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Case Fatality Rate of Severe Acute Respiratory Syndromes in Beijing

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Objective To describe the case fatality rate of SARS in Beijing. **Methods** Data of SARS cases notified from Beijing Center for Disease Control and Prevention (BCDC) and supplemented by other channels were collected. The data were analyzed by rate calculation. **Results** The case fatality rate of SARS in Beijing was 7.66%, and had an ascending trend while the age of cases was getting older, and a descending trend while the epidemic development. The case fatality rate in Beijing was lower than that in other main epidemic countries or regions. **Conclusions** The risk of death increases with the increment of age of SARS patients. Beijing is successful in controlling and treating SARS.

Key words: SARS; Case fatality rate; Beijing

INTRODUCTION

Severe acute respiratory syndrome (SARS), a highly transmissible atypical pneumonia, is a new clinical entity caused by a novel coronavirus[1]. In November 2002, SARS emerged in Guangdong Province of China, and soon was transmitted into Hongkong Special Administrative Region, Vietnam, *etc*. In March 2003, SARS was imported into Beijing, and the outbreak reached its peak in late April. Beijing became one of the cities severely attacked by SARS all over the world. When a large number of SARS cases emerged in Beijing, Beijing municipal authorities took the decisive measures to increase the admission rate and the cure rate, in order to decrease the case fatality rate and the attack rate of health care workers. The case fatality rate was not only concerned by the medical field but also by the health administrators and publics. Up to August 16, 2003, all the SARS patients were discharged from hospitals. So it was possible to calculate the SARS case fatality rate in Beijing. It is of great importance and value to analyze the difference of SARS case fatality rate between different populations and the variations of the case fatality rate in different epidemic stages. It could be served as the basis for the decision making of how to prevent and control SARS among populations.

MATERIALS AND METHODS

Data Source

All data of SARS cases were collected from daily notification of Ministry of Health, P. R. China and the database of infectious diseases established by the Beijing Municipal Centers for Disease Prevention and Control. In the dataset collected by Beijing Municipal Centers for Disease Prevention and Control, 2521 were clinically diagnosed as SARS cases according to the interim diagnostic criteria set by the Ministry of Health of China[2]. All data from foreign countries were downloaded from the WHO official website.

Statistical Analysis

Valid data of the 2521 cases were input into a data file with Microsoft Excel-2000 software and analyzed with SPSS version 10.0, and figures were made with Microsoft Excel-2000 software. The case fatality rate was calculated with the following formula:

Case fatality rate=the number of cases died of SARS/the clinically diagnosed SARS cases×100%.

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RESULTS

There were 2521 clinically diagnosed SARS cases in the data collected by the Beijing Municipal Centers for Disease Prevention and Control. Of the cases, 1279 were males and 1242 were females, accounting for 50.73% and 49.72%, respectively, and there was no statistical gender significance. 30.98% of the cases were aged 20-29 years.

Comparison of Case Fatality Rate Between Different Populations in Beijing

In this study, the case fatality rate was compared between the different populations by gender, age, occupation, area, contact history with SARS patients, classification of admitted hospital, interval from onset to admission, different epidemic stages. A comparison was also made between the case fatality rate in Beijing and other regions.

Gender and Age

Of all the 2521 cases, 193 died of SARS, the overall fatality rate of SARS was 7.66%. All the cases were divided into 10 groups by age with the interval of every 10 years. Two thousand five hundred and eighteen eligible cases were analyzed, 3 survived cases were excluded because their age was not clear. The number of cases and case fatality rate in each age group are shown in Fig. 1. During the epidemic of SARS in Beijing, the cases were mainly distributed in the 20-, 30-, 40- age groups which accounted for 72.36% of the total cases. The case fatality rate increased with age. The fatality rate of the groups younger than 49 years old, including the 20-, 30-, 40- age groups, was lower than the crude fatality rate 7.66%. The case fatality rate in the 5 groups older than 50 was higher than 15%. Generally, the case fatality rate increased with the age, but there was a slight decrease in the 80-year-old group. Two cases in the 90-year-old group died.

