

RESEARCH PAPER

The Epidemiological Pattern of COVID-19 Outbreak, During the Initial Phase in Thi-Qar province, Iraq: A Cohort Retrospective Study

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Abstract

Background / Aims: Understanding the epidemiological features and transmission dynamic during the initial phase of the COVID-19 epidemic provide valuable information for control and mitigation of the outbreak. Thus, this study focused on a cohort who represent early cases in Thi-Qar governorate for describing the early epidemiological features during the initial phase of the COVID-19 outbreak.

Subject & Methods: This case series study was conducted in AL-Hussien Teaching Hospital, Thi-Qar governorate, from 27, February to 8, May 2020. Patient's data were obtained from official records of the Public Health Department of ThiQar Health Directory. A descriptive and analytical statistic were used by the aid of SPSS, also household secondary attack rate was estimated.

Results: The median age was 37 years (IQR:31,20-51), females were 57.2% and males were 42.8%. According to age groups, as a higher infection rate (30.61%) was found in the age group (14-26), while only (4%) found old age groups (66-78,79-91). Only six patients(12.25%) had comorbidities. Clinically, majority (79.6%) of cases were mild and (18.4%) moderate while only (4%) were severe. The age and comorbidities had an effect on the severity of symptoms. Family transmission (80.43%) was the predominant dynamic of disease transmission. Three index cases in this cohort fulfill the criteria of super-spreader as collectively transmitted the disease to 79.6% individuals, the household secondary attack rates were 22%, 24%, and 17% respectively.

Conclusion: Family transmission was the predominant dynamic of transmission which was the result of the presence of a super-spreader event in the early infected patients in the governorate.

Keywords: COVID-19, Epidemiology, Initial phase, Iraq.

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Introduction

In December 2019, a newly emerging respiratory viral disease, coronavirus disease (COVID-19) has started in Wuhan, Hubei province, China.¹ The progressive global spread of the disease has led the WHO (World Health Organization) to announce it as a pandemic.² Clinically, the disease is characterized by fever, cough, fatigue, pneumonia, shortness of

breathing, and death in severe cases.³ The first confirmed case of COVID-19 in our country (Iraq) was reported on February 24, 2020, in the holy city, Al-Najaf, the patient was an Iranian theology student, had recently returned from Iran.⁴ Since then, cases were reported from other Iraqi governorates. By March 10, 2020 the disease had been reported in all Iraqi governorates. In Thi-Qar province (375Km south of Baghdad), the first confirmed case of COVID-19 was reported on February 27, the patient was 62 years old, an Iraqi student studying at Qum University recently had returned from Qum-Iran.⁴ Subsequently, cases were reported from various districts of Thi-Qar

governorate. By April,12, the total number of cases has reached the forty-nine cases, and the first fatality case (Male, 88-year-old) was recorded on March,19. Tracking the early introduction of the emerging pathogen is the best way to understand the transmission dynamics of the epidemic, where the uninfected and the close contacts to a confirmed case are often easily tracked which is usually very difficult when the pathogen is widely distributed in the population.⁵ Thus, this study focused on a specialized cohort who represent the first confirmed cases in the Thi-Qar governorate to provide an opportunity for describing the early epidemiological features during the initial phase of the COVID-19 outbreak including; transmission dynamic, clinical severity, course of disease in the Thi-Qar governorate.

Materials and Methods

Study Design and Patients

This case series study was conducted on the first 49 patients of COVID-19 recorded in the Thi-Qar governorate and hospitalized in Al-Hussien Teaching Hospital which was specified for COVID-19 patients only. All the participants of the cohort were diagnosed as SARS-Cov-2 positive based on the Real-Time PCR official records obtained from the central laboratory of Public Health in Thi-Qar. This study covered the period extended from 27 February (first recorded case) to May 8, 2020 (hospital discharge of the last patient in this cohort). Basic demographics, clinical features, severity, exposure history, medical history were extracted from the official records of the public health department at Al Nasiriyah city. Ages of the patients were stratified into seven age groups.

