Novel influenza A (H1N1) virus, currently referred to as 2009 H1N1, caused the first influenza pandemic in decades.\(^1\) Influenza-like illness (ILI) is defined by the Centers for Disease Control and Prevention (CDC) as fever (temperature ≥100°F or 37.8°C) and either cough or sore throat in the absence of another known cause.\(^2\) A confirmed case of the 2009 H1N1 infection is defined by ILI with positive test results for the 2009 H1N1 virus by either real-time reverse transcriptase polymerase chain reaction (RT-PCR) or viral culture.\(^1\) On 24 April 2009, the World Health Organization (WHO) issued an official statement declaring a public health emergency of international interest, and on 11 June 2009, the pandemic alert level increased to phase 6, indicating that the human-to-human transmission of the virus had occurred in at least 2 countries of 2 different WHO regions.\(^3\)

The aim of the present study was to characterize the demographics, clinical presentation, complications, and duration of illness; identify associated underlying medical conditions; and describe the outcome in the pediatric age group as well as in different nationalities, especially in the time of pilgrimage.

**Patients and Methods**

This prospective study was conducted in Jeddah Clinic Hospital-Al Kandarah (JCH-K) on the basis of records in the time period from October 2009 to January 2010. It included 89 patients with a confirmed pandemic (H1N1) 2009. Cases presenting with flu-like symptoms such as fever equal to or greater than 38°C (100.4°F), cough, sore throat, rhinorrhea, lethargy in children...
under the age of 1, and respiratory distress were investigated. These patients were subsequently tested with real-time RT-PCR by using protocols from the United States CDC. The diagnostic test was performed in the Ministry of Health regional laboratory in Jeddah. The diagnostic test was a real-time RT-PCR assay that uses fluorogenic hydrolysis probe technology for the detection of human influenza A virus in nasopharyngeal swabs according to manufacturer’s instructions (Roche, Germany), using specific probes for the novel influenza A (H1N1) strain.

Data were tabulated and subjected to analysis using Microsoft Excel version 2007 and the SPSS version 12.0 using the t test, testing differences between means for statistical significance and the chi-square test to compare nonnumerical data. In general, P values less than .05 are considered significant.

RESULTS
The majority of cases 67.4% (60/89) were noted in the epidemiological weeks 43, 44, and 45 as shown in Figure 1. Their ages ranged between 1.5 months to 15 years with mean (standard deviation) of 80.2 (44.5) months. Thirteen patients were up to 2 years of age, 21 patients were older than 2 years and up to 5 years of age, and 55 patients were older than 5 years. Thirty (33.7%) patients had a history of direct contact with a confirmed case, showing a statistically significant higher rate in patients up to 2 years of age (9/13) in which \( P = .003 \). A total of 73% patients were hospitalized with a mean (SD) duration of 3.62 (2.05) days. Hospitalization rates were 26/33 in Saudis, 19/22 in Yemenis, and 7/17 in Egyptians, showing a statistically significant higher hospitalization rates in Saudis and Yemenis \( (P = .003) \). Five out of 65 hospitalized patients needed oxygen supplementation and intensive care unit (ICU) admission, but without the need for mechanical ventilation. All patients were completely cured (100%).

Bronchial asthma was the commonest underlying medical condition. It was present in 14/23 patients. Two patients had congenital heart disease and presented with acute heart failure. One patient had a suggestive history of immunodeficiency as she used to have recurrent skin abscesses. She presented with severe bronchopneumonia and acute renal failure in addition to generalized anasarca (Figure 2). Another patient had sickle cell disease with a recent history of Epstein-Barr infection and presented with a generalized lymphadenopathy and pericardial effusion. One patient had cerebral palsy and presented with generalized convulsions. The most statistically significant clinical symptoms were fever, cough, and rhinorrhea \( (P = .001) \) (Table 2). The statistically significant clinical signs were congested pharynx and chest wheezes \( (P = .001) \).

The complete blood picture done for all patients highlighted that lymphopenia was present in 58.4% of

| Table 1. Demographic and hospitalization data of 89 H1N1 patients of the study. |
| --- |
| Nationality | Number | Percentage |
| Saudi | 33 | 37.1 |
| Yemeni | 22 | 24.7 |
| Egyptian | 17 | 19.1 |
| Other | 17 | 19.1 |

| Gender | Number | Percentage |
| --- |
| Male | 46 | 51.7 |
| Female | 43 | 48.3 |
| Direct contact with a case | 30 | 33.7 |
| Hospitalization | 65 | 73 |
| Ward | 60 | 92.3 |
| Intensive care unit | 5 | 7.7 |
| Treatment with oseltamivir | 76 | 85.4 |
| Complete cure | 89 | 100 |
cases with statistical significance ($P=.001$) (Table 3). The chest radiograph was normal in 31 (34.8%) cases. Radiologic diagnosis was bronchitis in 30 (33.7%) cases and pneumonia in 28 (31.5%) cases.

