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Characteristics and Outcome of 69 Cases of Coronavirus Disease 2019 (COVID-19) in Lu'an City, China Between January and February 2020

Authors' Contribution:

Study Design A

Data Collection B

Statistical Analysis C

Data Interpretation D

Manuscript Preparation E

Literature Search F

Funds Collection G

ABCD **Zhenghao Jiang**

ABCE **Jie Sun**

ABCF **Xiude Li**

CEFG **Yong Lyu**

Department of Public Health, Lu'an Center for Disease Control and Prevention, Lu'an, Anhui, P.R. China

Corresponding Author: Yong Lyu, e-mail: lyong@lacdc.com.cn

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Background: This population study aimed to investigate the demographic and clinical characteristics and outcome of cases of coronavirus disease 2019 in Lu'an City, China between January 22, 2020 and February 18, 2020 identified from the China Information System for Disease Control and Prevention (CISDCP).

Material/Methods: Laboratory-confirmed cases of COVID-19 reported in the CISDCP were included in this study. The distribution of cases, exposure history, clustered epidemic situation, and clinical manifestations, disease severity, and key time nodes were analyzed. Once the throat swab or sputum sample was positive for SARS-CoV-2 by real-time reverse transcriptase-polymerase chain reaction testing as confirmed cases.

Results: There were 69 cases of COVID-19 that were confirmed between January 22 and February 18, 2020 reported. The onset time was concentrated on January 25, 2020 solstice to February 6, 2020 (71.0%), and the reporting dates were concentrated on January 31, 2020 and February 9, 2020 (69.6%). Nineteen cases (27.5%) had a history of sojourn in Hubei Province, and none of the cases reported after February 6, 2020 had a history of exposure in Hubei Province. There were 14 cluster outbreaks, and human-to-human transmission was the most common (78.6%). The most common symptoms were fever (56.5%), cough (37.7%), and self-conscious discomfort (14.5%). Besides, there were 9 severe cases (13.0%).

Conclusions: The epidemic prevention and control in Lu'an City has achieved phased results. Yet, new strict control measures need to be implemented to prevent a further outbreak, especially for those who will return to Lu'an City.

MeSH Keywords: **Cluster Analysis Coronavirus Infections • Epidemiologic Methods**

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Background

A cluster of unexplained pneumonia cases was reported in Wuhan in late December 2019. On February 11, 2020, the World Health Organization (WHO) named the disease coronavirus disease 2019 (COVID-19). Up till now (April 16, 2020), the outbreak of COVID-19 has spread to 6 continents, infecting 3 million people and killing nearly 137 000 [1,2]. COVID-19 outbreak is considered one of the deadliest pandemics in human history. On February 28, 2020 the WHO raised the pandemic level to the highest level [3,4].

COVID-19 is a new infectious disease, whose etiological characteristics, pathogenesis, and epidemic characteristics are still not well understood. Early studies have shown that the disease is highly contagious and has a high risk of human-to-human and inter-city transmission, with an early basic regeneration index (R_0) of about 2.2 [5]. This paper summarizes and analyzes the epidemic characteristics of confirmed cases in Lu'an City (located 300 km from Wuhan City), China between January 22, 2020 and February 18, 2020 identified from the China Information System for Disease Control and Prevention (CISDCP) [6], so as to facilitate the formulation and adjustment of prevention and future control strategies.

Material and Methods

Study participants

Laboratory-confirmed cases with COVID-19 reported in the China Information System for Disease Control and Prevention (CISDCP) between January 22, 2020 and February 18, 2020 were included in this study.

Laboratory testing

Cases with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection were confirmed by the real-time reverse transcriptase-polymerase chain reaction (RT-PCR) of nasopharyngeal and oropharyngeal swabs [7]. The RT-PCR kit was manufactured by the Sun Yat-sen University Da'an Gene Co., Ltd, China (20203400063). According to the test results of the clinical samples, the ROC curve was used to determine that the ORF1 ab and N reference values exhibited Ct values equal to 40.

Definition of study outcomes

Once the throat swab or sputum sample was positive for SARS-CoV-2 by RT-PCR testing as confirmed cases [8,9]. Positive cases were confirmed based on clinical data or epidemiological history, and nucleic acid testing. The clinical classification of COVID-19 included mild cases, ordinary cases, severe cases,

and critical cases [10]. A cluster outbreak was defined as 2 or more confirmed cases in a small area (such as a family) within 2 weeks; this usually suggests a human-to-human transmission through close contact or joint exposure [11].

