy, young adult population (20–30 years), with a female predilection. Multiorgan failure was the cause of death in all fatal cases. Public health measures and early treatment with oseltamivir considerably reduced morbidity and mortality. Further research is necessary to identify the sociodemographic determinants of this pandemic influenza.

## Acknowledgements

We wish to thank the whole-hearted support of Dr. Divakaran, District Medical Officer, Thrissur District and Mr. Raju, Technical Assistant, District Medical Office, Thrissur. We are grateful to Dr. Ajithkumar K, Additional Professor of Dermatology,



Government. Medical College, Thrissur for reviewing the draft.

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