**DISCUSSION**

The maximum flow of H1N1 cases that we recorded in JCH-K (60/89, 67.4%) was during week 43, 44, and 45, from 25 October to 14 November 2009. This period coincided with the beginning of the school year in Jeddah. The transmission in schools probably contributed substantially to the epidemiology of pandemic H1N1, and alerted the public that foreign travel was no longer the only risk factor. In addition, this coincided with the time of Islamic pilgrimage (Hajj), as at that time the area received a mass influx of travelers. A total of 61.8% of patients were between 5 and 15 years and the median age was 6.7 years. In contrast to studies in Argentina and Canada, no sex predominance was reported in our study. The female predominance was present in other studies conducted in Panama and Hawaii and the male predominance was reported in...
two studies in Riyadh and Bolivia. Thirty-seven percent of our cases were from Saudi, which was far lower than that reported in Riyadh (85.3%). The lower percentage of Saudi children in our study might be explained by the diversity of nationalities in Jeddah rather than a genetic predisposition; however, further studies are needed. A total of 52.9% of our preschool cases acquired the infection through household contacts. Similar results with variable rates of local transmissions reaching 95.6% were detected in other series. A statistically significant higher rate of contact transmission was observed in children up to 2 years old (Group 1) \((P=.002)\).

The hospitalization rate varied greatly between different studies across the world ranging from 2% to 75% \cite{1,6,11}. In our study, 73% of children were hospitalized. The mean hospital stay was 3.62 days (2.05). In contrast, 1 study conducted in Singapore reported 1 day hospitalization. Others reported hospitalization for 6.1 days. Five of 65 hospitalized patients were admitted in the ICU and required oxygen supplementation. A similar range, between 2.0% and 30.6%, was recorded in some series. None of our children were mechanically ventilated. However, the mechanical ventilation was reported up to 68% of cases in other studies. All ICU patients had risk factors, including a history suggestive of immunodeficiency, bronchial asthma, age less than 2 years old, congenital heart disease, and Down syndrome.

Oseltamivir was given according to the CDC guidelines, and it was continued for 7 days in 5 patients because of the case severity. Although the therapy started after 48 hours in most of the children (66/76, 86.4%), complete cure was achieved in all cases. This fact was supported by reports from other studies. However, variable mortality rates were reported by other studies. Bronchial asthma was the commonest underlying medical condition, found in 60% of patients. Comorbidity was found in 23 (25.8%) children and was reported between 6.7% and 80.9% by others. The most statistically significant clinical symptoms were fever (100%), cough (91.0%), and rhinorrhea (67.4%) with a \(P=.001\). The clinical examination revealed a congested pharynx in 80 (89.9%) patients and chest wheezes in 31 (34.8%) patients, which were statistically significant \((P=.001)\). This agrees with other reports.

Leucopenia was detected in 35.9% of H1N1 cases. Other studies reported leucopenia in fewer patients (2.0-7.4%). 9 Lymphopenia was statistically signifi-

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**Table 2.** Symptoms and signs, and radiologic diagnosis of 89 H1N1 patients of the study.

| Symptoms          | Number | Percentage |
|-------------------|--------|------------|
| Fever             | 89a    | 100        |
| Chills            | 12     | 13.48      |
| Rhinorrhea        | 60a    | 67.42      |
| Cough             | 81a    | 91         |
| Dyspnea           | 18     | 20.22      |
| Irritability      | 5      | 5.62       |
| Nausea            | 10     | 11.24      |
| Vomiting          | 26     | 29.21      |
| Diarrhea          | 17     | 19.10      |
| Abdominal pain    | 18     | 20.22      |
| Pallor            | 2      | 2.25       |
| Cyanosis          | 3      | 3.37       |
| Congested pharynx | 80a    | 89.89      |
| Red eye           | 6      | 6.74       |
| Respiratory distress | 12   | 13.48      |
| Crackles          | 12     | 13.48      |
| Wheezes           | 31a    | 34.83      |
| Chest radiographic findings |
| Normal            | 31     | 34.8       |
| Bronchitis        | 30     | 33.7       |
| Pneumonia         | 28     | 31.5       |

*a* of Chi-square test <.05.

**Table 3.** Total and differential leukocyte counts.

| WBCs             | Normal or high n (%) | Low n (%) |
|------------------|----------------------|-----------|
| Total WBCs       | 57 (64.0)            | 32 (36.0) |
| Neutrophils      | 64 (71.9)            | 25 (28.1) |
| Lymphocytes      | 37 (41.6)            | 52 (58.4)*|
| Monocytes        | 74 (83.2)            | 15 (16.9) |

*a* of Chi-square test <.05.
cant and was present in 52 (58.4%) cases ($P=.001$). D-dimer was high in 2 patients, but none of them developed disseminated intravascular coagulation. The majority of novel H1N1 cases reported in our study have been mild, ILIs. Lower respiratory tract infections were the most common complications of H1N1. Radiologic diagnosis included bronchitis in 33.7% of cases and pneumonia in 31.5%. Gastrointestinal complications like vomiting, diarrhea, and abdominal pain were reported in 29.2%, 19.1%, and 20.2% patients, respectively. The incidence of these complications was very variable in the other reported studies.