Population infection control measures

All close contacts received 14 days of intensive medical observation and nucleic acid testing. On January 25, 2020, the government issued a notice to cancel all gatherings and asked residents to spend their holidays at home as much as possible. From February 5, 2020 all communities, villages and units will be placed under closed management to restrict the movement of people.

Research methods

The onset date, report date, epidemiological exposure history, clinical characteristics, treatment history, and general demographic characteristics of the COVID-19 confirmed cases were collected and further analyzed. Clinical data of the COVID-19 confirmed cases were obtained from patient records; epidemiological and socio-demographic data were obtained from epidemiological surveys. EXCEL 2013 was used to draw the epidemiological curve of the disease, while ArcGIS 10.3 was used to draw the regional distribution map of the disease

Statistical analysis

Statistical analyses were performed using SPSS 20.0. Significance level was set at $P < 0.05$. Non-parametric Mann-Whitney U test was used for the comparison of age between independent samples.

Ethical statement

The medical ethics committee of Lu'an Center for Disease Control approved this study. Informed consent was obtained from all patients.

Results

General data

A total of 69 cases of COVID-19 that were confirmed between January 22, 2020 and February 18, 2020 were reported in Lu'an City. All COVID-19 patients were successfully cured, and, consequently, discharged (before March 3, 2020).

Time distribution

The onset date of all cases (69 cases) was between January 12, 2020 and February 17, 2020; while the onset date of 49

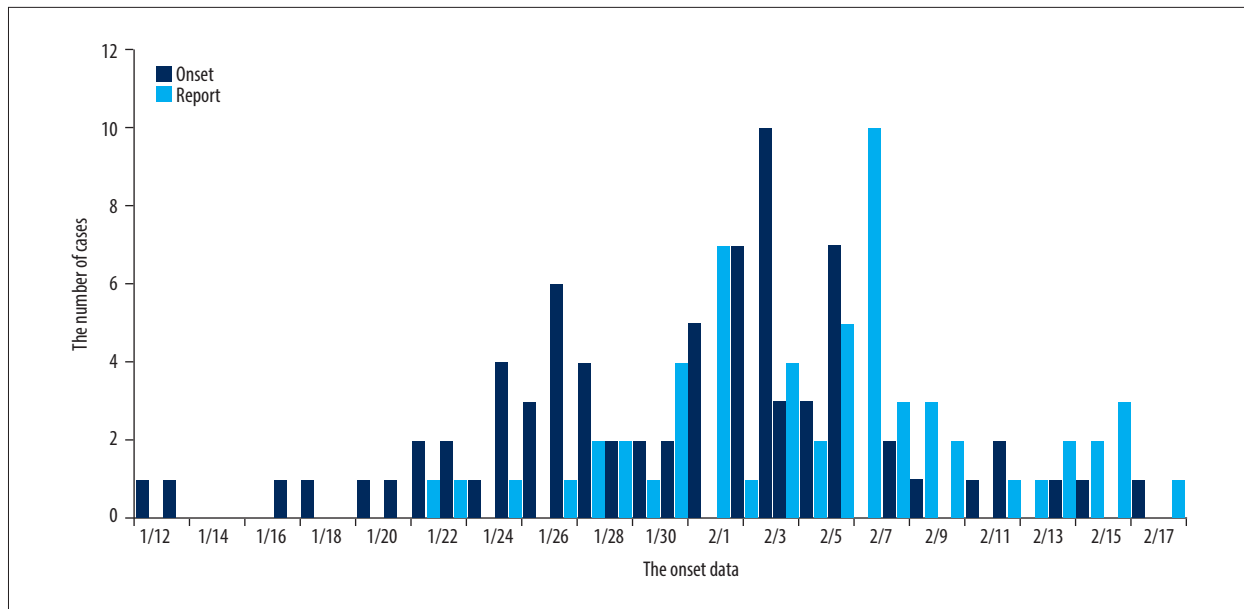


Figure 1. The distribution of onset and report date of COVID-19 cases in Lu'an City.

cases (71%) was between January 25, 2020 and February 6, 2020. The number of reported cases has gradually increased since the first case was reported on January 12, 2020, and the onset date of 48 cases (69.6%) was mainly concentrated between January 31, 2020 and February 9, 2020. The number of new confirmed cases per day took a downward trend since February 9, 2020, while no new cases were reported after February 18, 2020 (Figure 1).

