Severe acute respiratory syndrome surveillance in Australia

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Abstract

In March 2003, the World Health Organization (WHO) issued a global alert recommending active worldwide surveillance for severe acute respiratory syndrome (SARS). This paper describes the epidemiological features of cases reported by Australian states and territories to the Australian Government Department of Health and Ageing between 17 March and 31 July 2003. There were 138 people investigated for SARS: 111 as suspect and 27 as probable. Five probable cases were reported to WHO after review of other possible diagnoses and Australia-specific exclusion criteria had been applied. An additional probable case identified by laboratory testing overseas, but who was not under investigation when in Australia, was also reported to WHO. The method by which surveillance for SARS was rapidly established provided an opportunity to examine Australia's planning and preparedness for future respiratory disease epidemics such as influenza. *Commun Dis Intell* 2004;28:181–186.

Keywords: Severe acute respiratory syndrome, surveillance, Australia, influenza

Introduction

On 12 March 2003, the World Health Organization (WHO) issued a global alert about cases of a new, highly infectious severe atypical pneumonia referred to as severe acute respiratory syndrome (SARS).[1] Thought to have originated in Guangdong province, China in November 2002, SARS spread to 27 countries worldwide and two administrative regions of China. Mainland China, Hong Kong Special Administrative Region of China, Taiwan, Singapore, Vietnam and Canada were particularly affected.[2]

The global alert recommended countries undertake appropriate surveillance to detect cases of SARS. Symptoms of SARS included high fever (greater than 38° C), cough, shortness of breath or breathing difficulties.[3] On 16 March 2003 the Joint Executive Group, comprised of state and territory members from the Communicable Diseases Network Australia (CDNA), called by the acting Chief Medical Officer, commenced daily teleconferences to respond to the threat of importation of SARS. An Australian government inter-departmental taskforce for SARS was established on 28 March 2003. The Australian Government Department of Health and Ageing (DoHA) authorised the activation of an Incident Room on 4 April 2003 which coordinated the national public health response to SARS. This report summarises the people under investigation as suspected and probable cases of SARS notified to DoHA from 17 March to 31 July 2003.

Methods

Case definition

During the reporting period of March to July 2003 the WHO SARS case definition was used to determine those under investigation.[4] A person was classified as under investigation as a suspect case if they had a history of high fever (greater than 38° C); *and* cough, shortness of breath or breathing difficulty; *and* had resided or travelled in a SARS affected area or had contact with a SARS case in the 10 days prior to onset of symptoms. A person was classified as under investigation as a probable case if they met the criteria to be under investigation as a suspect case *and* had evidence of pneumonia by chest x-ray or acute respiratory distress syndrome or was positive for SARS coronavirus by one or more assays.

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Persons investigated as probable or suspect cases were excluded if an alternative diagnosis (including if there was a clinical response to antibiotic treatment) was made. Cases were also excluded if they met Australia-specific criteria, which included no convincing possibility of exposure (in transit for less than 8 hours in an area designated by WHO as SARS-affected, and remaining within the airport) or—for cases investigated as suspect—the illness was mild and self-limiting. The Australia-specific exclusion criteria—although subjective—were used to increase the specificity of the case definition in a non-SARS affected country where prevalence would be expected to be extremely low, to avoid an undue burden on health-care facilities created by the excess patient management and respiratory isolation required for suspect or probable SARS cases.

Notifications

State and territory health authorities raised clinicians' awareness of SARS by contacting hospitals and health alerts to general practitioners; however the mechanisms used varied between jurisdictions. Cases were initially notified by clinicians to local and jurisdictional public health authorities voluntarily, although during the surveillance period most jurisdictions listed SARS as a notifiable disease to make reporting mandatory. SARS notifications from each jurisdiction were reported to DoHA from 17 March to 25 July 2003. Data were collected initially by verbal report at daily teleconferences and through a nationally developed questionnaire which could be submitted by email or facsimile.

Following investigation, persons that met the case definition for a probable case were reported to WHO. Initially, WHO requested that both suspect and probable cases be reported. After 22 March only probable cases were reported via the WHO website.

Results

There were 138 persons under investigation for SARS notified to DoHA between 17 March and 31 July 2003. Of these, 111 were investigated as suspect cases and 27 were investigated as probable cases (Figure 1).