Classification of Disease Severity

The severity of the disease was classified into; mild, moderate and severe based on the protocol of diagnosis and treatment of COVID-19 (version7)⁶ as:

Mild cases: mild respiratory symptoms without pneumonia upon radiography.

Moderate cases: fever with respiratory symptoms and radiological finding indicative of pneumonia.

Severe cases: respiratory distress (breathing rate > 30/minute) Oxygen saturation less than 93% with more than 50% lung infiltration revealed by radiography.

Transmission & Contacts

Data concerning the exposure history and close contacts to confirmed cases were obtained through personal communications (phone call) with infected individuals. All information obtained from patients through personal communication was cross-checked with the official record of contact tracing team of Central Laboratory of Public Health in Thi-Qar province.

Imported infection case: a laboratory-confirmed patient who had returned from outside of Iraq within 14 days before symptoms onset.

Local infection case: a laboratory-confirmed patient who had no history of traveling outside Iraq within 14 days before symptoms onset. Local infections were further divided based on the mode of transmission into:

- **Community transmission:** a laboratory-confirmed patient who has no known contact history with confirmed cases and had no history of visiting high risk setting (eg; hospitals or private clinics).
- **Household transmission:** a laboratory-confirmed patient that lives in the same

house or apartment of a confirmed case or close relative to a confirmed case that had long exposure (at least 24 hours) to the index case⁷.

Index case: A first patient within the family showing symptoms and had a positive laboratory test (RT.PCR).⁸

Secondary case: A susceptible individual who turned infected due to the contact with index case during the infectious period⁹ which is in this study roughly estimated as the period extended from 14 days before symptoms onset to outcome(recovery or death).

Super-Spreader: an individual with confirmed COVID-19 infection that disproportionately transmitted the infection to many other susceptible individuals.¹⁰

Household Secondary Attack Rate (SAR)

In this study, the crude household secondary attack rate (SAR) is defined as the percentage of susceptible individuals within the family that develop the disease as consequences of exposure to index case during the infectiousness period. The SAR was calculated according to Miquel Porta¹¹

$$SAR = \frac{\text{Infected Household contacts within 14 days of exposure to index}}{\text{total exposed susceptible individuals within the family}} \times 100$$

Statistical Analysis

Data in this study were expressed as a median and interquartile range for age because it was not distributed normally while those follow normal distribution were expressed as Mean \pm SD (normality was tested by SPSS). Categorical variables were expressed as percentages. Chi-Square test was used to find the significant association between categorical variables. A p-

value of < 0.05 was considered as statistically significant. Pearson correlation was used to find the correlation between the duration of infectiousness of index cases and the number of secondary cases. All statistical analyses were done with SPSS version19 software.

Ethical Approval

This study was conducted according to the written approval agreement of the Training & Development Department of the Health Directory of Thi-Qar governorate and the scientific committee of Technical Institute/Southern Technical University. A verbal patient's consent was obtained through personal communication (phone call).

Results

Cohort Description

The basic demographic information of the cohort is shown in the table (1). The analysis of patient's ages revealed heterogeneity in age distribution. In general, the ages were ranged from 1-91 years, with a median 37 (IQR:31 ranging from 20-51). The infection was higher in 30.61% in age group 14-26 years followed age group 40-52 which recorded 26.53%. Both age groups (1-13 and 53-65 years) had similar infection proportion 12.2%. while the old-age groups (65-78 and 79-91years) had lowest proportion (4% for each). Gender distribution of the cohort showed females (57.2%) was higher than males (42.8%), however, the mean age of males (42.65 \pm 21.6) was higher than females (34.07 \pm 22.95) with no significant differences. The majority of patients (91.83%) were residents in urban areas (Al-Nasiriyah City). Regarding the level of education, the majority of patients (46.9%) were having primary education, and only very low percent 4% have been graduated from college, while 12(24.9%) were

not educated at all. Six patients (12.25%) had comorbidities including; hypertension, diabetes

mellitus, chronic obstructive pulmonary disease, and renal failure.

