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Epidemiological Features of Severe Acute Respiratory Syndrome in Beijing Urban and Suburb Areas in 2003

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Objective To describe the epidemiologic features of an outbreak of severe acute respiratory syndrome (SARS) in urban and suburb areas in Beijing and to explore their differences between these two areas. **Methods** Data of SARS cases were collected from daily notification of China Ministry of Health and a database of infectious diseases was established by the Beijing Municipal Center for Disease Prevention and Control (BCDC). All the data were put into dataset files by Microsoft Excel-2000 and analyzed with SPSS version 10.0 software. **Results** The respective urban incidence and mortality rate were 29.06 and 2.21 per 100 000, while the case fatality rate was 7.62%. In contrast, the respective suburb incidence and mortality rate were 10.61 and 0.78 per 100 000, and the case fatality rate was 7.32%. No significant differences were found in demographic characteristics between the urban and suburb areas. **Conclusion** Beijing urban area suffered a more serious SARS epidemic than the suburb area in 2003.

Key words: SARS; District distribution; Epidemiology

INTRODUCTION

Severe acute respiratory syndrome (SARS), an atypical pneumonia highly transmissible to healthcare workers (HCWs)[1], is a new clinical entity caused by a novel coronavirus. In November 2002, no sooner did SARS firstly emerge in Guangdong Province of China than it transmitted into the Hongkong Special Administrative Region, then Vietnam, *etc*. In March of 2003, SARS was imported into Beijing. Beijing Municipal Authorities took aggressive measures to enhance detection, isolate case-patients, and trace contacts to minimize opportunities for further transmission in community and institutional settings. The widespread transmission in Beijing came under control three month later. Since some issues regarding transmission, infection control, diagnosis and management of SARS have not been fully understood[2], we summarized some epidemiologic features of the outbreak of SARS in Beijing in the year of 2003, and tried to explore their differences between these two areas.

MATERIALS AND METHODS

Setting

Beijing municipality has an estimated population of 13.8 million and includes 14 districts and 4 counties. We defined the cases living in the districts of Dongcheng, Xicheng, Chongwen, Xuanwu, Chaoyang, Haidian, Fengtai and Shijingshan as urban cases, and those living in the districts or counties of Mentougou, Fangshan, Changpin, Shunyi, Tongzhou, Daxing, Huairou, Miyun, Yanqin, and Pinggu as suburb cases.

Source of Data

All the data of SARS cases were collected from daily notification of Beijing CDC. Disease reporting and epidemic investigations of reported cases were conducted through the collaboration with district centers within Beijing, using guidelines for surveillance and case investigation issued by the Ministry of Health (MOH). In accordance with the interim diagnostic criteria set by MOH[3], there were 2521 clinically diagnosed SARS cases, and 2447

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valid data with clear living site were identified by August 16, 2003.

Diagnostic Criteria

All the cases were diagnosed based on their epidemiological histories and clinical features, with or without serum evidence of SARS Co-V infection, according to the interim diagnostic criteria set by MOH[3].

Statistical Analysis

A total of 2477 valid data were input into a dataset file with Microsoft Excel-2000 software and analyzed with SPSS version 10.0, and figures were made with Excel-2000 software. The incidence, mortality, and case fatality rates were calculated, and other distribution characteristics were described.

RUSULTS

SARS Incidence, Mortality and Case Fatality Rates in Beijing, 2003

A total of 2521 SARS probable cases were reported in Beijing between March and June, 2003. Of these cases, 2447 registered their resident address (1996 in urban area, while 451 in suburb area). The incidence and mortality rate from March to June were 21.99 per 100 000 and 1.66 per 100 000, respectively. The case fatality rate in Beijing was 7.56%. In contrast, the respective incidence, mortality and case fatality rates in urban area v.s. suburb area were 29.056 per 100 000 v.s. 10.61 per 100 000, 2.21 per 100 000 v.s. 0.78 per 100 000, and 7.62% v.s. 7.32% (Table 1).

Date of Disease Onset and Hospitalization

The first case in urban area of the city was identified on March 1, while the first one in suburb area was identified on March 21. The outbreak peak appeared between April 10 and May 5, 2003 in urban area and between April 10 and May 5, 2003 in suburb area. The peak stage of outbreak in urban and suburb areas overlapped mostly. Fig. 1 shows the distribution of cases by date of onset both in urban and suburb areas.