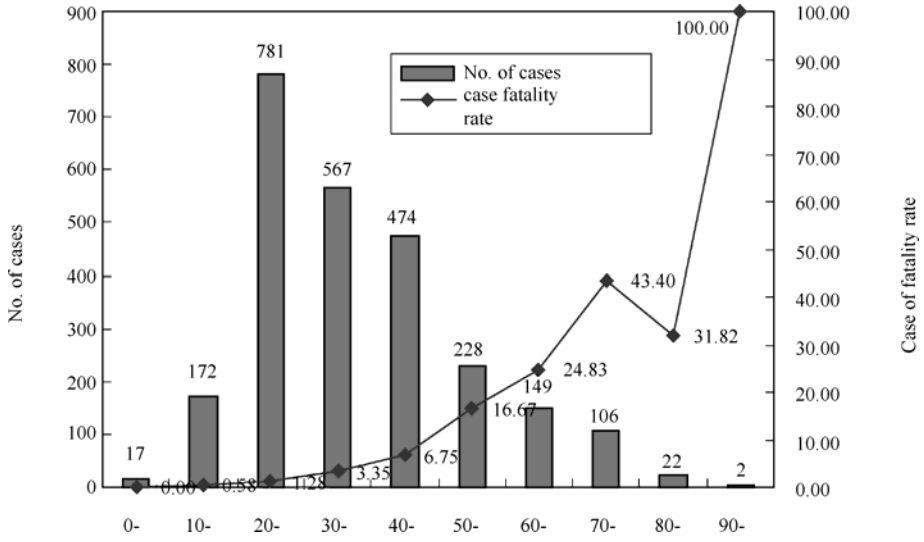

FIG . 1. SARS cases and case fatality rate by age in Beijing.

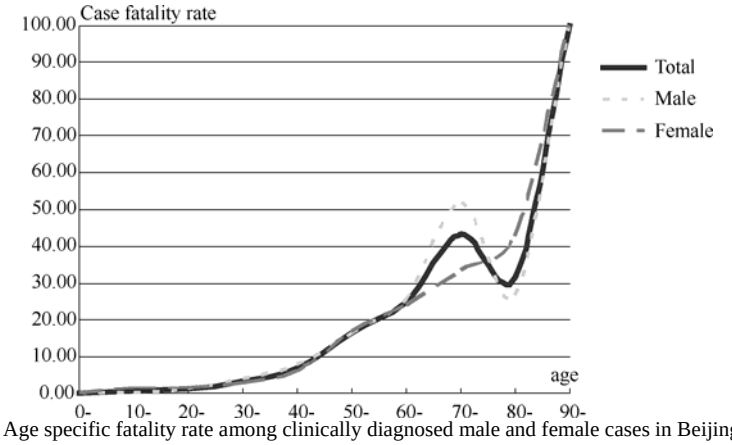

FIG . 2. Age specific fatality rate among clinically diagnosed male and female cases in Beijing.

Fig. 2 shows the case fatality rate by gender and age. Since 3 survived cases whose age was unclear were excluded, 1276 male cases and 1242 female cases were analyzed. Of the 2518 cases, 107 males and 86 females died. The case fatality rate of males and females was 8.39% and 6.92%, respectively, and no significant difference was found between the males and females (χ^2=1.665, P=0.197). Male fatality rate showed a decrease in the 80-year-old group, which was different from the female group. This contributed to the change in the crude fatality rate in the 80-year-old group.

Occupation

The case fatality rate by occupation is shown in Table 1. Among the 2516 cases who reported their occupation, 191 died. The case fatality rate of retired workers was the highest among all the occupations, followed by the soldiers. The case fatality rate of the cases who were farmer, industrial worker, teacher or household-chorers was higher than the overall fatality rate 7.66%. There were no children in day-care centers died.

