Are the World Health Organisation case definitions for severe acute respiratory distress syndrome sufficient at initial assessment?

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ABSTRACT

Introduction: On March 13, 2003, Singapore doctors were alerted about an outbreak of atypical pneumonia that became known as severe acute respiratory syndrome (SARS). We now describe a series of patients that did not fit World Health Organisation (WHO) case definitions for SARS at initial assessment.

Methods: The Ministry of Health, Singapore centralised SARS cases in the study hospital and its emergency department (ED) became the national screening centre. A screening questionnaire and a set of admission criteria based on WHO case definitions were applied. Patients discharged from ED were tracked via telephone surveillance and recalled if necessary. A retrospective review was done of patients who did not fit WHO definitions initially, were discharged and had re-attended.

Results: During the outbreak, 11,461 people were screened for SARS. Among 10,075 (87·9 percent) discharged from the ED, there were 28 re-attendees diagnosed to have SARS later, giving an under-triage rate of 0·3 percent. Among the 28, six (21·4 percent) did not complain of fever and 22 (78·6 percent) had temperatures less than 38·0 degrees Celsius during their first ED visit. One patient was screened to have all three criteria but during consultation, the contact history was found to be unrelated to the known "hot spots". The initial mean temperature was 37·6 degrees Celsius (standard deviation [SD] 0·8), which increased significantly (p-value equals 0.04) to 38·0 degrees Celsius (SD 0·8) during their subsequent visit. Chest radiographs with infective changes increased significantly (p-value equals 0·009) from 16 percent to 52·4 percent over the two ED visits.

Conclusion: The WHO case definitions were helpful in evaluating majority of SARS patients initially. However under-triage at ED is inevitable, with a 0.3 percent under-triage in our study population. In this group and asymptomatic individuals who came for screening, a tracking and recall system helped to ensure their timely return to the ED.

Keywords: atypical pneumonia, chest radiographs, emergency department, severe acute respiratory syndrome (SARS), World Health Organisation

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INTRODUCTION

Severe acute respiratory syndrome (SARS) had affected many countries worldwide, including Singapore[1]. On March 13, 2003 at 15:36 hours, the Ministry of Health (MOH), Singapore sent an alert[2] via email to doctors about an outbreak of atypical pneumonia in Hong Kong, Vietnam and Guangdong Province in China. On March 14, six healthcare workers from the same ward in the study hospital were admitted for pneumonia. Their supervisors noted the cluster effect and a hospital-wide alert went out. This heralded the outbreak of SARS in Singapore. On March 22, SARS cases were centralised in the study hospital and all non-SARS admissions were directed to other hospitals. The emergency department (ED) of the study hospital became the main screening centre for SARS in the nation.

As SARS was a completely new disease, the ED adopted the World Health Organisation (WHO) case definitions as the main tool for screening and initial assessment of patients. This paper describes a case series of patients whose initial presentations did not fit WHO criteria, and were discharged home but were eventually hospitalised and diagnosed to have probable or suspect SARS.

METHODS

The WHO case definition[3] for a suspect case of SARS is a person with history of high fever (more than 38ºC) with cough or breathing difficulty. He must have in the past 10 days had (1) close contact with a person who is a suspect or probable case of SARS or (2) history of travel to an affected area or (3) residing in such an area. The WHO case definition[3] for a probable case is a suspect case with