TABLE 1

SARS Incidence, Mortality and Case Fatality Rates in Urban and Suburb Areas, Beijing

Area	Population (Ten Thousand)	No. of Probable Cases	Incidence Rate (1/ten Thousand)	No.of Death	Mortality Rate (1/ ten Thousand)	Case Fatality Rate (%)
Urban	686.89	1996	29.058[a]	152	2.213[b]	7.62[c]
Suburb	425.73	451	10.612	33	0.775	7.32
Total	1112.62	2447	21.993	185	1.663	7.56

Note: [a]Incidence rate: u=20.38, $P<0.00$; [b]Mortality rate: u=5.75, $P<0.00$; [c]Case fatality rate:u=0.057, $P=0.2843$.

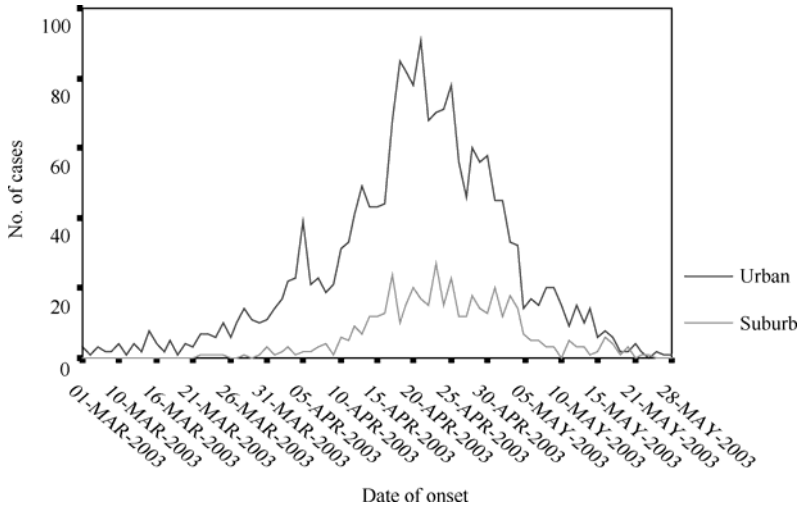

FIG. 1. The distribution by date of onset.

The first case in urban area was admitted to hospital on March 5, and the first one in suburb areas was done so on March 26. In urban area the peak of hospitalization was from April 11 to May 9, and that in suburb areas was from April 19 to May 9. The peak stage of hospitalization in urban and suburb areas also overlapped mostly. Fig. 2 shows the distribution of case by date of hospitalization in urban

and suburb areas.

Distribution of SARS Cases by Age

The youngest case in Beijing was 1 year old, and the oldest was 93 years old. The mean age was 37.11 years (95% CI: 37.11±15.84 years). The age of SARS cases in urban areas ranged from 1 to 93, averaged 37.27 years (95% CI: 37.27±15.92 years), while the age of SARS cases in urban areas ranged from 7 to 82, averaged 36.56 years (95% CI: 36.56± 15.65). There was no significant age difference between the two areas (t=0.857, P=0.992). The distribution of SARS cases by age is shown in Table 2 and Fig. 3.

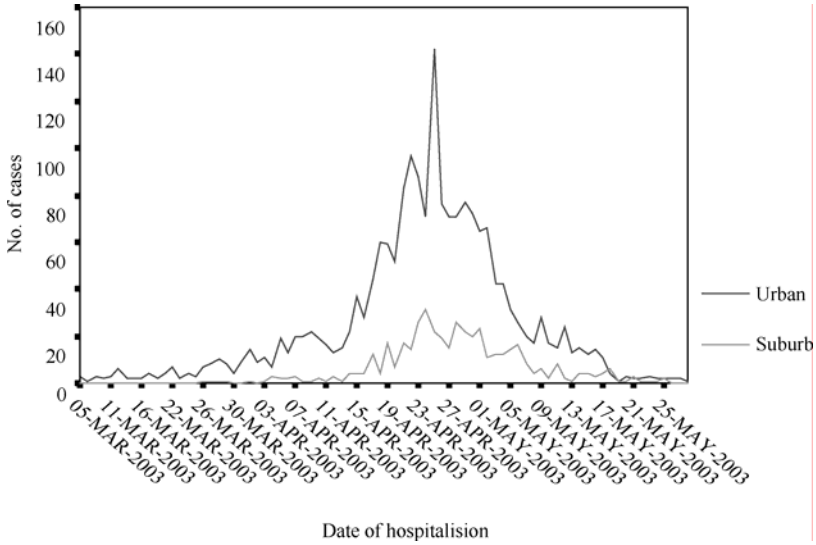

FIG. 2. The distribution by date of onset.

