The SARS epidemic in mainland China: bringing together all epidemiological data

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Summary

OBJECTIVE To document and verify the number of cases of severe acute respiratory syndrome (SARS) during the 2002–2003 epidemic in mainland China.

METHOD All existing Chinese SARS data sources were integrated in one final database. This involved removing non-probable and duplicate cases, adding cases at the final stage of the outbreak, and collecting missing information.

RESULTS The resulting database contains a total of 5327 probable SARS cases, of whom 343 died, giving a case fatality ratio (CFR) of 6.4%. While the total number of cases happens to be equal to the original official reports, there are 5 cases overall which did not result in death. When compared with Hong Kong Special Administrative Region of China, China Taiwan, and Singapore, the SARS epidemic in mainland China resulted in a considerably lower CFR, involved relatively younger cases and included fewer health care workers.

CONCLUSIONS To optimise future data collection during large-scale outbreaks of emerging or re-emerging infectious disease, China must further improve the infectious diseases reporting system, enhance collaboration between all levels of disease control, health departments, hospitals and institutes nationally and globally, and train specialized staff working at county centres of disease control.

keywords severe acute respiratory syndrome, epidemiology, data collection, data analysis, mainland China

Introduction

The worldwide outbreak of severe acute respiratory syndrome (SARS) struck mainland China, Hong Kong, Taiwan, Singapore, Vietnam, Canada and eventually 32 countries or regions (WHO 2003a). The first case with typical symptoms of SARS emerged in Foshan municipality, Guangdong Province, China, with the onset date of 16 November 2002 (Zhong & Zeng 2005). Five index cases were reported in Foshan, Zhongshan, Jiangmen, Guangzhou and Shenzhen municipalities of Guangdong province before January 2003. The early-stage outbreak of SARS in Guangdong province was sporadic and apparently not associated with the index cases (He *et al.* 2003). By January 2003, SARS had become a large-scale outbreak in Guangdong Province (Zhao *et al.* 2003), and after February 2003, it had appeared in Hong Kong (Lee *et al.* 2003) and seven other provinces: Guangxi, Jiangxi, Fujian, Hunan, Zhejiang, Sichuan and Shanxi (Xu *et al.* 2004). Some cases from Shanxi province and Hong Kong were imported to Beijing and transmission from index cases was amplified within several health care facilities by March (Liang *et al.* 2004b). Soon Beijing became the epicentre of the SARS outbreak and endangered various other provinces or cities of mainland China. At the same time, Singapore, Canada, USA and Vietnam were involved in the worldwide spread through imported cases from Hong Kong (Tsang *et al.* 2003). By the end of the SARS epidemic in 2003, 32 countries had reported SARS cases.

WHO issued the first global alert on 12 March 2003 regarding a cluster of cases of severe atypical pneumonia in hospitals in Hong Kong, Hanoi and Guangdong (WHO 2003d). Three days later, WHO gave an emergency travel advisory (WHO 2003f). On 24 March, WHO described the clinical features of SARS, which were revised on 1 May 2003 (WHO 2003e,g). A novel coronavirus, named SARS-CoV, was identified as the infectious agent responsible for SARS in April 2003 (Drosten *et al.* 2003; Ksiazek *et al.* 2003; Peiris *et al.* 2003). In total, 8437 probable SARS cases, of whom 813 had died, were reported during the

SARS epidemic in 2002/2003. Mainland China was by far the most seriously affected area, reporting 5327 probable SARS cases of whom 348 died, between 16 November 2002 and 11 June 2003 (WHO 2003a).

