

Epidemiological characteristics of children with coronavirus at a joint commission-accredited hospital in the United Arab Emirates

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ABSTRACT

Objectives: Our aim was to identify the epidemiological characteristics and transmission patterns of coronavirus (COVID-19) among pediatric patients in the multicultural and multiethnic city of Al Ain in the United Arab Emirates (UAE). **Method:** A retrospective study was conducted by abstracting data from the electronic medical records of pediatric patients with COVID-19 from two major public hospitals in Al Ain. The data of patients from birth through 16 years of the cases with COVID-19 confirmed by reverse transcription-polymerase chain reaction were obtained. In addition to the epidemiological characteristics, transmission patterns, comorbidities, index cases, travel history, and coinfection with other viruses were analyzed. Cohen's kappa was used to assess interrater reliability and descriptive data. Chi-square test was used to assess significant differences between the variables and was conducted using Statistical Product and Service Solutions software. **Results:** We identified 298 (150 males, 148 females) laboratory-confirmed cases. The patients' median age was 7 years. Of these, 50% had parents who also tested positive. Most patients (86.9%) were healthy without any known medical problems. The coinfection rate was ~2%. **Conclusion:** The epidemiological characteristics of children with COVID-19 in Al Ain are similar to those observed internationally. Children of all ages appeared to be susceptible to COVID-19 and no significant sex or ethnicity differences were detected. Furthermore, this study provides strong evidence of human-to-human transmission.

Keywords: Child, COVID-19, epidemiology, pediatrics, SARS-CoV-2, UAE

Background

In late December 2019, pneumonia of unknown etiology was first identified in a cluster of patients in Wuhan, China.^[1] A beta-coronavirus, previously unknown, was identified in the patients' respiratory samples.^[2] The virus was first labeled "severe

acute respiratory syndrome coronavirus 2" (SARS-CoV-2) and the disease was named "coronavirus disease" (COVID-19).^[2] COVID-19 spread rapidly from China throughout the world, and the World Health Organization declared it a pandemic on March 11, 2020. By this time, the virus had infected 118,319 patients and caused 4,292 deaths in 113 nations.^[3]

The first reports focused on the infectivity, severity, and fatality of COVID-19 in adult patients, reflecting the belief that pediatric patients had lower infection rates. However, on January 20, 2020,

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the first pediatric case was reported, that of a 10-year-old child who had contracted the infection after a visit to Wuhan.^[2,4,5]

Limited data are available on the prevalence and epidemiological characteristics of COVID-19 in pediatric populations because they were rarely tested for the virus in the earliest phase of the outbreak. Despite the worldwide spread, the epidemiological and transmission patterns of COVID-19 remain unclear in the pediatric population. In this study, we explore the epidemiology of COVID-19 in pediatric patients in Al Ain, United Arab Emirates.

Methods

This retrospective study was conducted at the largest tertiary care hospital in Al Ain, UAE. The approval for the research was obtained from the centralized National Research Ethics Committee of the Department of Health–Abu Dhabi, UAE. It was ensured that patient data were secured confidentially and the requirements for informed consents are waived as per our national ethics committee policy. Furthermore, this research was declared for publication by our national ethics committee by May 2020. Furthermore, this research was declared for publication by our national ethics committee. The data were collected between January and May 2020, when the infection rate for COVID-19 was high. Physician–researchers blinded to the study hypothesis examined the patients’ electronic medical records (Cerner).

The study included male and female patients of all nationalities and the specific patient inclusion criteria were as follows: a) age 0–16 years; b) diagnosed with a positive COVID-19 nucleic acid test using real-time reverse transcription-polymerase chain reaction (RT-PCR); c) presented to the emergency department, the in-patient unit, or off-site screening locations of the two leading hospitals in Abu Dhabi’s Al Ain region: Tawam and Al Ain hospitals. Patients were excluded if they were seen at private hospitals or who had incomplete data. Data on the epidemiological characteristics, transmission patterns, comorbidities, index cases, travel history, and coinfection with other viruses were collected.

Interrater reliability and data differences between the data abstractors were evaluated using Cohen’s kappa coefficient. Data were analyzed using SPSS (IBM, Chicago, US) Version 23, and the results were presented using descriptive statistics. The Chi-square test was applied to assess the significant differences between the variables. A P value of ≤ 0.05 was considered statistically significant.

Results

Of the 14,737 patients examined within the 152 days of our study period, the number of children (from birth to 16 years) was 497 (4%); 298 met the inclusion criteria and were included in this study. Cohen’s kappa coefficient assessment yielded a score of 0.77, indicating substantial agreement between the data abstractors (data not shown).