Table 1. Description of the First 49 COVID-19 Patients Recorded in Thi-Qar Governorate

Demographic information	Groups / years	Frequency	Proportion
Age Median (IQR): 37 (31: 20-51)			
Age Groups	1-13	6	12.24%
	14-26	15	30.61%
	27-39	5	10.2%
	40-52	13	26.53%
	53-65	6	12.24%
	66-78	2	4%
	79-91	2	4%
Gender (Age Mean \pm SD)	Male	21 (42.65 \pm 21.6)	42.8%
	Female	28 (34.07 \pm 22.95)	57.2%
Residency	Urban	45	91.83%
	Rural	4	8.16%
Education level	High education	2	4%
	Intermediate	12	24.9%
	Primary	23	46.9%
	Non-Educated	12	24.9%
Co-morbidity (n=6) 12.25%	Hypertension	1	16.7%
	Diabetes mellitus	3	50%
	Chronic Obstructive pulmonary disease	1	16.7%
	Renal failure	1	16.7%

High education: Bachelor degree and higher, Intermediate: secondary school, Primary: Primary school.

Clinical Severity

At hospital admission time, the majority of cases were classified as mild 38(77.6%) showed mild respiratory symptoms (low-grade fever, mild dry cough) and 9(18.4%) were moderate showed high fever $>38^{\circ}\text{C}$, productive cough, fatigue, and respiratory symptoms with indicative signs of pneumonia as revealed by radiography, while only two cases (4%) were severe, showed acute respiratory symptoms with high fever and continuous dry cough, shortness of breath, and low blood oxygen saturation. (Figure-1).

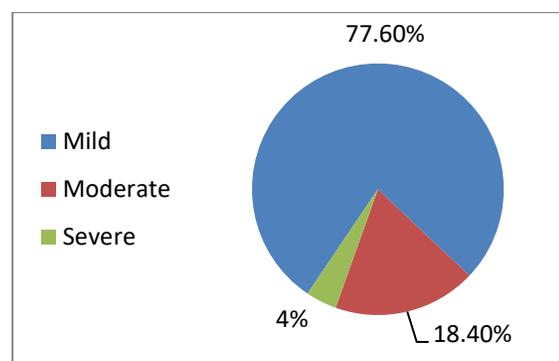


Fig 1. The Severity of symptoms of 49 COVID-19 patients. The patients were classified into Mild, Moderate and Severe.

A link has been found between the severity of symptoms and the mean age of patients. Severe symptoms were found in older ages (age group 79-91 years) with mean \pm SD (71.3 \pm 14) in

comparison with the mean age of moderate cases was (49.7±9) and the mean age of mild

cases which was (35.32±24) with statistically significant differences. (Table-2)

Table 2. The effect of age on severity of symptom

Clinical severity	Mild	Moderate	Severe	Statistical significant
Age mean (mean± SD)	35.32±24	49.7±9	71.3±14	0.015

Fisher exact value= 4.588, on way ANOVA test.

Furthermore, there was a statistically significant difference ($P < 0.05$) has been found between the severity of clinical symptoms and presence of underlying diseases, all (100%) mild cases have no underlying diseases, while 4(57.14%) of

moderate cases have underlying diseases (3 diabetes mellitus and 1 hypertension). On the other hand, the two patients who had severe symptoms were suffering from chronic obstructive pulmonary disease and renal failure.