Six probable cases were reported to WHO; three from Victoria, two from New South Wales and one from Queensland. One of the probable cases was identified by SARS coronavirus serological testing overseas. This case was not hospitalised, and was not detected or investigated by routine surveillance methods for SARS when in Australia.

Eighty-one per cent of the remaining 21 cases initially under investigation as probable cases were excluded on the basis of an alternate diagnosis (including 9 cases with a clinical response to antibiotic treatment) and 19 per cent were excluded on the basis of no convincing possibility of exposure. One case was excluded for no clearly identified reason (Table 1).

Six cases met the case definition for suspected SARS. The alternate diagnosis of mild self-limiting illness accounted for the exclusion of 27 per cent of persons investigated as suspect, 44 per cent were excluded by other alternate diagnoses. Twenty per cent were excluded on the basis of no convincing exposure and five people excluded without a specific diagnosis provided.

Figure 1. Persons under investigation for severe acute respiratory syndrome and probable cases, Australia, 1 November 2002 to 10 July 2003, by week of onset

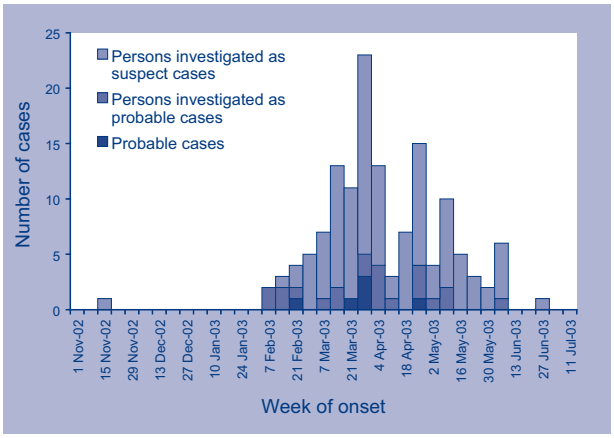

Table 1. Status of persons investigated for severe acute respiratory syndrome

	Suspect	Probable	Total
Final SARS classification	6	6*	12
No convincing exposure	21	4	25
Alternate diagnosis			
Cancer	1	1	2
Cellulitis	2	0	2
Chlamydia pneumoniae infection	1	0	1
Chlamydia (unspecified) infection	4	0	4
Chronic obstructive airway disease	1	0	1
Coronavirus infection†	1	0	1
Epstein-Barr virus infection	1	0	1
Exacerbation of asthma	2	0	2
Haemophilus (unspecified) infection	1	0	1
Influenza virus (Type A) infection	6	1	7
Influenza virus (Type B) infection	2	1	3
Maxillary sinusitis	1	0	1
Measles	1	0	1
Mycoplasma (unspecified) infection	3	1	4
Parainfluenza virus infection	2	1	3
Pharyngitis	1	0	1
Picornavirus/rhinovirus infection	3	1	4
Respiratory syncytial virus infection	1	1	2
Streptococcus (Group A) infection	1	0	1
Streptococcus pneumoniae infection	3	1	4
Typhoid fever	1	0	1
Unspecified bacterial infection	2	0	2
Unspecified viral infection	1	0	1
Upper respiratory tract infection	4	0	4
Responded to antibiotics	5	9	14
Mild self-limiting illness	28	0	28
Not provided	5	1	6
Total	111	28	139

* Includes probable case identified by serology overseas

† Does not include SARS coronavirus.

There were persons investigated for SARS in each jurisdiction. Notification rates of persons investigated as suspect and probable cases were highest in the Australian Capital Territory and the Northern Territory respectively (Table 2).

The male to female ratio among persons investigated for SARS was 1.4:1. This ratio was the same when stratified into those investigated as suspect and probable cases, although the ratio was 0.5:1 in those who met the case definition for a probable case. The median age of people investigated for SARS was 41 years (range 7 months to 89 years). The highest number of people under investigation as suspect and probable cases occurred in the 50–59 year and 0–9 year age groups respectively. The 10–19 year age group had the lowest rate of people under investigation, both as suspect and probable cases (Figure 2). The median age of those meeting the case definition for a probable case was 20 years (range 1–45 years).

