

Manuscript Title: Epidemiological Features of 135 Patients with Coronavirus Disease (COVID-19) in
Tianjin, China

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Running Title: Epidemiological Features of Coronavirus Disease (COVID-19)

ABSTRACT

Objective To describe the epidemiologic features of an outbreak of coronavirus disease (COVID-19) in Tianjin caused by a novel coronavirus (2019-nCoV) and to provide scientific basis for prevention and control measures.

Methods Data from COVID-19 cases were collected from daily notifications given to the National Health Commission of the People's Republic of China and Tianjin Health Committee. All of the data were analyzed with SPSS version 24.0 software.

Results As of February 24, 2020, there have been 135 confirmed cases, 3 deaths, and 87 recoveries in Tianjin, China. The incidence of COVID-19 was 8.65/1,000,000 with a 2.22% case fatality rate. Regarding geographic distribution, the incidence was 8.82 per 1,000,000 in urban areas and 8.00 per 1,000,000 in suburbs. During the early stage of the epidemic, most cases came from urban areas and in patients with a history of sojourning in Hubei Province. The majority of patients were 31–70 years old (75.97%). A familial cluster was the most important characteristic of COVID-19 (accounting for 74.81%).

Conclusions Current information suggests that people are generally susceptible to COVID-19, which has shown a familial cluster in Tianjin.

Key words: Coronavirus disease; 2019-nCoV; Epidemiology

INTRODUCTION

The 2019 novel coronavirus (2019-nCoV) is the coronavirus identified as the cause of an outbreak of coronavirus disease (COVID-19) first detected in the city of Wuhan, Hubei Province, China at the end of 2019.^[1] Early on, many of the patients in the Wuhan outbreak reported some contact with a large seafood and animal wholesale market, suggesting animal-to-person spread. However, a growing number of patients have reported no such exposure to animal markets, suggesting possible person-to-person spread.^[2,3] COVID-19 was imported to Tianjin on January 21, 2020. Tianjin Municipal authorities took aggressive measures to improve detection, isolate COVID-19 patients, and trace contacts to minimize opportunities for further transmission in community and institutional settings.^[4] We here summarize some epidemiologic features of the outbreak of COVID-19 in Tianjin during 2020, and we attempt to explore prevention and control measures.

METHODS

Setting

Tianjin municipality has an estimated population of 15.6 million and includes 11 districts and 5 counties. We defined the districts of Heping, Hexi, Hedong, Nankai, Hebei, and Hongqiao as urban areas. These areas have a total population of 5.1 million. We defined the districts and counties of Dongli, Xiqing, Jinnan, Beichen, Baodi, Wuqing, Ninghe, Jinghai, Jixian, and Binhai New Area (including Tanggu, Dagang, and Hangu) as suburban areas. They have a population of 10.5 million.

Source of Data and Diagnostic Criteria

All of the data of COVID-19 cases were collected from daily notifications given to the National Health Commission of the People's Republic of China and Tianjin Health Committee.^[4,5] The cases were diagnosed according to the diagnostic and treatment guidelines for COVID-19 issued by the Chinese National Health Committee (Version 3–5). The hospital admission date and the severity of COVID-19 were recorded. There were 135 clinically diagnosed COVID-19 cases (admission data from January 21 to February 24, 2020) in Haihe Hospital of Tianjin. Haihe Hospital of Tianjin is the only designated hospital for the hospitalization of patients with COVID-19 in Tianjin. Clinically, the disease is divided into four types of cases: mild, ordinary,

severe, and critical. Mild cases are defined as the cases with mild clinical symptoms and no pneumonia manifested through imaging results. Ordinary cases have fever, respiratory symptoms and others symptoms of viral pneumonia manifested through imaging results. Severe cases meet any one of the following: (1) Respiratory distress: $RR \geq 30$ times/min; (2) Fingertip oxygen saturation $\leq 93\%$ under resting state; (3) Arterial partial pressure of oxygen (PaO_2)/fraction of inspiration O_2 (FiO_2), $P/F \leq 300$ mmHg (1mmHg=0.133kPa). Critical cases meet any one of the following: (1) Respiratory failure and an artificial airway required for invasive mechanical ventilation; (2) Shock; (3) Combing failure of other organs which requires ICU monitoring and treatment.

Statistical Analysis

A total of 135 valid data were entered into a dataset file with Microsoft Excel-2010 and analyzed with SPSS version 24.0. The incidence, mortality, and case fatality rates were calculated, and other distribution characteristics are described here.