Table 3. Relationship of the Severity of Clinical Symptoms and Presence of Underlying Disease

Severity (n)	Underlying disease No. (%)	No underlying disease No. (%)	P-value
Mild (38)	0(0)	38(88.4)	0.001
Moderate (9)	4(66.7)	5(11.6)	
Sever (2)	2(33.3)	0 (0)	
Total	6 (100)	43(100)	

Chi-Square = 24.747

Collectively, the disease duration (from symptom onset to hospital discharge) of all cases was ranging from 2 to 30 days with a mean (14.19 ±6.77 days). The mean duration of moderate cases (17.7±9.8 days) was higher than mild cases (14.1±5.6 days) with no statistical differences, on the other hand, the mean duration of severe cases was 1.5 day because one of the severe cases died at the same day of hospital admission, and the other case has died after two days of admission. Statistically, no significant difference has been observed between the mean hospital duration of patients and presence of underlying diseases, (Figure-2).

The observation during hospitalization period did not show severity progress from mild to moderate or severe.

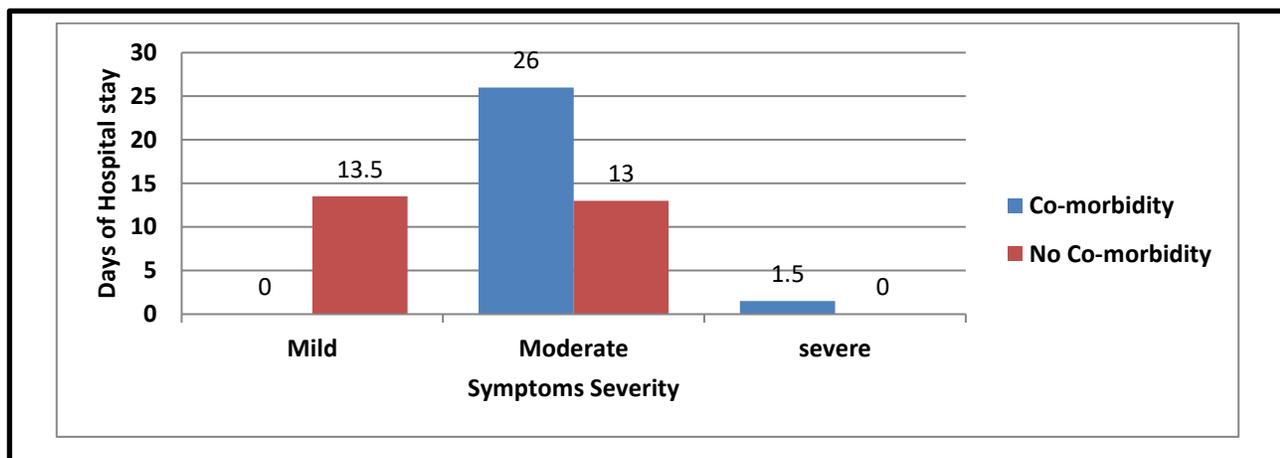


Fig 2. The mean hospital duration/Days according to clinical severity and the presence of underlying disease

Tracing the source of infections revealed that 3(6.12%) patients were imported infections (had a history of visiting an epidemic country, Iran). Clinically they had moderate symptoms. On the other hand, 46 (93.87%) were categorized as local infection (patients with no history of traveling). This category (local infections) has further divided according to the transmission of the disease into; household transmissions, they were constituted the majority of the cohort 37(80.43%), while 8(17.4%) were community

transmission, and 1(2.8%) infected in the hospital (health care worker working at isolation section). The majority of family transmission cases were mild 36(97.3%) and only 1(2.3%) had moderate symptoms, none of the family transmission had severe symptoms. Interestingly, 6 (75%) of the patients infected through community transmission had moderate symptoms, and 2(25%) have died after severe symptoms. The hospital infection was mild.