TABLE 2

Distribution of SARS Cases in Urban and Suburb Areas

Age (yrs.)	Urban Area		Suburb Area		Total	
	No.of Cases	%	No. of Cases	%	No. of Cases	%
1-19	146	7.32	39	8.65	185	7.57
20-	615	30.86	145	32.15	760	31.10
30-	447	22.43	98	21.73	545	22.30
40-	388	19.47	71	15.74	459	18.78
50-	173	8.68	50	11.09	223	9.12
60-	117	5.87	29	6.43	146	5.97
70-93	107	5.37	19	4.21	126	5.16
Total	1993	100.00	451	100.00	2444	100.00

Note. χ^2=7.324, P=0.292.

As shown in Table 2 and Fig. 3, no significant difference was found in the age group between the two areas (χ^2=7.324, P=0.292).

Distribution by Gender

Of the total urban and suburb SARS cases in Beijing, 1224 were males and 1213 were females, accounting for 50.40% and 49.60%, respectively. There were 1008 males (50.50%) and 988 (49.50%) females in the urban area, and 226 (50.11%) males and 255 (49.89%) females in the suburb area. No gender difference was found in the cases between urban and suburb areas (χ^2=0.022, P=0.881).

Distribution by Occupation

Of all the cases, no matter in the urban or suburb area, health-care workers (HCWs) accounted for the highest percent, which was 15.93% and 18.63% respectively. The distribution by occupation in urban and suburb areas is shown in Table 3.

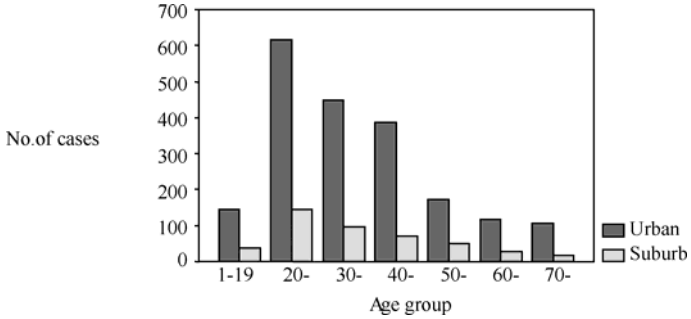

FIG. 3. Distribution of SARS cases by age in urban and suburb areas.

TABLE 3

Occupational Distribution of SARS Cases in Urban and Suburb Areas

Occupation	Urban Area		Suburb Area		Total	
	No. of Cases	%	No. of Cases	%	No. of Cases	%
Health Care Workers	318	15.93	84	18.63	402	16.43
Officials / Clerks	247	12.37	42	9.31	289	11.81
Retired Workers	219	10.97	45	9.98	264	10.79
Industrial Workers	172	8.62	51	11.31	223	9.11
Household Chores	157	7.87	43	9.53	200	8.17
Migrant Laborers	154	7.72	40	8.87	194	7.93
Students	141	7.06	33	7.32	174	7.11
Commercial workers	101	5.06	26	5.76	127	5.19
Soldiers	69	3.46	3	0.67	72	2.94
Armed Police	56	2.81	0	0.00	56	2.29
Teachers	42	2.10	5	1.11	47	1.92
Food Handlers	25	1.25	0	0.00	25	1.02
Nursery maids	18	0.90	5	1.11	23	0.94
Farmers	17	0.85	39	8.64	56	2.29
Children	5	0.25	0	0.00	5	0.20
Others	111	5.56	25	5.54	136	5.56
Unspecified	144	7.21	10	2.22	154	6.29
Total	1996	100.00	451	100.00	2447	100.00

Note. χ^2=171.699, P=0.000.

As shown in Tables 3, the top four occupations in the urban area were officials/clerks, retired workers, industrial workers and household chores/ unemployed, while the top four occupations in the suburb area were industrial workers, retired workers, officials/clerks and migrant laborers. There was significant difference in distribution by occupation between the two areas (χ^2=171.699, P=0.000).

History of Contact With SARS Patients

Of the 2223 SARS cases in Beijing, 971 (43.68%) contacted SARS patients before the onset of symptoms, but 1252 (56.32%) had no contact history with SARS patients before the onset. Table 4 shows the distribution by history of close contact with SARS patients. There was no difference in the distribution

by history of contact between the two areas (χ^2=0.753, *P*=0.185).