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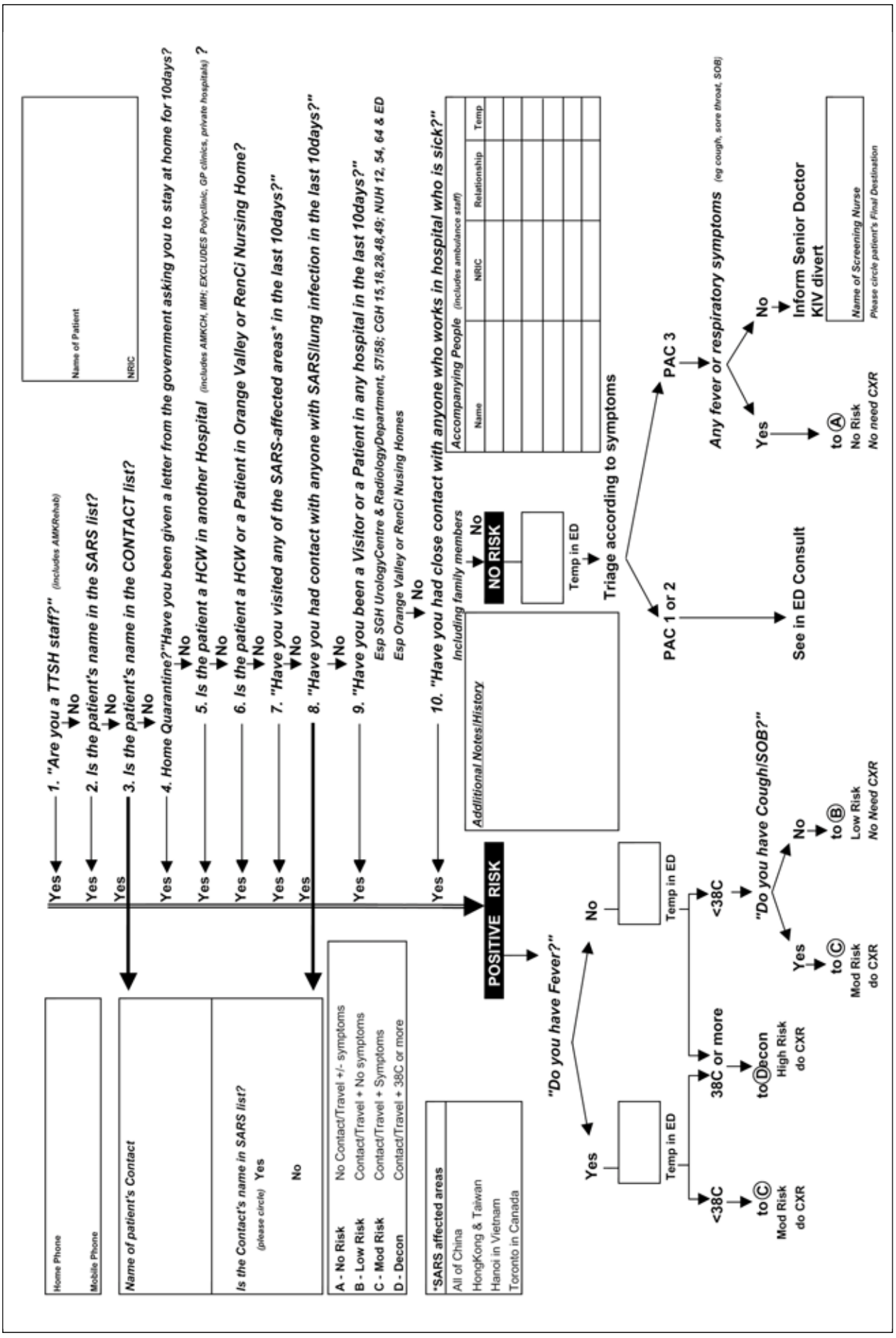
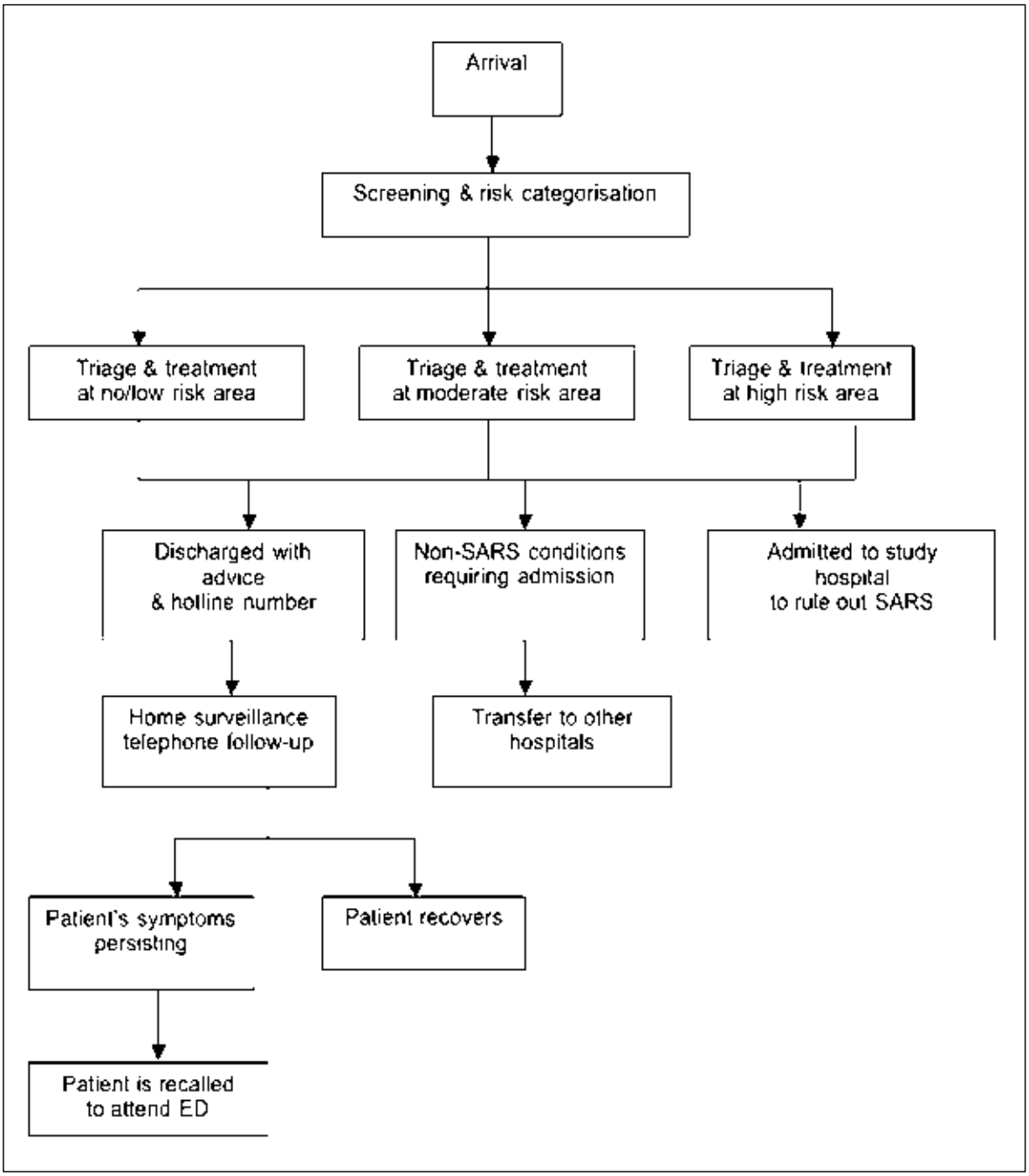