The epidemic revealed a number of limitations of the public health system in China (Wenzel & Edmond 2003). As a result of initial lack of awareness of SARS by health workers, the disease spread unnoticed at the early stage of the epidemic (Zhang 2003), which was unduly prolonged by limited information transfer (Zheng 2003). At the time, a functional infectious diseases surveillance system was not yet available, and the reporting system was outdated, hampering data collection and delaying interventions (Ma *et al.* 2003; Xu *et al.* 2003; An *et al.* 2004; Lv *et al.* 2004; Pan 2004). The absence of reliable serological diagnostics (Fang *et al.* 2003), and changes in the clinical definition of SARS during the epidemic (Abdullah *et al.* 2003; CDC 2003a, 2003b, 2003c, 2003d, 2003e, 2003f, 2004) made misreporting inevitable and complicated the study of the dynamics of the epidemic (Shi *et al.* 2004; Liu *et al.* 2005). In summary, in mainland China, data collection and data analysis were extremely difficult when compared with other affected areas, which explains why the epidemiological characteristics of the SARS outbreak in China have not been published in a comprehensive epidemiological account so far.

The objective of our study was to bring together the data of all probable SARS cases in mainland China using all available data sources.

The reporting system of SARS in mainland China at the time of the epidemic

Before the SARS outbreak, the district/county centre of disease control (CDC) was required to report summary data of notifiable infectious diseases monthly to both the national CDC and Health Department (HD) level by level. According to the Law of Prevention of Infectious Diseases of mainland China, there are 35 notifiable infectious diseases, divided into three classes, i.e. classes A, B, and C. Of these, 27 must be reported. For example, if local hospitals found cases of plague or cholera (both class A), or AIDS or pulmonary anthrax (both class B), they had to inform the district/county CDC and local HD by telephone within 6 h in urban and within 12 h in rural areas and complete the reporting form for infectious diseases immediately. Then, the district/county CDC investigated the case at once, notified the provincial/city CDC and concurrently forwarded the information to the local HD (PRC 1989). Forms reporting cases of infectious diseases were sent or mailed to the district/county CDC. After integration of all data from the whole district/county, summary data of infectious diseases were sent to the provincial CDC and district/county every month. In the same way, summary data integrated by provincial CDC were sent to the national CDC and to the same level HD. (Figure 1). The military reporting system of infectious diseases was similar to the national reporting system, but supervised by the Military CDC, and did not link up regularly with the national reporting system of infectious diseases. Only on special occasions such as major outbreaks, interaction occurred at the highest level.

Data collection of SARS comprised four stages. At the first stage, from 16 November 2002 to 8 April 2003, most cases of SARS emerged in Guangdong Province. Guangdong provincial CDC established their own database for data collection of SARS on 3 February 2003 (Fang *et al.* 2003). Two cases reported in Foshan (16 November) and Heyuan (15 December 2002) were included retrospectively in this database, together with cases reported after 2 January 2003. The database included cases matching the definition of unexplained pneumonia (the name later changed to atypical pneumonia and then to SARS) and identified during the course of case investigations or after voluntary reporting by clinicians (PRC 2003). At the second stage, from 8–26 April 2003, the district/county CDC was ordered to submit summary data of SARS cases daily to the national CDC, level by level, as SARS had become a new notifiable infectious disease as a result of a revision of the Law of Prevention of Infectious Diseases. During the third stage, from 26 April to 16 May 2003, individual cases had to be reported to the national CDC daily. At the fourth stage, from 16 May to the end of SARS epidemic, county CDCs could enter SARS data into a national database with a special network reporting system for SARS data collection established on 16 May (Xu *et al.* 2003).

Control of infectious diseases depends on an effective response system. An effective response system relies on a sound surveillance system for infectious diseases. The quality of data collection plays an important role in the process of infectious diseases control and prevention (Pan 2004). The national infectious disease reporting system, which covered all levels of CDCs based on a network for reporting data of notifiable infectious disease by month, could not meet the need of daily data collection in emergency situations. At the time, rather than a surveillance system for new and existing infectious diseases, it was a data management system for existing ones (Pan 2004). The system could not detect emerging infectious diseases as it did not possess a monitoring and alert function. There was also a lack of coordination and collaboration among fragmented governmental HDs. Furthermore, the hospital information system is indepen-