RESULTS

COVID-19 Incidence, Mortality, Case Fatality Rates, and Severity in Tianjin, 2020

A total of 135 confirmed cases of COVID-19 in residents whose addresses were reported as being in Tianjin as of February 24, 2020. There were 45 in urban areas, 84 in suburban areas, and 6 from other provinces. There were 87 cured cases (64.44%), 32 common cases (23.70%), 11 severe cases (8.15%), 2 critical cases (1.48%), and 3 fatal cases (2.22%). The incidence and mortality rate were 8.65 per 1,000,000 in urban areas and 0.19 per 1,000,000 in rural areas. The fatality rate in Tianjin was 2.22%. The incidence in urban and suburb areas was 8.82 per 1,000,000 and 8.00 per 1,000,000, respectively. 9 mixed medical assistance teams were set up by Haihe Hospital of Tianjin, with a total of 153 clinicians and 369 nurses.

Date of Disease Onset

The first 4 cases in Tianjin were identified on January 21. The outbreak peak appeared January 27 and February 6, 2020 in urban and in suburban areas, respectively. In the first 8 days of the outbreak, urban cases accounted for the majority of daily new cases (23, 82.14%). As of February 1, suburban cases have made up the majority (79, 78.22%). In the first 8 days of the outbreak, severe cases accounted for the majority of daily new cases (17, 70.83%). As of February 24, recovered cases have made up the majority (87, 64.44%).

Distribution of COVID-19 Cases by Age

The youngest case in Tianjin was 9 years old and the oldest was 90 years old. The mean age was 48.87 years (48.87 ± 16.91 years). The age of COVID-19 cases in urban areas ranged from 19 to 90, averaging 51.89 years (51.89 ± 15.79 years), while the age of COVID-19 cases in suburb areas ranged from 9 to 90, averaged 47.89 years (47.89 ± 17.12). There was no significant difference in age between infected individuals from the two areas ($t=1.298$, $P=0.197$). The distribution of COVID-19 cases by age is shown in Table 1.

Distribution of COVID-19 Cases by Gender

Of all of the COVID-19 cases in Tianjin, 72 were male and 63 were female, accounting for 53.33% and 46.67%, respectively. There were 29 male cases (64.44%) and 16 (35.56%) female cases in the urban areas and 38 (45.20%) male cases and 46 (54.80%) female cases in suburban areas. The gender difference was found in the cases between urban and suburb areas ($\chi^2=5.398$, $P=0.020$). There were more male cases in urban areas and more female cases in suburban areas. The distribution of COVID-19 cases by gender is shown in Table 1.

Familial Clusters of COVID-19 Patients

Of the total COVID-19 cases, 101 cases (74.81%) belonged to family or social settings (including workplace and public place) clusters. There are 78 cases (57.78%) of family settings clusters, 17 cases (12.59%) of workplace clusters, and 18 cases (13.33%) of public place clusters. Table shows that 23 family settings clusters (71.87%) and 9 (28.13%) social settings clusters in the urban area, and 51 (66.23%) family settings clusters and 26 (33.77%) social settings clusters in the suburb area. No difference was found among the cases between family settings and social settings clusters ($\chi^2=0.330$, $P=0.566$). Figure 1 shows the familial clusters of COVID-19 patients.

History of Sojourning in Hubei Province

Of the 135 COVID-19 cases in Tianjin, 26 (29.55%) came into contact with the epidemic area before the onset of symptoms, but 109 (80.74%) had no history of contact with the epidemic area before the onset. During the first 10 days of the outbreak, cases with a history of sojourning in Hubei Province accounted for the majority of new cases every day (19, 61.29%). As of January 31, COVID-19 cases with no history of sojourning in Hubei began to account for

the majority of the new cases. Even on January 31, February 1, and February 5–24, all of the new cases daily had not been to Hubei Province. Among urban residents, there were 14 (31.10%) COVID-19 cases in people who had visited Hubei Province and 31 (68.90%) COVID-19 cases in people who had not. Among suburban residents, there were 6 (7.14%) COVID-19 cases in people who had visited Hubei Province and 78 (92.86%) COVID-19 cases in people who had not. The difference between the two areas was significant ($\chi^2=12.850$, $P=0.001$) (Table 1).

DISCUSSION

Tianjin municipality has an estimated population of 15.6 million across its 11 districts and 5 counties. The first case of COVID-19 was detected in Tianjin on January 21, 2020. The COVID-19 outbreak struck not only the urban area but also the suburbs. All of the 14 districts and counties were affected by COVID-19. The number of people living permanently in Tianjin was used as the denominator to compute the incidence of COVID-19. The familial cluster was found to be the most important characteristic of COVID-19. Patients with familial clusters accounted for 74.81% of cases, and there was no difference in cluster between urban and suburban areas. Infection was not found to be related to contact with animals. It has been preliminarily concluded that the source of infection is human. ^[6,7]

The attack rate in urban areas was significantly higher than the attack rate in suburban areas. However, of the 135 COVID-19 patients, 87 cases were common, accounting for 64.44%. The condition was relatively serious, and the case-fatality rate was 2.22%. The youngest case was 9 years old and the oldest was 90. The mean age was 48.87. With regard to the gender distribution of COVID-19 cases, 72 were male and 63 were female. The distribution by age and gender in urban and suburb areas showed no significant difference. The distribution by gender in urban and suburb areas showed a significant difference. There was a public place cluster in the urban, and a total of 9 infected subjects were males, accounting for 31.03% of the male patients in the urban. The 24 cluster cases in suburb were all linked to a local department store, 20 of which were female, accounting for 43.48% of the male patients in the urban. The result may attribute to more male in the urban and more women suffering from the disease in suburban. These results indicate that the population is generally susceptible.