Fig. 1 Screening questionnaire.

Fig. 2 Chart shows emergency department patient flow.

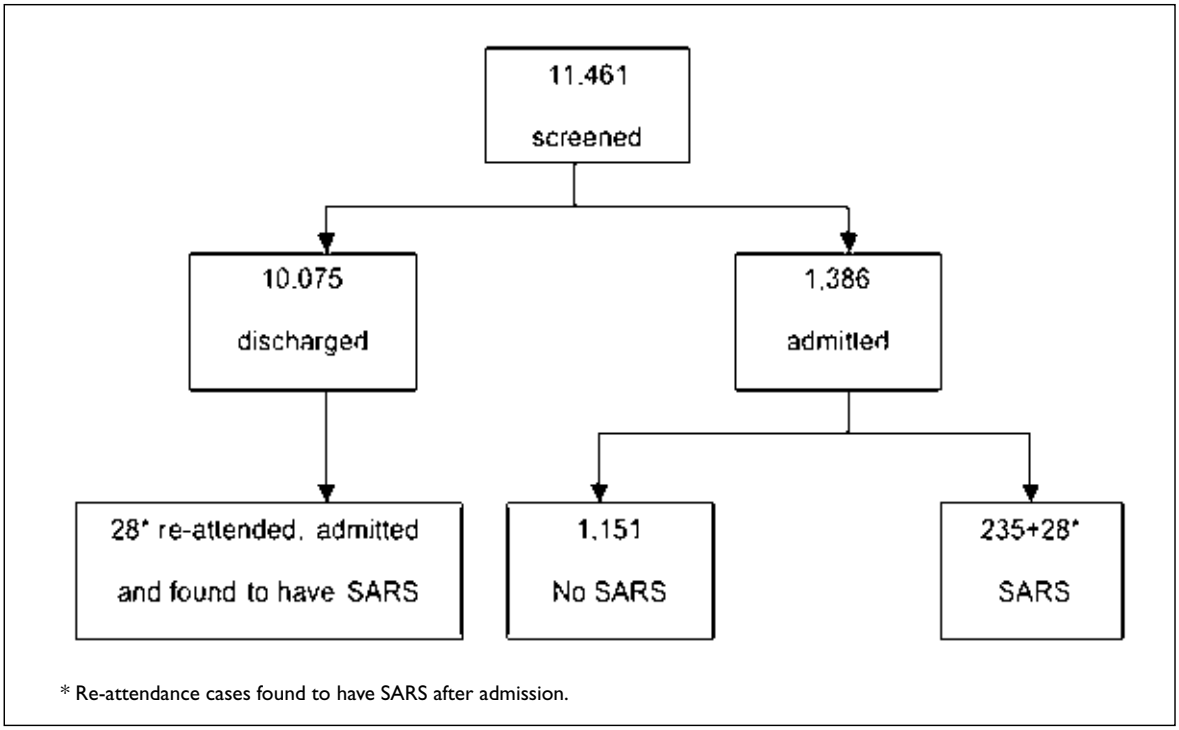


radiographical evidence of infiltrates consistent with pneumonia or respiratory distress syndrome (RDS) on chest radiograph. A case would be excluded if an alternative diagnosis can fully explain their illness, after carefully considering the possibility of co-infection.

The ED of the study hospital is the busiest in Singapore, providing care to persons aged 15 years or older and had an annual attendance of 131,127 patients in year 2002[4]. To manage the outbreak, a screening station, cubicles for triage and consultation, and satellite radiology services were set up outdoors. This outdoor ED was divided into three areas with cordon and railings where patient of different risk categories were segregated.

Patients who came to ED for assessment for SARS included referrals and walk-ins. They were screened at the screening station and tympanic membrane temperature was taken at the same time. A screening questionnaire (Fig. 1) in the form of a flow chart enabled the nurses to screen large number of patients rapidly. This screening questionnaire acted as first line triage and was developed based on WHO case definitions. From experience, it was realised that contact history gave the highest chance for a positive screen and hence it was used as the first filtering

Fig. 3 Outcome of 8 weeks of SARS screening.



question. The epidemiology team identified "hot spot" areas where atypical pneumonia cases had arisen in Singapore, and this information was updated regularly in the screening questionnaire. A travel history to other SARS affected areas[5] was considered significant exposure. The screening questionnaire also took into account the patient's temperature and symptoms.

After screening, the nurses were able to sort patients into (1) No-risk or low-risk: tenuous history of exposure without symptoms or with mild symptoms; (2) Moderate-risk: positive exposure with mild symptoms or temperature <38ºC; and (3) High-risk: positive exposure with temperature ≥38ºC.

Patients assigned to one of three risk categories were then directed to their respective areas to await formal triage and assessment. This prevented mingling of patients of different risk categories. Each risk area had its own team of nurses and doctors. History of presenting complaints, exposure to at-risk persons and travel was once again taken by the attending doctor during consultation. Based on a patient's recorded temperature, presenting complaints, exposure history, examination and chest radiograph, a diagnosis was made and the patient was managed accordingly. All three WHO criteria were applied to all the patients during consultation. A patient diagnosed to have suspect or probable SARS would be admitted for observation, isolation and treatment to rule out SARS.

A patient diagnosed not to have SARS and could be managed as an outpatient would be discharged. Standard discharge advice included the reminder to monitor temperature and to return for review if fever persisted. It also included the need to monitor for other symptoms including cough and breathlessness. The importance of social responsibility, such as avoidance of crowded areas when ill, was also reinforced in the discharge advice. A 24-hour hotline number was included in the discharge advice allowing the patient to call back if he had enquiries. All discharged persons were placed on home surveillance by the hospital and were contacted on days 1, 2, 3 and then on alternate days till day 14 to ensure their well-being. Patients with non-SARS conditions requiring admission would be transferred to other hospitals. Fig. 2 summarises the patient flow in a schematic representation.

Data was extracted from screening forms, ED computerised clinical notes and in-patient records. The following data was collected from the ED computerised log: (1) Total ED attendance; (2) Number of persons who came for screening; (3) Number of patients who were admitted and confirmed to have suspect or probable SARS; and (4) Repeat attendances resulting in admission. We focused on patients with features not fitting the WHO case definitions and were discharged after their initial consultation. In this group of patients, their initial temperature, symptoms and chest radiograph findings were compared with those in the subsequent visit. The under-triage rate was calculated by dividing the number of discharged patients diagnosed to have SARS subsequently with

Table I. Application of WHO criteria at first screening and first consultation.

No. of patients during screening	Fever (documented to be ≥38°C)	Cough and/ or SOB	Positive contact history	No. of patients during consultation
2	yes	no	no	4#
0	no	yes	no	0
13	no	no	yes	13
1	yes	yes	no	2*
8	no	yes	yes	8
2#	yes	no	yes	0
1	no	no	no	1
1*	yes	yes	yes	0

* This patient was judged by screening nurse to have positive contact but doctor judged that the contact history was not significant during consultation.