Regional distribution

The regional distribution of the 69 cases involved 5 counties/areas, including Jinzhai county (23 cases), Huoshan county (17 cases), Huoqiu county (13 cases), Yu 'an area (8 cases) and Jin 'an area (8 cases). Twenty-two cases (31.9%) were from urban areas (including county) and 47 cases (68.1%) from rural areas.

On January 22, 2020, only one suburb area reported positive cases. Consequently, (from January 22, 2020 to February 18, 2020) infection was reported in the other 5 counties/areas in Lu'an City: Tangjiahui Town of Jinzhai County (14 cases), Hengshan Town of Huoshan County (12 cases), and Zhouji Town of Huoqiu County (6 cases), accounting for 46.4% of the total cases (Figure 2).

Population distribution

Among the 69 cases, the male (44 cases) to female (25 cases) ratio was 1.8: 1. The patients' age ranged from 10 months to 78 years old, with a median age of 41.0 years. The age group 20–49 years had the largest number of cases (68.1%). In the occupational distribution, those making up the largest

proportion were farmers (44.9%), business people (23.2%), domestic workers or unemployed (7.2%), food service personnel (4.3%), government employees (4.3%), workers (4.3%), medical staff (2.9%), children (2.9%), and other occupations (5.8%).

Exposure history in Hubei province

Of the total cases, 19 cases (27.5%) had a history of sojourn in Hubei Province, while the other 50 cases stated not having lived or traveled in Hubei province in the 2 weeks before the onset of the disease. The cases reported before January 29, 2020 had a history of exposure to Hubei province, and none of the cases reported after February 6, 2020 had a history of exposure to Hubei province (Figure 3).

Cluster epidemic situation analysis

A total of 14 clustered outbreaks occurred, with 47 cases, accounting for 68.1% of the total cases. The main counties/areas where the outbreak occurred were Huoshan county (5 outbreaks), Jinzhai county (4 outbreaks), and Jin 'an area (1 outbreak). The shortest interval between the first case and the last case was 1 day, and the longest interval between the first case and the last case was 19 days. Eleven clustered outbreaks were reported; human-to-human transmission was the most common route of transmission, accounting for 78.6% of the total cluster outbreaks (Table 1).

Clinical manifestations

The first symptoms of the COVID-19 were fever (56.5%), cough (37.7%), self-conscious discomfort (14.5%), chills (8.7%),