Although 19.26% of COVID-19 cases in Tianjin were reported in people who had been in contact with the epidemic area before the onset of symptoms, cases with a history of visiting Hubei Province accounted for the majority of new cases for each of the first 10 days of the outbreak. The proportion of cases both in urban and suburban areas who had a history of contact with COVID-19 patients or epidemic areas was higher than among those who had such history, and the difference was found to be significant. Over time, the new COVID-19 cases emerged among people with no history of sojourning in Hubei Province. This raised the possibility that person-to-person transmission was the main form of transmission. Tianjin Municipal authorities took aggressive measures to protect public health and prevent the spread of COVID-19. ^[8] There were no new confirmed cases in Tianjin for two consecutive days (February 23 and February 24, 2020).

CONCLUSION

All of the COVID-19 cases were admitted to hospitals in urban and suburban areas, indicating that the hospitals in Tianjin had sufficient capacity to admit and treat all of the cases efficiently at that time. These results indicated that COVID-19 was an infectious disease with a familial cluster and there was a high incidence of crowd susceptibility in Tianjin.

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Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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References

1. National Health Commission of the People's Republic of China (2020). <http://www.nhc.gov.cn/xcs/zhengcwj/202002/18c1bb43965a4492907957875de02ae7.shtml>.
2. Li Q, Guan XH, Wu P, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus infected pneumonia. *N Engl J Med*. 2020; doi: 10.1056/nejmoa2001316.
3. Phan LT, Nguyen TV, Luong QC, et al. Importation and human-to-human transmission of a novel coronavirus in Vietnam. *N Engl J Med*. 2020; doi: 10.1056/nejmoa2001272.
4. Tianjin Health Committee (2020). <http://wsjk.tj.gov.cn/col/col86/index.html>.
5. National Health Commission of the People's Republic of China (2020). http://www.nhc.gov.cn/xcs/xxgzbd/gzbd_index.shtml.
6. Dawei Wang, Bo Hu, Chang Hu, et al. Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA*. Published online February 7, 2020. doi:10.1001/jama.2020.1585
7. Jasper Fuk-Woo Chan, Shuofeng Yuan, Kin-Hang Kok, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. *Lancet*. 2020; 395: 514-523. doi: 10.1016/S0140-6736(20)30154-9
8. Jun She, Jinjun Jiang, Ling Ye, Lijuan Hu, Chunxue Bai and Yuanlin Song. 2019 novel coronavirus of pneumonia in Wuhan, China: emerging attack and management strategies. *Clin Trans Med*. 2020; 9:19. doi: 10.1186/s40169-020-00271-z.

Table and figure legends:

TABLE 1 Distribution of COVID-19 cases in Tianjin

Variable	Urban area			Suburban area			Total ^a		t or χ^2 , <i>P</i>
	No. of cases	%		No. of cases	%		No. of cases	%	
Age									
1-	0	0.00		2	2.50		2	1.55	1.298, 0.197
10-	2	4.44		0	0.00		2	1.55	
20-	3	6.67		11	13.75		14	10.85	
30-	6	13.33		17	21.25		23	17.83	
40-	11	24.44		17	21.25		28	21.71	
50-	11	24.44		14	17.50		25	19.38	
60-	6	13.33		16	20.00		22	17.05	
70-	5	11.11		5	6.25		10	7.75	
80–90	1	2.22		2	2.50		3	2.33	
Gender									
Male	29	64.44		38	45.20		67	51.94	4.330, 0.037
Female	16	35.56		46	54.80		62	48.06	
Cluster									
Family	23 ^b	71.87		51 ^b	66.23		74 ^b	67.89	0.330, 0.566
Social ^c	9 ^b	28.13		26 ^b	33.77		35 ^b	32.11	
Contact history									
Yes	14	31.10		6	7.14		20	15.50	13.850, 0.001
No	31	68.90		78	92.86		109	84.50	

^a Six cases from other provinces were excluded.

^b Some COVID-19 cases have to do with both family clusters and social clusters.

^c The social place cluster includes workplace and public place cluster.

FIGURE 1 Familial clusters of COVID patients. The numbers in circles or boxes indicate the codes of confirmed cases.