\# These 2 patients were also judged by screening nurses to have positive contact but doctors judged that the contact history was not significant during consultation.

SOB: shortness of breath

Table II. Comparison of clinical findings in the two visits.

	1st ED visit	2nd ED visit	p-value
Symptoms			
Fever	22 (78·6%)	27 (96·4%)	0·04
Cough	9 (32·1%)	13 (46·4%)	0·23
Gastrointestinal	1 (3·6%)	5 (17·9%)	0·07
Others (e.g. myalgia)	15 (53·6%)	17 (60·7%)	0·48
Temperature			
Mean (°C)	37·6 (SD 0.8)	38·0 (SD 0.8)	0·04
Median (°C)	37·3	38·1	NA
Chest radiograph			
Normal	21	10	
Infective changes	4	11	0·009
Not done	3	7	

SD: standard deviation; NA: not applicable

the number of persons discharged from ED. This study was approved by the hospital review board.

RESULTS

During the duration of the outbreak, total ED attendance was 16,606 of which 11,461 (69%) were screened for SARS. The outcome of all persons who came to the ED for screening was recorded (Fig. 3). 28 re-attended of whom 13 were later diagnosed to have probable SARS and 15 with suspect SARS, giving an overall under-triage rate of 0·3% (95% confidence interval 0.1% to 0.4%).

Of the 28 re-attendees, there were 15 women and 13 men with a mean age of 35 (standard deviation (SD) 14.3) years and median age of 32 years. There were four patients with chronic illness, consisting of three persons with diabetes mellitus and one with systemic lupus erythematosus on steroids, among these 28 re-attendees. Four patients were asymptomatic and came just for screening during the first visit. The mean duration of symptoms of the other 24 patients at the first visit was 1·8 days. Table I shows the application of the WHO criteria to these 28 patients at first screening and consultation.

The mean temperature of these 28 persons during their first ED consultation was 37·6ºC (SD 0·8), which increased significantly (p=0·04) to 38·0ºC (SD 0·8) during their repeat visit. 22 (78·6%) of these 28 patients had temperatures less than 38ºC during their first ED consultation (Table II). Six persons

had temperature higher than 38ºC of whom one was not truthful with his history of exposure. The other five patients did not have any known exposure during the initial consultation.

Three patients did not have chest radiograph examination because they presented early and their symptoms were mild, and one of them was pregnant and declined radiograph. 21 had chest radiographs interpreted as normal during their initial ED visit. Four patients with infective changes on chest radiographs were presumed to have bacterial pneumonia and discharged from ED with outpatient management. Upon their subsequent visits, the proportion with infective changes on chest radiographs had increased significantly (p=0·009) to 11 out of 21 chest radiographs (Table II).

The mean time interval between first and second ED visits was 55·4 (SD 35·7) hours; median was 47·3 hours with a range from 10·5 to 137·7 hours. None of these 28 caused secondary transmission during the time interval between their first and second ED consultations. After discharge, 18 patients followed the discharge advice and returned voluntarily because of persistence of symptoms, while 10 patients returned because of the recall mechanism in place through the home surveillance team and the 24-hour hotline. There was no death among these re-attendees. One of them required care in the intensive care unit but did not require mechanical ventilation. The epidemiological team confirmed that every SARS patient inadvertently discharged were tracked and recalled to return for admission and treatment.

The clinical features of the re-attendees were also compared with the SARS patients admitted at the first ED visit. Among the 28 re-attendees, six (21·4%) patients did not complain of fever. Of the 235 patients admitted during their first ED visit, a significantly smaller (p=0·008) proportion, 6·8%, did not complain of fever. There was no significant difference in the incidence of other symptoms such as cough and gastrointestinal symptoms. However there is a significantly smaller (p=0.0001) proportion of abnormal chest radiographs among the re-attendees during their first visit (14·3%) compared to the 235 SARS patients admitted at first visit (60.0%). There is no difference in terms of age, sex and race in both groups.

DISCUSSION

When the disease was named as SARS on March 15, 2003[6], the causative virus had not yet been identified. There was no diagnostic kit. The only tool available then was WHO case definitions, which acted as a guide for physicians working at the frontline. The WHO case definitions were by and large helpful in screening and initial assessment of SARS. However, under-triage is still inevitable and in our series, the combination of ED screening questionnaire and admission criteria for SARS gave an under-triage rate of 0·3%.