The COVID-19 pediatric patient cohort included more male (150/298, 50.3%) than female (148/298, 49.7%) patients; however, the difference was not statistically significant ($p < 0.992$, Chi-square test) [Table 1]. More than half of the patients (208 [69%]) were between 3 and 16 years of age and the median age was 7; 180 (60.4%) were not UAE citizens, 117 (39.3%) were UAE citizens, and the nationality of 0.1% patients was unknown [Table 1]. Of the included patients, 10% were obese (31/298); however, the majority did not present with comorbidities (259/298 [86.9%]).

The close contacts of the patient were identified through contact tracing and were defined as those who lived in the same home or who had interacted with the patient socially or in some other context. During this study, all the children were quarantined and were not attending school as per UAE law. In the current study, the infected patient’s index case was identified in 182/298 (61%) of cases, and the predominant index contact was “parents” in half of the cases (149/298, 50%) [Table 2]. The index case was unknown in 116 (38.9%) of confirmed cases, and other contacts (siblings, grandparents, and others) contributed to less than 10% of the confirmed cases [Table 2]. As would be expected, a higher proportion of the contact cases (224/298, 75%) had COVID-19 and were confirmed to be positive by RT-PCR [Table 2].

Upon subgroup analysis, a statistically significant association was noted between the age of the patients and the index cases: the older the patient, the more likely that the index case was unknown ($p = 0.004$; value 46.2, df 24, two-sided Chi-square test of significance [data not shown]). Neither travel exposure (2/298 cases positive cases) nor sex was significantly associated with disease contraction during the study period.

Table 1: Demographics of pediatric patients with COVID-19. The patient demographics are presented as actual numbers (n) and as the percentage of the total (%)

Categories	n (%)
Sex	
Male	150 (50.3)
Female	148 (49.7)
Age	
Infants	35 (11.7)
Toddlers	55 (18.5)
>3-10 years	112 (37.6)
>10-16 years	96 (32.2)
Nationality	
Non-UAE Citizens	180 (60.4%)
UAE Citizens	117 (39.3%)
Unknown	1 (0.1%)
Comorbidities	
Cardiac	1 (0.3)
Genetic	1 (0.3)
Respiratory	2 (0.4)
CNS	2 (0.4)
Unknown	2 (0.4)
Obesity	31 (10.7)
None	259 (86.9)

Table 2: Patient index contacts and coinfection with other pathogens, represented as actual numbers (n) and as a percentage of the total (%)

Categories	n (%)
Index Case	
Parent	149 (50)
Unknown	116 (38.9)
Brother	12 (4)
Grandparent	8 (2.7)
Others	5 (1.6)
Sister	4 (1.3)
Houseworker	4 (1.3)
Coinfection ^a	
No	10 (3.4)
Yes	7 (2.3)
Not checked	281 (94.3)
Contact with illness	
Yes	224 (75.2)
No	31 (10.4)
Unknown	43 (14.5)

^aCoinfection pathogens (Enterovirus, Adenovirus, Rhinovirus [five cases in infants] and group A strep [two cases in six-year-old patients])

Discussion

We undertook this retrospective review to further improve our knowledge about the epidemiology and clinical characteristics of COVID-19 in pediatric patients who were 16 years of age and younger. To the best of our knowledge, this is the first retrospective study in the Al Ain region that focused on the epidemiological characteristics of children with COVID-19.

COVID-19 was found to affect children less frequently than adults as observed in China based on multiple studies involving 8,866 cases.^[6] The largest number of affected patients were adults between 36 and 65 years old, and only 14 patients were less than 10 years old.^[3] As of April 2020, only 1.7% (n = 2,572) of the diagnosed cases in the US (149,082) were below 18 years of age, and 15% of these cases were infants,^[4] as reported by the Center for Disease Control. China and Italy reported similar rates (2% and 1.2%, respectively).^[5] In our study, 4% of patients were pediatric, and 61% were between three years to 16 years, which is comparable with the global findings.^[4]

Similar to other epidemiological studies, more male patients than female patients (50.3% vs. 49.7%, respectively) were affected by COVID-19^[7] but the difference was not statistically significant. Our population had a median age of seven, with a range from birth to 16 years, indicating that children of all ages are susceptible to COVID-19.

The observed infection rates were as follows: for infants; <1 year old (11.7%), toddlers; 1–3 years (18.5%), children; 3–10 years (37.8%), and adolescents 10–16 years (32.2%). These figures reflect that the highest prevalence (70%) occurs in the age group of 3–16-year-olds. Upon a systemic review and meta-analysis done by Badal *et al.*, of different countries including

Europe, China, and the USA, our numbers and percentage were similar.^[8] These are the ages where children walk and move around independently, and this finding supports that the virus is transmitted from surroundings.

The COVID-19 transmission rate is known to be correlated with the degree of contact.^[9] Therefore, infection rates would be expected to be highest among younger children who have closer and more frequent physical interactions with parents and others in their lives. In our study, parents accounted for 149 (50%) of the 182 (61%) documented index cases. However, we found the lowest infection rate in the youngest age group (11.7%). Our infection rate for parents was higher than that found in the study by Li *et al.*, which showed a 4% COVID-19 infection rate among 100 pediatric patients and a 21% infection rate among adults.^[10] However, this finding might be related to cultural differences and practices between UAE and China.