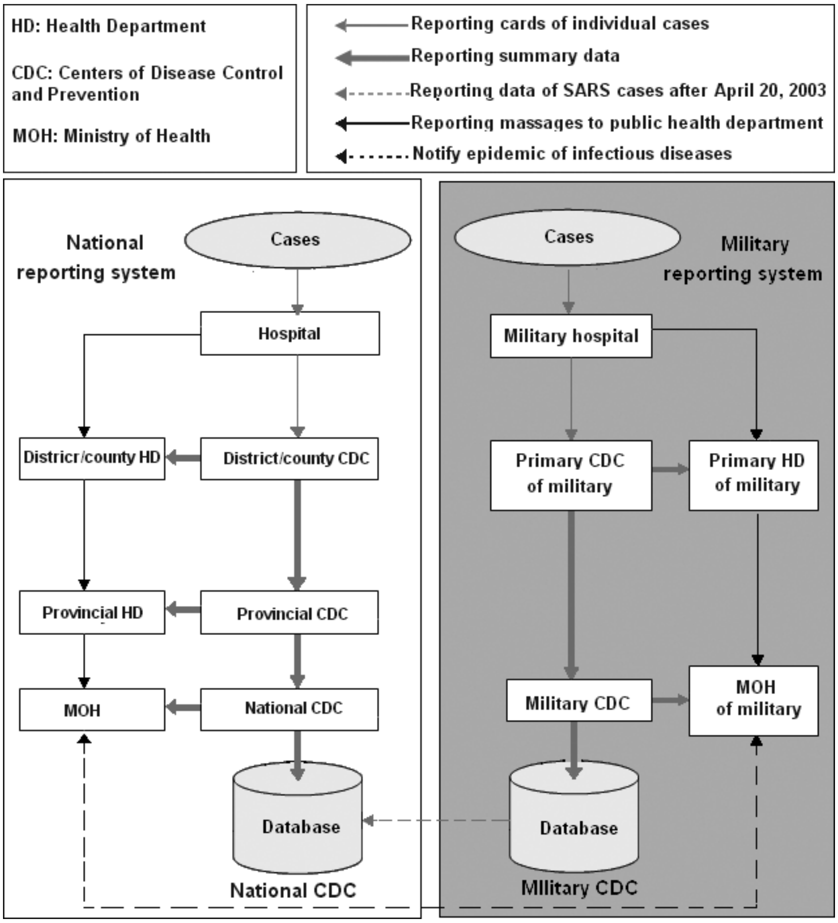

Figure 1 System for reporting notifiable infectious diseases in mainland China at the time of the SARS epidemic, but before May 16, 2003.

dent of the infectious disease management system and the data of infectious disease reported by level. Thus, information on the SARS epidemic was not exchanged and the chance missed to detect the outbreak early and to put in place adequate control measures (Pan 2004). Finally, there was a lack of reflection on the information about cases, which could not be modified over time by local CDCs, once the cases were submitted to be included in the national database (Tang *et al.* 2003; Liu *et al.* 2004a,b; Xie *et al.* 2005).

Definition of SARS

The case definition for 'atypical infectious pneumonia', later termed SARS, was modified during the course of the SARS epidemic in mainland China. Table 1 presents the clinical criteria of SARS cases during the epidemic (CDC 2003a–c,e). The first clinical criterion of probable SARS was mainly used for diagnosis for the cases in Guangdong province until 31 January 2003. It was based on symptoms and signs of febrile respiratory illness, decreased white blood cells, abnormal chest X-ray, close contact with SARS cases, being a member of an infectious cluster, having infected another person, or failed antibiotic treatment within 72 h. Data of probable cases during that time were collected retrospectively (PRC 2003). This definition became the national criterion for the diagnosis of SARS cases whose onset date was after 1 February (CDC 2003a), and was recommended to other provinces and cities on 14 April by the Chinese Ministry of Health (MOH).

The first clinical definition of SARS was revised on 3 May by adding the epidemiological criterion of having visited or resided in a city or area, where SARS cases were reported during 2 weeks before onset of symptoms. in addition, criteria for 'probable', 'suspected', and 'excluded' cases of SARS were defined. After 1 May, the criteria for a SARS case included evidence of laboratory findings of SARS-CoV (Drosten *et al.* 2003; Ksiazek *et al.* 2003), when laboratory testing became available (Zhu *et al.* 2003).