Among the 28 re-attendees, the mean initial temperature was 37·6ºC and 22 persons did not meet the 38ºC criteria in the WHO case definitions. This may be because they had taken antipyretics prior to consultation. The presence of an impaired immunity state modifying the febrile response may have contributed or it may have been an atypical presentation whereby high fever was not a feature in the initial course of illness. Another possibility was that these patients may have presented very early in the course of their illness, hence clinical signs and symptoms had not manifested yet. A break in the fever between the viraemic phase and the lung inflammation phase has also been reported[7] and our patients could have presented in this afebrile phase of their illness.

Our data did not capture the use of antipyretics among patients and retrospectively, this might have been useful information. However, to date, there has not been any paper examining the impact of antipyretics on temperature in SARS patients. The possibility of an impaired immunity state suppressing natural febrile reaction in SARS was postulated because the three diabetic patients and the patient on long-term steroid use in our series, had temperatures of less than 38ºC. A report by Donnelly et al[8] showed that fever was present in 94% of patients but the authors did not postulate any reason for the absence of fever in the remaining 6%.

The six persons with temperature >38ºC at the first consultation were not admitted, because they were found not to have any known contact. One patient was transferred to another hospital when he revealed that his wife was receiving treatment for a chest infection in intensive care unit. For the other patients, it was only during their second visit, that their contact history became apparent as the epidemiology team had informed the ED of new clusters of outbreak. Though history of contact was an important factor in evaluation, it became a limitation if the patient was not forthcoming or was truly unaware of any contact with an infected person.

There were four patients with radiograph changes suggestive of chest infection in the first consultation. None of them had temperatures greater than 38ºC, cough nor breathing difficulty at first presentation and were then treated as outpatients for community acquired pneumonia. In this group of patients, the

ED doctors were faced with a difficult decision whether to admit or discharge the patients. Excessive admissions placed constraints on limited resources, especially isolation beds. Discharges however carried the risks of allowing a yet-to-be-diagnosed SARS patient back into the community and possibly causing secondary transmission, hence a tracking and recall system was important.

As confirmed by the national epidemiology team, none of these re-attendees had caused secondary transmission in the interval between their first and subsequent ED visits. A few factors probably contributed to this fortunate turn of event. Firstly, all patients were educated about this new disease during the consultation process, with regard to facts about SARS, the need to monitor their temperature, observing personal hygiene, keeping in touch with the ED and exercising social responsibility. Upon discharge, a comprehensive written advice was given to the patient to serve as a reminder. Secondly, a home surveillance team had been set up. The team members were staff drawn from other departments in the study hospital. This team would call each of the discharged patients on days 1, 2, 3 and then on alternate days until day 14 after their discharge to ensure that the patients were recovering uneventfully. Those with persistent fever or symptoms despite medications would be advised to return to the ED. Thirdly, a 24-hour telephone hotline number was given to all discharged patients. This telephone line was manned by a select group of ED staff who would answer any queries patients might have and complemented the work of the home surveillance team. Finally, we were fortunate that none of these 28 persons were "super-spreaders"[9].

Apart from the safety measures to track every patient who might have been inadvertently discharged, measures were also in place to ensure that SARS patients were identified in the first instance as far as possible. An on-line daily updated web site (SARSweb) with names of all SARS patients, their close contacts, and people under home quarantine became available from March 30, 2003. This lowered the dependence on patients volunteering information in the decision-making process. Timely information from the in-patient infectious disease team and the epidemiology team also enabled frontline staff to reduce the number of inadvertent discharges.

This series report had a small sample size and therefore generalisations would be difficult. Apart from reports of SARS in workers from a local wholesale market, there was no community spread in Singapore. History and SARSweb remained useful when there was no community spread but in the presence of extensive community spread, history would become unreliable and less helpful. It was noted that a lot of resources were required to man the hotline and to set up a home surveillance team. The ED managed a satisfactory arrangement by deploying "vulnerable" staff to man the 24-hour hotline[10], thereby ensuring safety for these staff and yet making certain that the hotline was manned by suitably qualified staff. The question of cost and sustainability of a home surveillance team would need careful review and consideration for its long-term implications.

In summary, under-triage by ED is inevitable given the novelty of SARS and the untested screening and admission criteria. However, an under-triage rate of 0.3% though not alarming is of concern. The WHO case definitions were helpful in the majority of SARS patients at initial presentation, but for 0.3% and asymptomatic individuals who came for screening, a tracking and recall system must be in place to ensure the timely return of these persons.

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