In conclusion, even though the majority of cases of the 2009 pandemic influenza A H1N1 were mild, a severe disease does occur in children. In view of delayed PCR results, clinical presentation and lymphopenia were utilized as diagnostic criteria to start the antiviral treatment as early as possible. Pneumonia and bronchitis were common complications. Though rare, the acute renal failure was one of the most severe complications of H1N1 in children. No deaths were attributed to the 2009 pandemic.

REFERENCES

1. Al Hajjar S, McIntosh K. The first influenza pandemic of the 21st century. Ann Saudi Med 2010;30:1-10.
2. Centers for Disease Control and Prevention (CDC). Interim guidance on case definitions to be used for investigations of novel influenza A (H1N1) cases. CDC website. Available from: http://www.cdc.gov/h1n1flu/H1N1Guidance/case%20def%20June%201.pdf. [Last accessed on 2009 Nov 10].
3. Tulloch F, Correa R, Guerrero G, Samaniego R, García M, Pascale JM, et al. Profile of the first cases hospitalized due to influenza A (H1N1) 2009 in Panama City, Panama, May-June 2009. J infect Dev Ctries 2009;3:811-6.
4. World Health Organization. CDC protocol of real-time RTPCR for influenza A(H1N1). 2009 Apr 30. Available from: http://www.who.int/csr/resources/publications/swineflu/CDCrealtimeRTPCRprotocol_20090428.pdf [Last cited on 2009 Jul 1].
5. Cauchemez S, Ferguson NM, Wachtel C, Tegnell A, Saour G, Duncan B, et al. Closure of schools during an influenza pandemic. Lancet Infect Dis 2009;9:473-81.
6. CDC. Outbreak of 2009 Pandemic Influenza A (H1N1) at a School --- Hawaii, May 2009. MMWR Morb Mortal Wkly Rep 2010;58:1440-4.
7. Rasheed A. New Saudi rules to combat H1N1. Available from: http://www.gulfnews.com/nation/health/10347706.html. [Last accessed on 2010 Aug 20].
8. Kamigaki T, Oshitani H. Epidemiological characteristics and low case fatality rate of pandemic (H1N1) 2009 in Japan. Plos Curr 2009;1:RRN1139.
9. Libste R, Bugna J, Coviello S, Hijano DR, Dunaiswky M, Reynoso N, et al. Pediatric Hospitalizations Associated with 2009 Pandemic Influenza A (H1N1) in Argentina. N Engl J Med 2010;362:45-55.
10. Bettinger JA, Sauvé LJ, Scheifele DW, Moore D, Vaudry W, Tran D, et al. Pandemic influenza in Canadian children: a summary of hospitalized pediatric cases. Vaccine 2010;28:3180-4.
11. Bin Saed AA. Characteristics of pandemic influenza A (H1N1) infection in patients presenting to a university hospital in Riyadh, Saudi Arabia. Ann Saudi Med 2010;30:59-62.
12. Gianella A, Walter A, Revollo R, Loayza R, Vargas J, Roca Y. Epidemiological analysis of the influenza A (H1N1) virus outbreak in Bolivia, May-August 2009. Euro Surveill 2009;14 pii:19323. Available from: http://www.eurosurveillance.org [Last accessed on 2009 Sep 3].
13. Leo VS, Lye DC, Barkham T, Krishnan P, Seow E, Chow A. Pandemic (H1N1) 2009 Surveillance and Prevalence of Seasonal Influenza, Singapore. Emerg Infect Dis 2010;16:102-5. Available from: http://www.cdc.gov/eid [Last accessed on 2010 Jan 1].
14. Van’t Klooster TM, Wielders CC, Donker T, Isken L, Meijer A, van den Wijngaard CC, et al. Surveillance of Hospitalisations for 2009 Pandemic Influenza A(H1N1) in the Netherlands, 5 June – 31 December 2009. Euro Surveill 2010;14 pii:19461.
15. Al-Hajjaj M. Bronchial Asthma in developing countries: A major social and economic burden. Ann Thorac Med 2008;3:39-40.
16. Perez-Padilla R, de la Rosa-Zamboni D, Ponce de Leon S, Hernandez M, Quinones-Falconi F, Bautista E, et al. Pneumonia and Respiratory Failure from Swine-Origin Influenza A (H1N1) in Mexico. J Infect Dis 2009;200:931-40.
17. Carrillo-Espar R, Ornelas-Arroyo S, Pérez-Bustos E, Sánchez-Zúñiga J, Uribe-Esquivel M. Rabdomiolysis and acute renal failure in human influenza A H1N1 mediated infection. Gac Med Mex 2009;145:519-21.