TABLE 1

Case Fatality Rate of SARS Patients by Occupation in Beijing

Occupation	No. Cases Survived	No. Cases Died	Total	Case Fatality Rate %
Retired Worker	203	66	269	24.54
Soldiers	64	8	72	11.11
Household-chorers	184	22	206	10.68
Farmer	53	6	59	10.17
Industrial Worker	208	20	228	8.77
Teacher	43	4	47	8.51
Official/Clerk	287	16	303	5.28
Food Handler	24	1	25	4.00
Health Care Worker	397	10	407	2.46
Armed Policemen	55	1	56	1.79
Student	175	3	178	1.69
Businessman	129	1	130	0.77
Children in Day-care Center	3	0	3	0.00
Children Staying at Home	3	0	3	0.00
Nurserymaid	24	0	24	0.00
Migrant Laborer	203	0	203	0.00
Others	270	33	303	10.89
Total	2325	191	2516	7.59

District/counties

The cases were divided into different groups according to the area where they lived. Among 2447 cases who reported their living areas, 185 died. The case fatality rate in each group is shown in Table 2.

Contact History With SARS Patients

The fatality rate of cases having contacted with SARS patients was higher than that of cases having no contact history with SARS patients (Table 3).

Classification of Hospitals

During the SARS epidemic period, some hospitals were designated to admit SARS patients by the government. The fatality rate of SARS cases admitted to special hospitals for SARS patients was lower than that in other hospitals (Table 4).

Interval Between Onset of SARS and Hospital Visit

During the SARS epidemic period, some cases visited the hospital immediately after the onset of SARS-like symptoms while some cases did not for some reasons. The cases were divided into two groups according to the interval between the onset of SARS and the date admitted to hospitals (Table 5).

TABLE 2

Fatality Rate of SARS Cases by Living Areas in Beijing

Living Area	No. Cases Survived	No. Cases Died	Total	Case Fatality Rate (%)
Pinggu	1	1	2	50.00
Mentougou	9	4	13	30.77
Xicheng	280	32	312	10.26
Chongwen	31	3	34	8.82
Tongzhou	218	20	238	8.40
Haidian	476	41	517	7.93
Dongcheng	200	17	217	7.83
Daxing	50	4	54	7.41
Chaoyang	422	32	454	7.05
Changping	40	3	43	6.98
Shijingshan	107	8	115	6.96
Xuanwu	111	8	119	6.72
Yanqing	16	1	17	5.88
Fengtai	217	11	228	4.83
Shunyi	33	0	33	0.00
Miyun	5	0	5	0.00
Fangshan	15	0	15	0.00
Huairou	31	0	31	0.00
Total	2262	185	2447	7.56

TABLE 3

Comparison of SARS Case Fatality Rate by Contact History With SARS Patients

Contacting History	No. Cases Survived	No. Cases Died	Total	Case Fatality Rate (%)
No	833	50	883	5.66
Yes	1287	115	1402	8.20
Total	2120	165	2285*	7.22

Note. *χ^2=5.217, *P*=0.022.

TABLE 4

Comparison of SARS Case Fatality Rate by the Classification of Hospitals

Type of Hospital	No. Case Survived	No. Cases Died	Total	Case Fatality Rate (%)
Special for SARS	2155	140	2295	6.10
Others	173	52	225	23.11
Total	2328	192	2520*	7.62

Note. *χ^2=109.729, P=0.000.

TABLE 5

Comparison of Case Fatality Rate by the Interval Between Onset of SARS and Admitted Date

Interval (days)	No. Case Survived	No. Case Died	Total	Case Fatality Rate (%)
⩽1	655	30	685	4.38
>1	1089	85	1174	7.24
Total	1744	115	1859*	6.19

Note. *χ^2=6.100, *P*=0.014.

Case Fatality Rate in Different Epidemic Stages

According to the number of new SARS cases diagnosed in various periods during the epidemic, the cases were divided into 5 stages: imported stage (March 1 to March 31), spreading stage (April 1 to April 15), peak stage (April 16 to May 5), slowly decreasing stage (May 6 to May 19), terminating stage (May 20-). Among the 2443 cases who reported their onset date, 178 cases died, the case fatality rate was 7.29%. The number of cases died of SARS and the case fatality rate in each stage are shown in Fig. 3.