Table 1 Case criterion for severe acute respiratory syndrome (SARS) in China*

	First period	Second period	Third period
Date	Nov. 16, 2002–April 20	April 20–May 1	After May 1
Probable case	[1.1 + 2 + 3 + 4] or [2 + 3 + 4 + 5]	[1.1 + 2 + 4] or [1.2 + 2 + 4 + 5] or [1.2 + 2 + 3 + 4]	[1.1 + 2 + 4] or [1.2 + 2 + 4 + 5] or [1.2 + 2 + 3 + 4]
Suspected case	[1 + 2 + 3] or [2 + 3 + 4]	[1.1 + 2 + 3] or [1.2 + 2 + 4] or [2 + 3 + 4]	[1.1 + 2 + 3] or [1.2 + 2 + 4] or [2 + 3 + 4]
Under medical observation	N.A.	[1.2 + 2 + 3]	[1.2 + 2 + 3]
Confirmed case	N.A.	N.A.	Probable SARS case and with positive laboratory findings for SARS-CoV (based on one or more of 6.1, 6.2 and 6.3)

1 Epidemiological history

1.1 Having close contact with a patient or being a member of an infected cluster, or having infected other persons.

1.2 Having visited or resided in a city or area where SARS cases were reported with secondary transmission during 2 weeks before onset of symptom.

2 Symptoms and signs of febrile respiratory illness (i.e. fever (≥ 38 °C), cough, difficulty with breathing, shortness of breath).

3 WBC in peripheral blood is not increased, some decreased (leukocyte count ≤ 10.0×10^9/L).

4 Radiograph of chest with abnormalities (evidence of infiltrates consistent with pneumonia or respiratory distress syndrome on chest x-ray).

5 Antibiotic treatment is not effective (within 72 h).

6 A person with positive laboratory findings for SARS-CoV based on one or more of the following diagnostic criterions:

6.1 PCR positive for SARS-CoV (at least two different clinical specimens, such as nasopharyngeal and stool OR the same clinical specimen collected on two or more occasions during the course of the illness, such as sequential nasopharyngeal aspirates OR two different assays or repeat PCR using a new RNA extract from the original clinical sample on each occasion of testing.

6.2 Seroconversion by ELISA or lFA (negative antibody test on acute serum followed by positive antibody test on convalescent phase serum tested in parallel OR fourfold or greater rise in antibody titer between acute and convalescent phase sera tested in parallel).

6.3 Virus isolation (isolation in cell culture of SARS-CoV from any specimen AND PCR confirmation using a validated method).

*According to references CDC (2003c), Shi *et al.* (2004).

The definition of SARS was further changed after the SARS epidemic (10 October 2003) by the Department of Medicine Management of China, based on the existing international regulations and criteria. This is included in the current guideline for the management of SARS by the Chinese Medical Association and the China Association of Chinese Medicine (Anonymous 2003b).

Bias and misdiagnosis in data collection were inevitable once SARS emerged in China. Both case definition and standard and sensitive diagnostic criteria were updated over the course of the epidemic. Diagnosis of a SARS case was by exclusion, meaning that a case could be excluded as SARS if it matched the diagnostic criterion of another disease (WHO 2003b). Most of the SARS cases in the various databases are probable cases as diagnosed by the SARS clinical criterion of the Chinese Ministry of Health, WHO, United States CDC, and Hong Kong since. Clinical diagnosis was the only means to recognise SARS, because reliable serological detection methods for SARS did not yet exist. Misdiagnosis or overdiagnosis may have resulted from limited knowledge about SARS, especially early in the epidemic, from the often mild clinical appearance of cases, and from the old age of some cases, usually combined with chronic disease (Anonymous 2003c; Liu *et al.* 2003a, 2004a,b, 2005; Liang *et al.* 2004a; Shi *et al.* 2004; Wu *et al.* 2004; Che *et al.* 2006; Si *et al.* 2006).