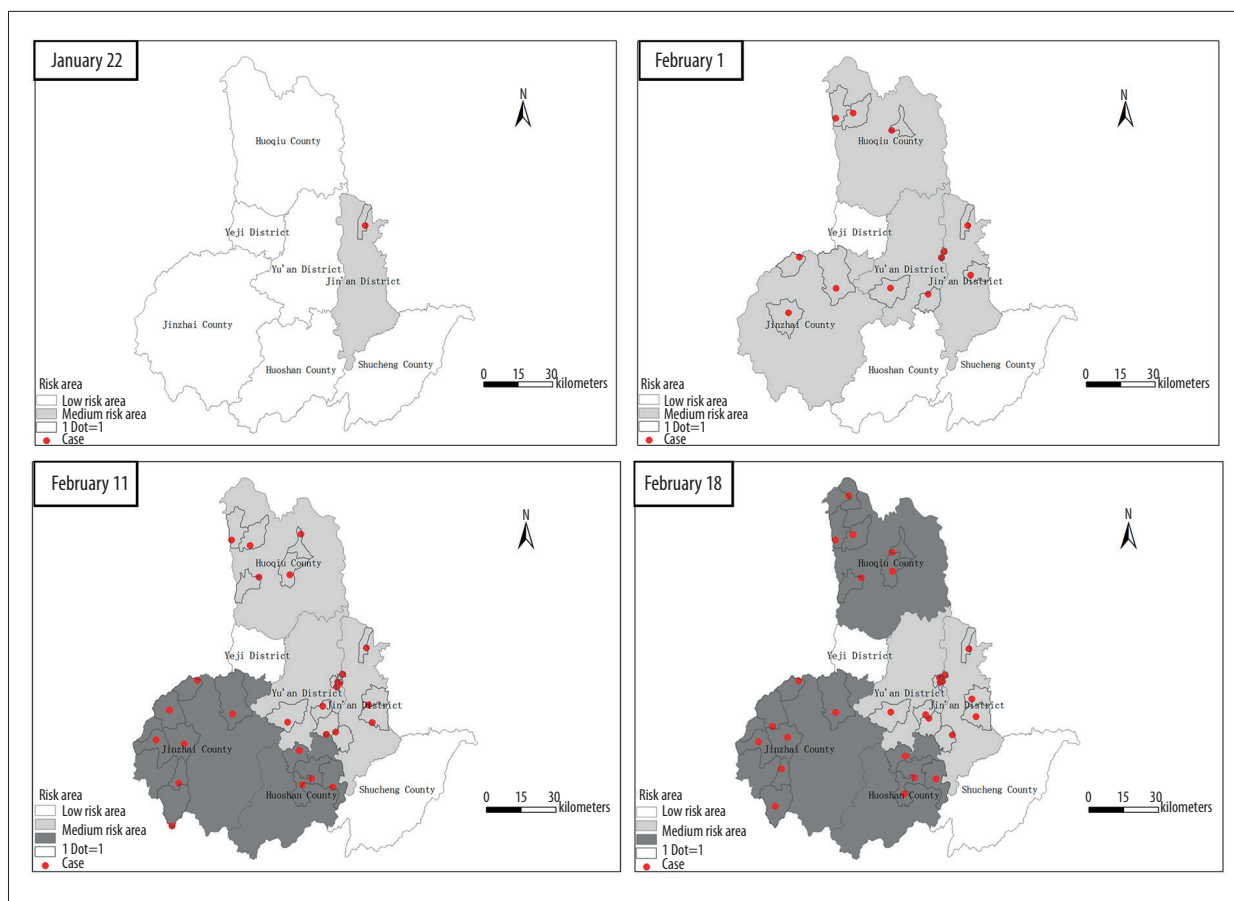


Figure 2. The time-space distribution of COVID-19 cases in Lu'an City.

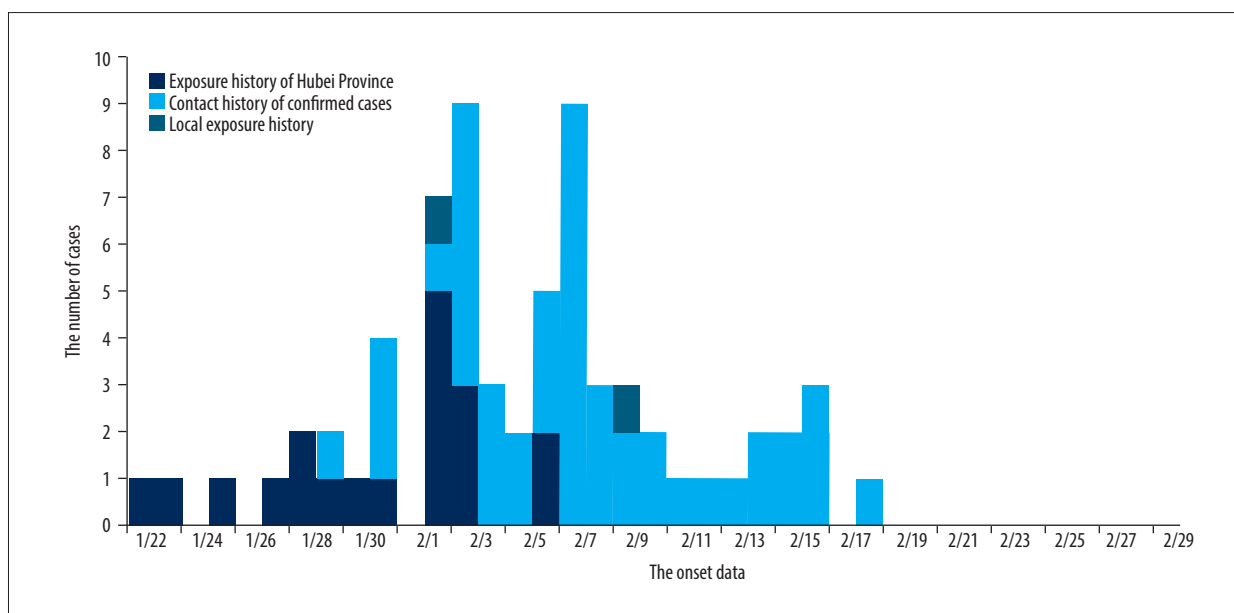


Figure 3. The report date distribution of exposure history in Hubei province of COVID-19 cases in Lu'an City.

Table 1. Distribution of COVID-19 cluster outbreak in Lu'an City.