Of the 138 persons investigated for SARS, 129 (93%) had cough, 60 (43%) had shortness of breath and 44 (32%) reported breathing difficulty. All persons under investigation as probable cases reported cough, and there was nearly a twofold greater reporting of the other symptoms compared to persons under investigation as suspect cases. Eighty-one per cent (n=22) of persons investigated as probable were hospitalised compared to 62 per cent (n=69) of persons investigated as suspect. Three of the six probable cases were hospitalised.

The most common SARS-affected areas where persons investigated as a probable case had travelled or resided were Singapore (14, 52%) and Hong Kong (10, 37%). Four (14%) reported travel history to China (1 to Beijing and 3 to Guangdong province) and Toronto, Canada. One person investigated as a probable case (4%) each had travelled to Hanoi, Vietnam and Taiwan. Contact with a suspect or probable SARS case in the 10 days prior to onset of symptoms was reported by four persons investigated as suspect cases.

Figure 2. Rate of persons under investigation for severe acute respiratory syndrome and probable cases, Australia, by age

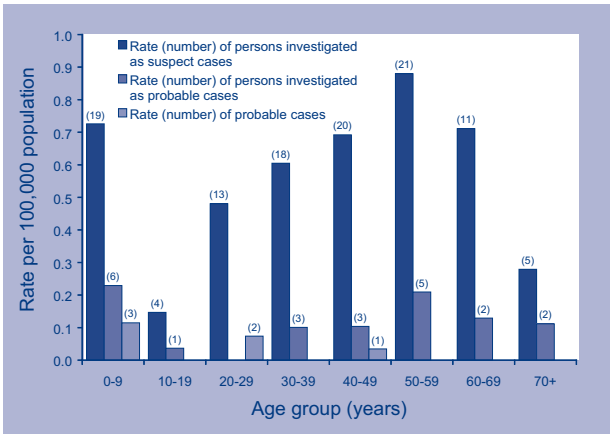

Table 2. Number and rate of persons under investigation for severe acute respiratory syndrome per 100,000 population, by jurisdiction

Jurisdiction	n		Rate	
	Suspect	Probable	Suspect	Probable
ACT	5	0	1.6	0
NSW	48	10*	0.7	0.2
NT	1	1	0.5	0.5
Qld	14	5	0.4	0.1
SA	7	1	0.5	0.1
Tas	0	1	0	0.2
Vic	26	8	0.5	0.2
WA	10	2	0.5	0.1
Total	111	28		

* Includes probable case identified by serology overseas

Discussion

Surveillance was a key component of Australia's response to SARS. Through the CDNA, a nationally coordinated approach to surveillance and public health management (including airport screening and contact tracing) was achieved. However, there were several limitations of the surveillance methods used including the poor positive predictive value of the case definition, inconsistencies with reporting and lack of data completeness, possible under-reporting and subjective exclusion criteria. The global SARS outbreak has highlighted changes and enhancements that could be made to current surveillance mechanisms for future respiratory disease epidemics such as influenza.

The case definition for SARS was very broad, which, while essential for the identification of cases in SARS-affected areas, was probably not specific enough in non-SARS-affected countries. This was recognised by WHO which rescinded its earlier directive for the reporting of all suspect cases in addition to probable cases. In an analysis of various cohorts, SARS was serologically or virologically identified in 26 per cent of cases meeting the WHO case definition for probable SARS in non-SARS affected areas compared to 79 per cent in SARS affected areas.[5] The age distribution of people under investigation as suspect and probable cases in Australia (Figure 2) is very different to that observed in SARS-affected countries where there were few cases in children and modal age groups were between 20 and 40 years.[6,7] This distribution most likely represents a generalised pattern of respiratory disease and travel habits, and reflects the poor positive predictive value of the case definition in a non-SARS-affected country.

Early clinical signs of SARS mimic many other respiratory diseases, and therefore a laboratory-confirmed diagnosis of an alternative cause was the most definitive method of exclusion. Less than half of the people under investigation as suspect or probable cases were excluded because of an alternative diagnosis involving a known aetiology. This highlights ongoing difficulties in determining aetiology for community acquired pneumonia which remains unknown in up to 70 per cent of cases.[8] It is highly unlikely whether five of the six probable cases in Australia reported to WHO actually had SARS: they did not test positive by polymerase chain reaction or serology, and were not very ill. Conversely, some of the alternate diagnoses were not entirely convincing when little was known about SARS. Although the validity of some of these may be questioned, many were difficult to follow up and this highlights the ongoing need for better communication between clinicians and public health authorities.