Constructing the final database

We integrated all databases derived from the various levels of the Chinese national and military health systems, which contained individual reported information of all probable and suspected cases. This comprised demographic characteristics, geographic information, dates of onset, admission, diagnosis, discharge and death, final diagnosis (probable or suspected case) and clinical outcome.

An international workshop on 'Epidemiological Studies of the SARS Outbreak in China', sponsored by the Beijing Institute of Microbiology and Epidemiology, State Key Laboratory of Pathogen and Biosecurity, and Erasmus MC, University Medical Center Rotterdam, The Netherlands, was held in Beijing, China, 19–20 September 2005. It was announced on the Internet and through the *Chinese Journal of Epidemiology* (May issue 2005). Participants shared data and opinions about the SARS epidemic. At the workshop, we not only presented a first complete SARS database, but also added some geographical and serological data. We also interviewed staff from some provincials CDCs, hospitals, and research institutes.

In all, we removed 52 duplicate cases and filled in 11 504 missing data by comparing medical records of cases with individual case records of the different data sources and by collecting the original medical records from hospitals. The final database now includes 5327 probable SARS cases (of whom 343 have died) in mainland China from the date of onset on 16 November 2002 to 28 May 2003. The total number of cases happens to be equal to the original official reports, but it includes added and removed cases. The overall number of deaths is five lower than originally reported. The database contains nearly complete basic information on the age, occupation, residential area, date of onset, admission, discharge and death as well as clinical outcome of each SARS case in mainland China. It does not contain information on contact history, treatment, and results of laboratory tests.

Five important weaknesses of the database remain. First, the criterion of diagnosis had changed over time, which limits the comparability of cases. Second, several potentially important epidemiological factors cannot be thoroughly analysed because the contact history is missing. Third, it was difficult to distinguish between confirmed and unconfirmed cases because of the absence of laboratory test results for SARS-CoV. Fourth, most cases were diagnosed clinically, but the sensitivity and specificity of this method are unknown. Finally, some information, especially of earlier cases, remains incomplete because the persons are untraceable.

SARS in mainland China compared with other outbreak areas

The pattern of the SARS epidemic over time in mainland China is shown in Figure 2a. The initial phase of the epidemic, from early November to late January, in Guangdong province was characterised by sporadic cases followed by a sharp rise in late January and a sharp decline in the first half of February. Thereafter, SARS in Guangdong seemed to decline gradually, while the case imported in Beijing changed the epidemic pattern. The highest peak occurred late in April with approximately 150–200 new cases reported every day, and it quite abruptly disappeared in the middle of May.

Table 2 shows the main characteristics of the probable SARS cases in mainland China in comparison with cases in other affected countries or areas. The overall case fatality ratio (CFR) was 6.4% for mainland China, which is much lower than elsewhere (Anonymous 2003d; Poutanen *et al.* 2003; Le *et al.* 2004; Leung *et al.* 2004; Goh *et al.* 2006). This may be explained by three important reasons: (1) in China co-morbidity was relatively less important as many infections concerned members of the general population and not hospitalised patients; (2) the majority of cases was relatively young; (3) over-reporting may have been more frequent than elsewhere, especially during the earliest stage of the epidemic in Guangdong when SARS was largely unknown. Furthermore, more intense treatment with steroids, possibly in combination with traditional medicine, may have reduced the CFR in mainland China (Anonymous 2003b; Lew *et al.* 2003; Li *et al.* 2003; Liu *et al.* 2003b; Wang *et al.* 2003; Zhong 2003). However, the better survival of SARS patients in China needs further analysis (Jia *et al.* 2009).

In mainland China, the proportion of female SARS cases (48.9%) was nearly equal to that of males, and it was also the same as that of the general population (48.5%). The proportion of females was considerably lower than in Singapore and Vietnam and slightly lower than in Hong Kong and Taiwan (Vu *et al.* 2004), perhaps because SARS spread more often within hospitals in these areas (Ho *et al.* 2003; Goh *et al.* 2006; Reynolds *et al.* 2006). Only in Canada, the majority of cases were male.