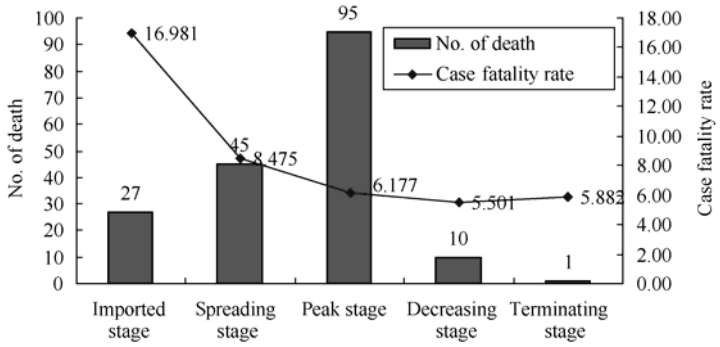

FIG. 3. Cases died of SARS and the case fatality rate in each epidemic stage in Beijing.

Comparison of Cases Fatality Rate Between Beijing and Other Regions

Fig. 4 shows the number of cases died of SARS and the case fatality rate in the main epidemic areas of mainland China. The case fatality rate in Inner Mongolia was the highest, followed by Tianjing and Beijing. The case fatality rates in these 3 regions were all higher than 7%.

The case fatality rates of SARS patients in Beijing and other main areas are shown in Fig. 5. The case fatality rate in Beijing was relatively lower than that in Taiwan, Hongkong, Canada, Singapore, and Vietnam (Fig. 5).

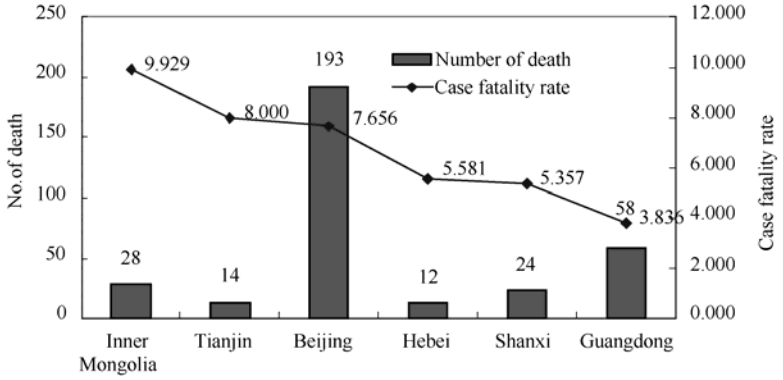

FIG. 4. Cases died of SARS and the case fatality rate in the main epidemic areas in mainland China.

DISCUSSION

Case fatality rate is the proportion of persons who died of a particular disease within a population affected by this disease within a specified period of time. The case fatality rate is influenced by the severity of the disease, the diagnosis time after onset and the regimen of treatment. The case fatality rate is generally used to reflect the severity of the disease, the diagnostic ability and the effectiveness of medical treatment.

Comparison of Case Fatality Rate in Different Populations

No difference in case fatality rate of SARS between genders was found in our study, which is different from that reported by J. Karlberg *et al.*[3] , who found that the case fatality rate of SARS in Hongkong was significantly (P<0.0001) higher in males than in females (21.9% versus 13.2%), and it

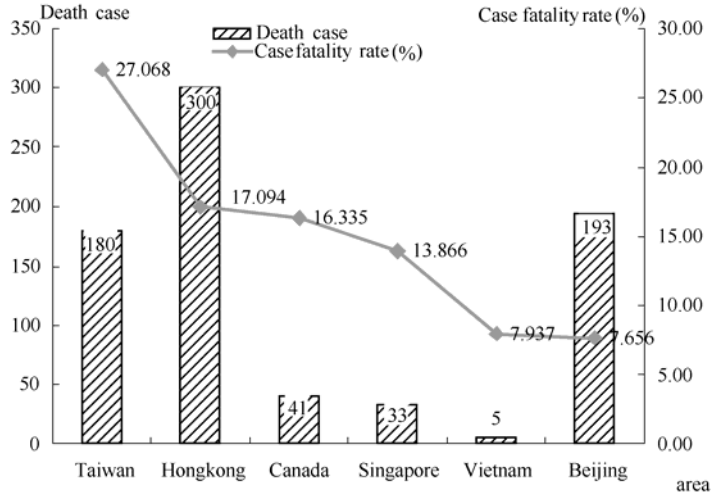

FIG. 5. Cases died of SARS and the case fatality rate in Beijing vs. other areas in the world.

may be speculated that this finding might be related to a different treatment regimen, a past chronic disease condition or gender-specific immune- defense factors, etc.