Prognosis of SARS Cases in Beijing

Till June 24, 2003, of the 2445 SARS cases in Beijing, 2233 (91.33%) recovered and discharged, 20 (0.82%) were still hospitalized, 185 (7.57%) died of SARS and 7 (0.29%) died of diseases other than SARS. Table 5 shows the prognosis of SARS cases in urban and suburb areas, Beijing. There was no significant difference in distribution by the prognosis of SARS cases between the two areas (χ^2=2.042, *P*=0.401).

TABLE 4

Distribution by History of Contact With SARS Patients in Urban and Suburb Areas

History of Contact	Urban area		Suburb Area		Total	
	No. of Cases	%	No. of cases	%	No. of Cases	%
Yes	792	44.37	179	40.87	971	43.68
No	993	55.63	259	59.13	1252	56.32
Total	1785	100.00	438	100.00	2223	100.00

Note. χ^2=0.753, *P*=0.185.

TABLE 5

Prognosis of SARS Cases in Urban and Suburb Areas, Beijing

Prognosis	Urban Area		Suburb Area		Total	
	No. Cases	%	No. Cases	%	No. cases	%
Recovered and Left Hospital	1819	91.18	414	92.00	2233	91.33
Still Hospitalized	19	0.95	1	0.22	20	0.82
Died of SARS	152	7.62	33	7.33	185	7.57
Died of Diseases Other Than SARS	5	0.25	2	0.44	7	0.29
Total	1995	100.00	450	100.00	2445	100.00

Note. χ^2=2.042, *P*=0.401.

Case Distribution by Hospitals

Of the 2445 cases in Beijing, 1593 were admitted to municipal hospitals and 155 to district hospitals, which accounted for 65.15% and 8.38%, respectively. Two hundred and ninety-nine cases were admitted to central hospitals, and 204 to military hospitals. The distribution by admitted hospital level is showed in Table 6.

TABLE 6

Case Distribution by Hospitals in Urban and Suburb Areas

Classification of Hospital	Urban Area		Suburb Area		Total	
	No. of Cases	%	No. of Cases	%	No. of Cases	%
Municipal	1285	64.44	308	68.29	1593	65.15
District	155	7.77	50	11.09	205	8.38
Central	230	11.53	69	15.30	299	12.23
Under Jurisdiction of the Ministry of Health	126	6.32	18	3.99	144	5.89
Military	198	9.93	6	1.33	204	8.34
Total	1994	100.00	451	100.00	2445	100.00

Note. $\chi^{2=}$=45.898, *P*=0.000.

The case distribution by hospitals between the two areas was significantly different (χ^2=45.898, *P*=0.000).

DISCUSSION

Beijing municipality has an estimated population of 13.8 million and includes 14 districts and 4 counties. The first case of SARS was introduced into Beijing on March 1, 2003 and then the outbreak of SARS attacked not only the urban area but also the suburb area. All the 18 districts/counties were attacked by SARS. The number of people constantly living in Beijing was used as denominator to compute the attack rate. The attack rate in the urban area was 29.058/100 000, the mortality rate was 2.213/100 000, both being significantly higher than the attack rate (10.612/100 000) and mortality rate (0.775/100 000) in the suburb area. However, the case-fatality rate (7.63%) in urban and suburb areas was similar (7.32%), and no significant difference was found between the two areas. The first case in the urban area was identified 20 days earlier than the first case in the suburb area, but the last case in the urban area occurred 4 days later than that in the suburb area. The peak of the date that SARS cases were admitted to hospital in urban and suburb areas overlapped, indicating that the hospitals in Beijing had the capacity of admitting and treating all the cases while the outbreak reached the peak in the suburb area.

Both the youngest and oldest SARS cases were residents in the urban area. The distribution by age and gender in urban and suburb areas had no significant difference. Both in urban and suburb areas, health-care workers accounted for the largest proportion in the distribution by occupation, which indicated that HCWs were under high risk in the outbreak of SARS in Beijing.

The proportion of cases both in urban and suburb areas, who had close contact with SARS patients, was higher than that of those who had no close contacts history, but no significant difference was found. Though the distribution by hospitals was not completely similar in urban suburb areas, the proportion of recovered and fatal cases in the two areas was similar.

The result indicated that all the hospitals admitting SARS patients were equipped with similar technological and physical conditions and all had the ability to treat SARS patients timely and efficiently.

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