Most of the cases with probable SARS in mainland China were relativity young: 62.0% were in the age group of 20–44 (Figure 2b). However, the youngest age group (<20) was largely underrepresented among the cases, contrary to that of the oldest age group (>55). Singapore showed a similar pattern with the 25–44 age group accounting for 46.6% of the cases (Goh *et al.* 2006). In all other areas, the cases had a higher median age.

Health care workers (HCW) constituted the largest group (19.2%) of cases in mainland China, followed by farmers (11.7%), civil servants (9.8%) and factory workers (9.7%). The proportion of HCW cases was lower than in all other important affected areas (Poutanen *et al.* 2003; Leung *et al.* 2004; Goh *et al.* 2006; Reynolds *et al.* 2006). This again reflects that the SARS outbreak more often concerned hospital infections in these countries than in mainland China, where a significant part of the transmission occurred in the general population.

During the earliest stage of the epidemic, it was understood that reducing the time from onset of clinical symptoms to admission to hospital and subsequent isolation was an important measure to reduce the rate of transmission within a community or country (Donnelly *et al.* 2004). The mean duration from onset to admission of a probable SARS case was 3.8 (95% CI: 3.7–4.0) days. The mean duration from admission to discharge of a probable SARS case was 29.7 (95% CI: 29.3–30.0) days (after excluding some reported unlikely durations from admission to discharge of less than 7 days). The duration from