Table 4. The connection of the source of infection with clinical severity of the disease in the cohort

Source of infection		No. (%)	Mild No.(%)	Moderate No.(%)	Sever No.(%)
Imported		3(6.12)	1(33.3)	2(66.4)	-
Local (93.87%)	Household transmission	37(80.43)*	36(97.3)	1(2.7)	-
	Community Transmission	8(17.4)*	0	6(75)	2(25)
	Health worker contact	1(2.8)*	1	-	-
Total		49			

*the percentage was calculated out of 46

Through the analysis of contact tracing, three index cases can be described as super-spreader. As these three index cases (6.1%) had 39 (79.6%) secondary infected cases, mostly

through the family transmission. The mean age of index cases was (51±5.29). The household secondary attack rates of each index were; 22%, 24%, and 17% respectively. (Table-5)

Table 5. The three index cases and their comorbidity and values of SAR

Index	Age	estimated contacts (family members & close relative)			Household secondary attack rate (sar)(%)
		Total	Infected	Non-infected	
Index 1	57	100	22	78	22
Index 2	47	50	12	38	24
Index 3	49	18	5	13	17

Upon personal communication (phone call) with index cases, they had stated that they participated in many social activities like meeting relatives, before symptoms onset, and even after symptoms onset with little protective measures. Unfortunately, accurate information

about the number of contacts before and after symptoms onset cannot be obtained thus, the entire duration of infectiousness of index cases was used to determine the correlation with number of secondary cases which was found as an excellent correlation (0.990), (Figure-3).

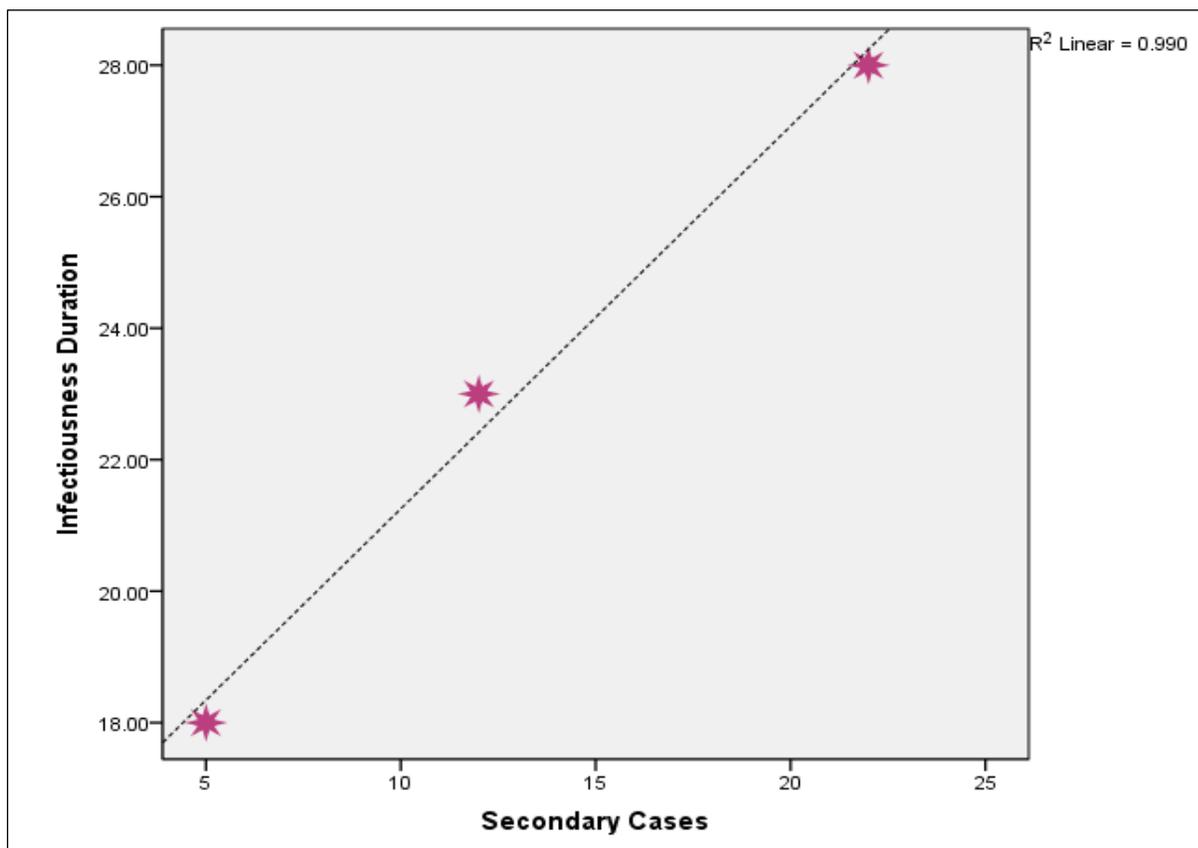


Fig 3. The correlation between the duration of infectiousness of index cases and their secondary cases