Reporting of surveillance data from jurisdictions and communication with DoHA through teleconferences was timely and open. Completion of questionnaires by most jurisdictions was also timely, although national data collation was difficult due to consistently slow return of questionnaires by one jurisdiction, use of a locally developed data collection form instead of the nationally developed form in one jurisdiction, and clinical data not always being timely and complete. The number of people meeting the criteria to be investigated as SARS cases is likely to have been under-reported and inconsistent as initial notifications were given voluntarily and listing of SARS as a notifiable disease was not uniform across jurisdictions. Furthermore, the drop in number of cases that were reported after March (Figure 1) could be indicative of reporting fatigue, but might also be attributed to fewer people travelling to affected countries.

In future similar efforts for influenza or other respiratory disease epidemics, improvements to national collation of data could be made by uniform reporting methods, in particular by electronic reporting rather than by facsimile, and standardised use of the data collection form. Linkage of the questionnaire to the database to create a one-step data entry process could streamline the collection and collation of data. Alternatively, reporting could be further streamlined by direct online reporting to DoHA from jurisdictions or public health units which would also ensure a uniform transition to usage of updated data collection forms.

Lack of completeness of clinical data was an important issue that highlighted the need to strengthen the links between public health and clinical data collection, particularly through clear communication in relation to the division of labour, data that is required, and how it can be reported in an easy and user-friendly way. It also highlighted the difficulties in obtaining complete clinical and laboratory workup for mild respiratory illnesses, especially those that are transient and self limiting.

The rapid and extensive allocation of resources required for the SARS response has also highlighted a need to examine surge capacity at primary care,[9] jurisdictional and national levels. Most stakeholders needed to make a substantial and prolonged response to SARS at the expense of other investigations, programs and routine activities. An assessment to estimate the impact of the response may assist in a more efficient future response to an influenza pandemic which would most likely be far greater in magnitude.

Australia may have been fortunate to avoid a SARS outbreak in the early stages of the global epidemic when very little was known about it. Careful evaluation of the implementation and method of surveillance both here and overseas are required for Australia to be well prepared for the possible re-emergence of SARS and future global outbreaks of influenza and other infectious respiratory diseases.

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References

1. World Health Organization. WHO issues a global alert about cases of atypical pneumonia. Geneva: World Health Organization; 12 March 2003. Available from: http://www.who.int/csr/sars/archive/2003_03_12/en/ Accessed 13 June 2003.

2. World Health Organization. Severe acute respiratory syndrome (SARS). *Wkly Epidemiol Rec* 2003;78:81–83.

3. World Health Organization. World Health Organization issues emergency travel advisory. Geneva: World Health Organization; 15 March 2003. Available from: http://www.who.int/csr/sars/archive/2003_03_15/en/ Accessed 13 June 2003.

4. World Health Organization. Case definitions for surveillance of severe acute respiratory syndrome (SARS). Geneva: World Health Organization; 1 May 2003. Available from: http://www.who.int/csr/sars/casedefinition/en/ Accessed 13 June 2003.

5. Kuiken T, Fouchier RAM, Schutten M, Rimmelzwaan GF, van Amerongen G, van Riel D, *et al*. Newly discovered coronavirus as the primary cause of severe acute respiratory syndrome. *Lancet* 2003;362:263–270.

6. Ministry of Health. Age-sex distribution of probable SARS cases in Singapore. Singapore: Ministry of Health; 21 May 2003. Available from: http://www.moh.gov.sg/sars/media/age_sex.gif Accessed 1 July 2003.

7. Donnelly CA, Ghani AC, Leung GM, Hedley AJ, Fraser C, Riley S, *et al*. Epidemiological determinants of spread of causal agent of severe acute respiratory syndrome in Hong Kong. *Lancet* 2003;361:1761–1766.

8. Donowitz GR, Mandell GL. Acute pneumonia. In: Mandell GL, Bennett JE, Dolin R, editors. *Principles and Practice of Infectious Diseases*. 5th edn. Philadelphia: Churchill Livingstone; 2000. p. 717–743.

9. Cameron PA, Rainer TH, De Villiers Smit P. The SARS epidemic: lessons for Australia. *Med J Aust* 2003;178:478–479.