Generally, the cases fatality rate increased with age and the case fatality rate of the cases older than 50 years was higher than the average fatality rate, suggesting that the age of patients strongly influences the outcome. The old patients generally had chronic diseases, and when they were suffering from SARS the health condition would be easily deteriorated. This was an important characteristic of SARS, suggesting that the tertiary prevention and clinical care should be strengthened to reduce the number of deaths.

It is interesting to note that in Fig. 2, there was a pair of "scissors" due to the male case fatality rate higher than that of females in the 70-year-old group (51.72% vs. 33.33%) while in 80-year-old group the male case fatality was lower than that of females (26.67% v.s. 42.86%). Based on the life tables, the health condition of old men was poorer than old women, this may be one of the explanations why in the 70-year-old group the male case fatality rate was higher than that of females. But the reason for the lower fatality in 80-year-old male group was not clear. Further studies will be needed.

Health care workers (including all people worked in hospitals, such as doctors, nurses, cleaners and drivers of ambulance) played an important role in the treatment and care of SARS patients. They were exposed to the SARS patients and the secretion of SARS patients directly or indirectly in their daily work, thus their risk of being infected with SARS was much higher than others. However, the case fatality rate of health care workers was only 2.46%, which was lower than the average case fatality rate. This suggests that the measures taken to protect the health care workers during the epidemic are effective. In addition, the younger age and good health condition of health care workers might also contribute to the lower case fatality rate.

Generally children are at a high-risk of respiratory diseases, but children were rarely attacked by SARS and no child died of SARS in Beijing.

In this study, we found that the case fatality rate of retried people was the highest among all the occupations. This is not related to the occupation since almost all retired people were more than 60 years old. The highest case fatality rate might well be caused by their old age.

The case fatality rate of SARS cases admitted to special hospitals for SARS patients was significantly lower than that of cases admitted to other hospitals (6.10% vs. 23.11%, $P<0.05$). This suggests that the measures of rebuilding hospitals specially to admit SARS patients could effectively reduce the number of deaths. The case fatality rate of the cases who were admitted to hospitals within a day after SARS onset was significantly lower than that of the cases who visited hospitals a day later after onset. But any conclusions could not be drawn from these univariate analyses because the results might be biased by the confounding factors, and multivariate analysis should be done further.

Fig. 3 shows that in the imported stage the case fatality rate was the highest and then decreased significantly, the case fatality rates in other stages were all lower than the average case fatality rate. As the epidemic developed, SARS was better understood by the doctors and nurses. Therefore, effective treatments were taken, which reduced the case fatality rate.

Comparison of Case Fatality Between Beijing and Other Regions

The WHO estimated that the case fatality ratio of SARS ranged from 0% to 50% depending on the age group: less than 1% in persons aged 24 years or younger, 6% in persons aged 25 to 44 years, 15% in persons aged 45 to 64 years, and more than 50% in persons aged 65 years and more[4]. Up to August 16, 2003, there were a total of 8422 SARS cases all over the world and 916 of them died, the case fatality rate was 10.88%. On the other hand, the total SARS cases in mainland China were 5327 and 349 of them died, with a case fatality rate of 6.55%[5]. The case fatality rate of SARS in Beijing was lower than the global case fatality rate (7.66% vs. 10.88%) and higher than that of the whole mainland of China (7.66% vs. 6.55%).

In fact, the case fatality rate was affected by many factors, and was closely associated with the medical care level, the dead case report system and the characteristics of the cases. Beijing was one of the cities severely attacked by SARS, but its case fatality rate was not the highest, suggesting the medical care level is relatively high and the measures to control SARS are really effective. But the case fatality rate in Guangdong Province was lower than that of Beijing. Further studies should be done to find out what measures taken by Guangdong Province have effectively decreased the case fatality and the experience should also be learned by other regions.

In conclusion, Beijing is successful in controlling and treating SARS.

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