No	The time interval between the first case and the last case (d)	The number of cases	Relationship	Outbreak counties/areas	Possible cause of infection
1	1	2	Couple	Jinzhai county	Common exposure
2	18	5	Relatives	Huoshan county, Jin'an area	Human-to-human transmission
3	2	2	Father and son	Huoshan county	Human-to-human transmission
4	7	3	Couple, friend	Jinzhai county	Common exposure, human-to-human transmission
5	19	4	Relatives	Yu 'an area	Human-to-human transmission
6	10	2	Mother and son	Yu 'an area	Human-to-human transmission
7	6	3	Couple	Huoshan county	Common exposure, human-to-human transmission
8	5	2	Couple	Huoqiu county	Human-to-human transmission
9	12	11	Relatives, friend	Jinzhai county	Human-to-human transmission
10	7	3	Relatives	Huoshan county	Human-to-human transmission
11	11	2	Relatives	Jinzhai county	Human-to-human transmission
12	17	2	Colleague	Huoshan county	Human-to-human transmission
13	4	3	Couple	Huoqiu county	Human-to-human transmission
14	19	3	Relatives, neighbor	Huoqiu county	Human-to-human transmission

Table 2. The key time nodes from onset to admission of COVID-19 cases in Lu'an City.

Time interval	Days				Median
	<1	1-3	4-7	>7	
From onset to visit	33	26	9	1	1
From onset to admission	19	23	21	6	2
From onset to diagnosis	0	28	29	12	4

fatigue (8.7%), and other symptoms (43.5%). Among the 69 cases, 5 cases (7.2%) had chronic underlying diseases, mainly including diabetes, uremia, chronic bronchitis, duodenal ulcer, and heart disease. There were 60 mild cases (87.0%) and 9 severe cases (13.0%). The time from onset to doctor visit was <24 hours (33 cases; 47.8%), 1-3 days (23 cases; 33.3%), and 4-7 days (29 cases; 42.0) (Table 2). The median age of severe cases (56.0 years) was significantly higher than that of mild cases (41.0 years), and the difference was statistically significant ($P=0.015$).

Discussion

The transmission mode of COVID-19 changed from small-scale exposure in the early stage to human-to-human transmission in the later stage. The change of transmission mode led to the rapid outbreak of COVID-19 in the whole country from January

2020 [12]. The prevention and control of COVID-19 in Lu'an City is a challenging task considering the city's geographical location and the proximity to the Wuhan area (the focal point of infection). The number of COVID-19 cases in Lu'an City reached the peak in the period between February 3, 2020 and February 7, 2020 [12], after which strict control measures were implemented, eventually reducing the number of reported positive cases in the city [13,14]. After February 7, 2020, newly reported cases were mainly local cases, and the causes of infection were mostly family clusters, which were similar to the epidemic characteristics of Jinan City [15].

Lu'an City is composed of 3 areas and 4 counties. Although strict control measures have been implemented to control the outbreak from and between counties/areas, there were still many close contacts of imported cases or returnees from Wuhan, which have not been fully controlled, thus leading to the second wave of infections in some areas [15].

According to this study, the 69 confirmed cases of COVID-19 in Lu'an City were more likely to be male, middle-aged, and farmers; according to statistics, Lu'an City had the highest rate of infection among farmers compared to other Chinese cities [8,12–16]. This may be because Lu'an is an economically underdeveloped area with a large number of young adults working outside the city.

The most common clinical features were fever and cough. Some cases presented with self-conscious discomfort and chills, which was similar to the results reported by Hunan province [17]. The atypical clinical manifestations of COVID-19 bring great difficulties to the early differential diagnosis; thus, the screening capabilities should be improved to detect suspicious cases as early as possible [18].

All cases in Lu'an City were cured, and, consequently, discharged from the hospital. The incidence rate of severe diseases was 13.0%, which was significantly lower than the national rate of 25.5%, and no death was reported, which may be related to the timely diagnosis and treatment of diseases in Lu'an City. Besides, the time interval from the onset to treatment, from the onset to the admission, and from the onset to the diagnosis in Lu'an was obviously lower than the data reported in earlier reports nationwide [19].

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Conclusions

At present (April 16, 2020), no new suspected or confirmed cases have been reported in Lu'an. All the cases have been successfully cured and discharged from the hospital, indicating that the early transmission chain has been blocked. Yet, new strict control measures need to be implemented to prevent a further outbreak, especially for those who plan to return to Lu'an City.

This study only carried out descriptive epidemiological observation on the cases in Lu'an City, China between January 2020 and February 2020, but lacked systematic analysis. In the future, it is necessary to carry out special studies on clustered epidemic situations.

Acknowledgments

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Conflict of interest

None.