Discussion

An observation and data analysis in the early phase of any epidemic newly introduced into a particular community is very useful for providing an insight into the natural history and early transmission dynamic. This study found that there is a heterogeneity in the distribution of infections according to ages, a finding which was also noted during the initial phase in China.^{12,13} The median patients-ages of the cohort in this study (37; IQR=20-51) were lower than those recorded in the early studies in Wuhan, China (the epicenter of the pandemic). Huang *et al.*,¹ found the median age was 49 years with IQR=41-58, and Wang *et al.*¹⁵ recorded 56 years in the same city and Chen *et al.*,¹⁶ also found the mean age was 55.5 years. Another study included 31 Chinese provinces found the median age of 1099 patients admitted to 552 hospitals was 47.0 years.¹⁷ It is notable that children group (1-13 year) in this study constitute relatively a small proportion of the early cases, although the low number of infected children in the initial phase of an epidemic is not indicative sign to assume that the children are less susceptible for COVID-19, indeed the disease has reported in infants.¹⁸ In this regard, the result of this study was also reported by other studies.^{5,17,19} The relatively small proportion of child group reported in this study could be attributed to small sample size or due to children are less likely infected or even infected with no or mild symptoms,¹⁹ that made this age group missed during testing and diagnosis,²⁰ another reason is that this age group are less socially active and has less social contacts. Similar to early reports of the disease in China, this study found that the most affected age was young adults.^{5,21} The findings of this study was agreed to the largest study of COVID-19 conducted in China.²² This could be explained as young adults' age groups are very socially active forming a very high number of

social contacts and individuals in this age group taking care of their child or parent once they had infected²⁰. For gender distribution this study found that infection of females was higher than males, which was also reported elsewhere^{5,20} however, other studies found males were infected at a higher rate than females^{1,14}. The higher infection rate of females than males reported in this study could be attributed to their role in caregiving within the family or prolonged period of exposure to index cases within the family. Concerning to level of education, most patients in the cohort had primary education, the high proportion of low educated patients may be explained by lack of awareness of how serious is the disease, accordingly, they were not following the standard guidelines of COVID-19 prevention. Most participants of the cohort in this study showed mild symptoms (79.6%), moderate cases were (18.4%), and severe cases were (4%) which was similar to the finding of previous studies.²² It is well documented that age and presence of underlying diseases such as; chronic lung diseases, cardiovascular diseases, and diabetes mellitus are important risk factors that govern the severity of COVID-19 disease.^{23,24} This fact demonstrated by the results of this study which found that the mean age of mild cases was (35.3 years) and all of them had no underlying diseases, on the other hand, the mean age of severe symptoms patient was (79 years) and had the underlying disease, this finding was inconsistent with previous studies during the initial phase of the epidemic in China.²³ The two severe symptoms patients noted in this study belonged to an elderly group and had comorbidities, both patients have died as consequences of COVID-19 infection, this finding was inconsistent with Wu *et al.*, (2020)²⁵ who demonstrated that older ages are more vulnerable for development of acute respiratory distress and death. According to the