There are many hypotheses to explain the lower occurrence of COVID-19 in children compared to adults: the immaturity of the receptor system, immune system-specific regulatory mechanisms, and possible common cross-protection from other common viral infections in children below one year of age;^[11] however, more studies are needed to validate these theories. Younger children are more protected at the cellular level, as the expression of angiotensin-converting enzyme 2, which is the receptor that SARS-CoV-2 uses for host entry, is more frequently expressed in nasal epithelium with increasing age.^[12,13]

The index contact was unknown for 38.9% of children as they had never knowingly been in proximity to anyone with a COVID-19 diagnosis, visited a zone with a high rate of infection, or interacted with anyone who had been exposed to the virus. This adds a layer of complexity for COVID-19 contact tracing and highlights the importance of strategies such as minimizing close contact with strangers, especially since many COVID-19 carriers are asymptomatic.

Obesity is an emerging risk factor for patients infected with COVID-19 and has been reported in 48% of the hospitalized adults.^[14] In our study, however, only 10% of our group was obese. This rate is significantly lower than the previously reported 20.5% incidence among children six years or older in the US,^[15] indicating that ethnicity may be a potential contributing factor.

Although pediatric patients with COVID-19 in the UAE come from different national, socioeconomic, and ethnic backgrounds; the rate of pediatric patients with COVID-19 in the UAE did not differ among the different socioeconomic levels. This finding differs from that of a previous report showing an increased rate of infection among black and low-income children.^[16] A study from the US comparing minorities reported a 38% COVID-19 disease burden in a lower socioeconomic setting, while the rate was 9% for high socioeconomic status.^[16] However, our study shows similar numbers to another Omani study.^[17]

The link between coinfection with other common respiratory pathogens and COVID-19 infection needs further study. Among our cohort, testing for other respiratory pathogens was done in only seven cases (2%), and we observed that the youngest age group (e.g., infants) were more likely to have coinfection with other viruses such as enterovirus, adenovirus, and rhinovirus.

These findings were parallel to those studies that analyzed the coinfection rate among children with COVID-19.^[18-21] Among a cohort of 74 pediatric patients included in the study by Wu *et al.*^[19], 19 (51.35%) of the 34 children who were screened for common respiratory pathogens had coinfection, and eight children (42.11%) had two or more pathogens other than COVID-19. Studies by other authors also had similar findings.^[18,22] The high coinfection rate in children can be used to highlight the importance of COVID-19 screening, especially during peak-season respiratory infections.

Our study has several limitations: first, the study's retrospective nature demonstrates association but not causation. Second, this is a single-city study, thus limiting the generalization of the results. Third, the analysis was limited by the poor documentation of the patients' index case. Despite the limitations, this is the first study from the Gulf Cooperation Council that addresses COVID-19 in children. Participation by two large public hospitals, where most of the patients with COVID-19 were being treated, can help overcome some of these limitations.

Conclusion

This study demonstrates that children of all ages are susceptible to COVID-19 disease. Demographic characteristics such as age, sex, and ethnicity did not statistically correlate with any of the variables. Most of the infected children who tested positive for COVID-19 were healthy, with no underlying comorbidities. The transmission of the COVID-19 infection occurred most likely via inhalation of infected droplets or direct contact with infected parents in our study. In line with the studies from other countries, our results indicate that close contacts are the primary transition vector for COVID-19 infection in children. Therefore, we encourage the primary healthcare providers to emphasize simple precautions and safety measures during this pandemic, such as physical distancing, wearing a mask, keeping rooms well ventilated, avoiding crowds, cleaning hands, and coughing into a bent elbow or tissue among children during home and schooling.

The mechanisms by which COVID-19 develops in children differ from those in adults and will require further research. Although a forerunner, our study was able to assess the epidemiological characteristics of children with COVID-19 from two public hospitals in the city of Al Ain, UAE. Additional multicenter studies are essential to further profile the characteristics of COVID-19 pediatric cases in the UAE.

Highlights

- Pediatric data for COVID-19 is limited and require more researches and multicenter collaborations

- The number of Pediatric COVID-19 patients in the multicultural and multiethnic city of Al Ain, UAE, and those at the international level are similar in epidemiological characteristic.
- Children of all ages are susceptible to COVID-19 disease and characteristics such as age, sex, and ethnicity did not statistically correlate with any of the variables
- COVID-19 transmission pattern seems to be from close contacts as it is the primary transition vector for COVID-19 infection in children

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Conflicts of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Declaration of patient consent

The authors ensured that patients data was secured confidentially and access was limited for patient information's. As no images or any initials/names will be published, the requirements for consent forms were waived as per our national committee.

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