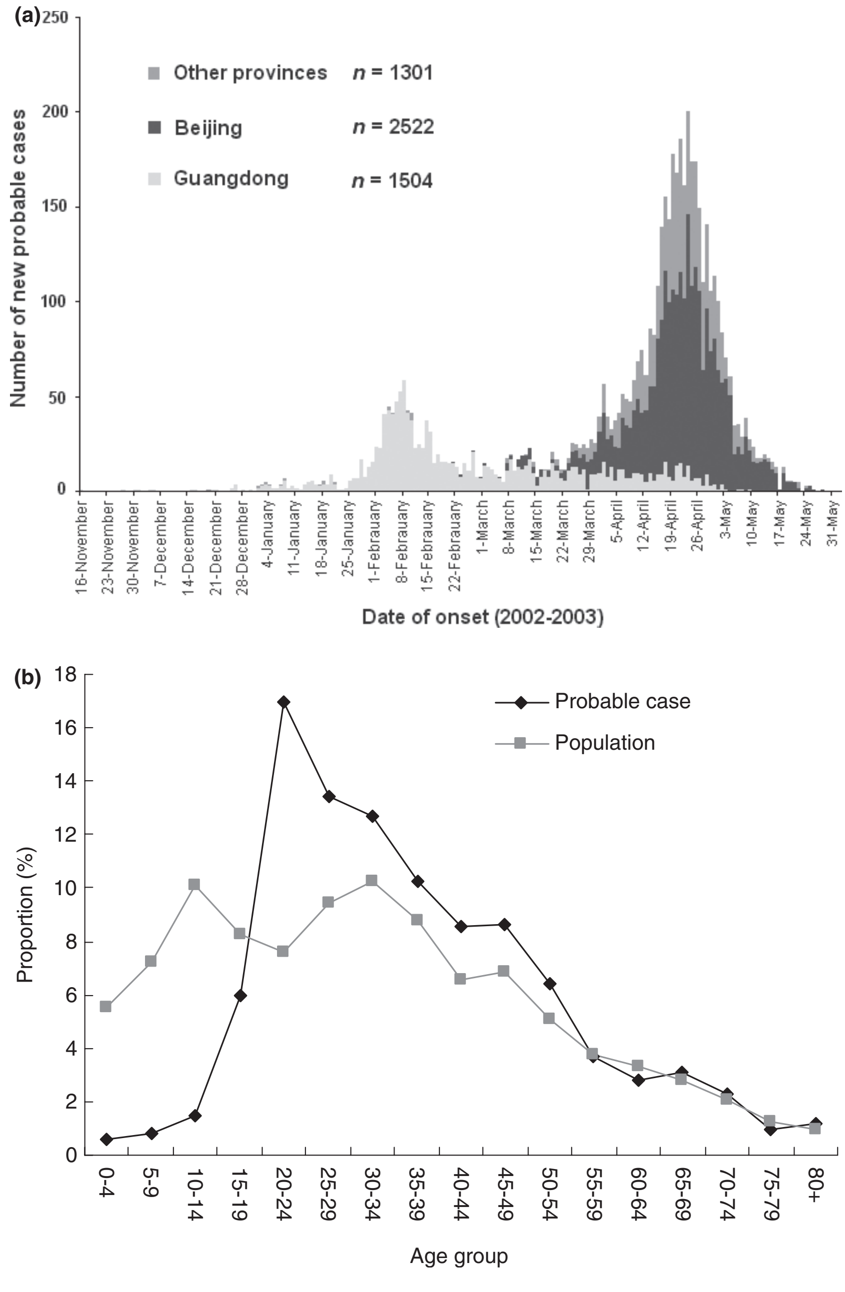

Figure 2 (a) Epidemic curve of all 5327 cases of severe acute respiratory syndrome (SARS) in mainland China by date of onset from the first case on November 16, 2002, to the last on May 28, 2003, and by three locations. Other provinces including 449 cases from Shanxi, 282 from Inner Mongolia, 175 from Tianjin and 395 from other provinces, respectively. Date of onset was known for 5280 cases (99.1%) and the 47 missing values were obtained from imputation using date of admission to hospital, corrected for location and occupation (health care worker or not). Number of cases shows total number of new cases per day. For example, at the peak of the epidemic on April 23, 2003, the total number of new probable cases is 197, of which 129 cases are from Beijing, 14 cases are from Guangdong and 54 cases are from other provinces. (b) The distribution of probable SARS cases (n = 5327S) and population (n = 1292 million) by age group, in mainland China, in 2003.

admission to death of a probable SARS cases was 17.3 (95% CI: 15.8–18.8) days. The mean time from onset of clinical symptoms to admission to hospital and the mean time from admission to death were shorter than in Hong Kong, which reported 4.9 and 35.9 days, respectively. But, the mean time from admission to hospital to discharge was longer than in of Hong Kong (23.5 days) (Donnelly *et al.* 2004).

Discussion

Mainland China has been successful in overcoming the SARS epidemic. The shock to the world of an impending dangerous pandemic was unprecedented. SARS maximally challenged the capacity of the Chinese health system and identified critical limitations, such as unpreparedness for emergencies, lack of effective surveillance, poor commu-

Table 2 The characteristics of the SARS outbreak in mainland China and other countries or areas in 2003

Country or area	Mainland China	Hong Kong†	Taiwan‡,§	Singapore¶	Vietnam#	Canada**
Time of the epidemic	Nov. 16, 2002–May 28	Feb. 15–May 31	Feb. 25–July 5	Feb. 25–May 11	Feb 26–Apr. 8	Feb. 23–July 2
Number of cases	5327	1755	674 [346]	238	62	251
CFR: no. dead (%)	343 (6.4)	302(17.2)	87 (12.9) [73 (21.1)]	33(13.9)	6(9.7)	43(17.1)
Sex: no. females (%)	2607 (48.9)	978 (55.6)	[218 (63.2)]	161 (67.6)	39 (62.9)	100 (39.8)
Age: median	33	40	[46]	37	43	49
Occupation: HCW (%)	1021 (19.2)	405 (23.1)	[205 (30.3)]	97 (40.8)	35 (56.5)	101 (40.2)

Data concern probable cases, and also include laboratory-confirmed cases for Taiwan. CFR is case fatality ratio, HCW is health care worker.
†Data from Leung *et al.* (2004), WHO (2003a, 2003c).
‡Data from Hsueh & Yang (2005), WHO (2003c).
§Data between brackets concern laboratory-confirmed cases.
¶Data from Donnelly *et al.* (2004), Goh *et al.* (2006), WHO (2003c).
#Data from Reynolds *et al.* (2006), Vu *et al.* (2004), WHO (2003c).
**Data from Poutanen *et al.* (2003), WHO (2003c).

nication among HDs, and delays in reporting (An *et al.* 2004; Shen 2004; Feng *et al.* 2005). Among these, lack of an effective surveillance system is of primary importance.