results of this study, it has appeared that the spark of the epidemic in Thi-Qar governorate came from Iran as the three imported cases had a history of visiting Qum-Iran within 14 days before symptoms onset, and all of them had moderate symptoms. However, from the results of this study, it is clear that household transmission constitute the major dynamic of transmission during initial phase. Similar findings were also reported in other global studies.^{26,27} The predominance of the household transmission over community transmission could be attributed to the following reasons; first, the strike governmental procedure in order to break the transmission chain which include curfew and closing the province borders and preventing the gathering. Second, many social activity including; board of condos has stopped. Third, international advice "staying at home" which was used to mitigate the pandemic, concomitantly increase the household transmission as confirmed and suspected individuals spending more time at home and providing constant source of infection to other family members.. This study unveils three cases in the cohort fulfill the criteria of being a super-spreader. As this study found three index cases had infected 39(79.6%) another susceptible individuals in the cohort, indicative that the epidemic in Thi-Qar governorate mostly follow the 20/80 rule, a term used for observational epidemiological studies for infectious disease, which is defined by 20% of individuals of a population are responsible at minimum estimate about 80% of disease transmission in giving population.²⁸ It should be mentioned that all these super-spreader cases in this cohort were not educated and did not follow the safety measures of COVID-19 like; wearing mask or clothes, or house quarantine, also two super-spreader had comorbidities and had moderate symptoms that may indicate high viral

shedding that assists in the high transmissibility and ultimately rendering super-spreaders.²⁹ Since household contact usually advantageous in understanding the early transmission dynamic. The estimated household secondary attack rates of the three index cases in this study were high than previously published in china, 15.6%¹⁵ 11.6% in Hong Kong³⁰, however, finding of this study was in consistence with Wang,et al³¹ who found the secondary attack rate in Beijing, China was 23%.

Conclusions

With the general trend of staying at home, resulted in generation of impalpable threat of transmission, household transmission which ultimately promoted the super-spreader event in the early infected patients in the province.

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النمط الوبائي لمرض كوفيد-19 في المرحلة الاولى للوباء في محافظة ذي قار : دراسة سلسلة حالات

الخلفية و الاهداف : ان فهم الملامح الوبائية و ديناميكية الانتشار الكوفيد-19 خلال مراحل انتشاره الاولى يوفر معلومات قيمة تفيد في السيطرة و الحد من الانتشار. لهذا ركزت هذه الدراسة على مجموعة من المرضى اللذين يمثلون اول 49 حالة مشخصة في محافظة ذي قار

طرائق البحث: اجريت هذه الدراسة سلسلة الحالات في مستشفى الحسين التعليمي في محافظة ذي قار. جمعت بيانات المرضى من السجلات الرسمية لقسم صحة العامة- دائرة صحة ذي قار. استخدم الاحصاء الوصفي بواسطة SPSS و تم حساب معدل الهجوم المرض.

النتائج: ان وسيط الاعمار 37 (النطاق بين الربعين الأول والثالث: 20-51 ، 31 ، شكلت الاناث 57.2% و الذكور 42.8%. سجلت الفئة العمرية 14-26 سنة اعلى معدل للإصابات بينما سجلت الفئات العمرية الكبيرة (66-78 سنة و 78-91 سنة) اقل نسبة اصابة (4%). وكان عدد المرضى اللذين لديهم امراض مصاحبة هو (12.25%)، صنفت اغلب الاصابات على انها طفيفة (79.6%) و شكلت الاصابات المتوسطة (18.4%) بينما كانت الاصابات الحادة فقط (4%). وجد ان الاعمار و وجود الامراض المصاحبة يؤثر على حدة العلامات المرضية. و توصلت هذه الدراسة ان ديناميكية انتشار سببها الانتشار بين العوائل , حيث وجد في مجموعة الدراسة وجود 3 مرضى يمكن وصفهم ناقل العدوى الفائق حيث بلغ اجمالي الحالات المصابة من 39 (79.6%) و بلغ معدل الهجوم الثانوي لعوائل هؤلاء المرض (22% و 24% و 17%).

الاستنتاجات: انتشار الوباء في مراحل الاولى كان بين العوائل بشكل اساسي و الذي كان سببه وجود ناقلين العدوى الخارجين ضمن اوائل المصابين في المحافظة.

الكلمات المفتاحية: كوفيد-19، وبائية، طور الاولى، العراق