Surveillance is the key to containment efforts and provides ready access to timely information on the number of new cases, the likely source of exposure, the number of cases not previously identified as contacts, and the number of contacts with high-risk exposures to known cases (Parashar & Anderson 2004). First, an effective national integrated data reporting system is the foundation of a public health system. Such systems did exist for infectious and occupational diseases and food or environmental poisoning (An *et al.* 2004). But, data were still submitted by telephone level-by-level, without feedback and evaluation of the quality of reported data, and possible missing or duplicated cases. Neither did those systems involve information of clinical case tracing or results of laboratory tests. Efficient surveillance for infectious diseases should link clinical, epidemiological and laboratory data on cases and to disseminate this information locally, nationally and globally. It also must allow for rapid identification, tracking, evaluation and monitoring of contacts of cases (Parashar & Anderson 2004). After SARS, a project for sharing scientific data of mainland China was funded (Lu *et al.* 2004).

Second, an international monitoring system with a far-reaching network crucial for early alerts (Zhong *et al.* 2003). Failure to immediately control the SARS epidemic was partly because of the absence of an efficient emergency monitoring system (Huang 2003; Xing & Zhang 2003). A survey conducted by the CDC in US showed that an effective surveillance system is a vital part of any public health system and should support the implementation of effective infectious disease control measures. The National Electronic Disease Surveillance System (NEDSS) of the United States is a standardisation and integration information system for infectious disease monitoring. With this system, professionals can share their data in different areas (Anonymous 2001; Mokdad *et al.* 2003). Confronted by the West Nile outbreak in 1999, the government of the United States established the symptom surveillance system, which was operational by 2000. The application of the system in the control of SARS proved to be efficient (O'Hara 2001). A nationwide monitoring system for emerging infectious diseases has been set up in mainland China. Surveillance of 185 designated hospitals and a network of 39 laboratories had soon thereafter resulted in the identification of 16 cases of human avian flu (Zhong *et al.* 2003).

Third, coordination and collaboration are keys in infectious diseases control. The public health system in China, although fragmented, used to be adequate in the control of infectious diseases, but it failed in the SARS epidemic because of lack of communication among HDs. The important lesson from SARS was that coordination and collaboration at every level of the CDC, HDs, hospitals and institutes nationwide and globally are very important for the control of emerging infectious diseases. The isolation of SARS-CoV was a fine illustration of worldwide collaboration (Anonymous 2003a). Reforming the mechanisms for managing infectious diseases in mainland China is ongoing.

Finally, training medical professionals and educating the public should be routine. The quality of data relies on the capacity and technique of data collection by professionals. Inadequate funding resulted in lack of essential skills for data collection and analysis by professionals. Panic among the public caused societal disorder in the early stage of the epidemic, amplified by lack of knowledge because of the media silence on the subject. The experience of the United States in the control of SARS demonstrated that training of health professionals and educating of the public about SARS (and about infectious disease in general) should be regular and timely (Hao 2006).

Conclusion

We have described the collection epidemiological data on infectious diseases in mainland China during the SARS epidemic and its limitations. From available data in several databases and other sources, we constructed a database which includes 5327 cases, of whom 343 died. The CFR in mainland China was considerably lower than in other affected areas; cases were relatively young and less often infected within hospital settings. Imperfect as it is, our database includes the main characteristics of all probable SARS cases of mainland China in the 2003 epidemic and will now be used for further analysis.

Based on the lessons of SARS, the Chinese government passed a new law on the response to emergency health affairs. The mechanism of surveillance and management of emerging infectious disease has been strengthened and a special organisation in charge of surveillance and management of emerging infectious disease by levels was established. Every county CDC can now report local data of infectious diseases to the national CDC through a special network and feedback among the CDCs has been enhanced. Thus, although the SARS outbreak brought disaster to China, it also brought opportunities for change for the better.

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Conflicts of interest

The authors have declared that they have no conflicts of interest.

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