

SPECIAL ARTICLE

Infectious diseases law and severe acute respiratory syndrome – medical and legal responses and implications: the Singapore experience

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INTRODUCTION

When considering infectious diseases, both the medical and consequent legal perspectives are important elements. With the recent epidemics of severe acute respiratory syndrome (SARS), type A Fujian influenza, tuberculosis, HIV, monkey pox and other communicable diseases, strict regulations on infection control have been developed to reduce the risk of disease transmission. Public health measures have to adapt to new health threats and methods of disease control. A comprehensive infectious disease law is needed to enforce the control measures for an effective implementation.

The law is an essential tool in medical and public health work to create the necessary social conditions for people to live healthily in a safe environment. Innovative new techniques, namely thermal imaging scanners (which Singapore is the first country in the world to implement it) and close-circuit cameras, have been used in the identification of febrile people and in the surveillance of quarantined persons, respectively. Case-identification (testing and screening), isolation to stop transmission by infected persons, contact tracing as well as vaccination, are some of the control measures to curb the spread of communicable diseases. Good surveillance and effective diagnostic tools can spot disease outbreaks very early.

This article discusses both the medical and legal responses including the legal implications of the recent

epidemic SARS outbreak in Singapore against the backdrop of the global efforts to control SARS.

MEDICAL RESPONSES TO INFECTIOUS DISEASES

With the emergence of any new disease, the scientific community will try to unravel its epidemiology and aetiology. Epidemiology refers to the study of the distribution and changes in diseases. Epidemiological methods are used to assess incubation periods, causative agents, mode of spread, community trends as well as preventive measures. The age-old accepted principles of prevention and spread of communicable diseases are implemented. With data available to us, we commence empirical treatment irrespective of the manifestations of the disease. At the same time, supportive treatment goes hand-in-hand with the empirical treatment. As and when the exact agent is identified, we then commence the specific treatment. If a drug is available against the putative agent, we then change the empirical treatment into the definitive treatment. Based on our knowledge of incubation periods, causative agents and mode of spread, the specific preventive measures are implemented. After preliminary identification of the causative agent, the Koch's postulates are ascertained.

Koch's postulates (1882)¹ was set to determine whether an infectious agent is the cause of a disease. It states that the organism:

- must be found in every case of the disease;
- must be isolated and grown in pure culture;
- must cause the specific disease when inoculated into a susceptible animal; and
- must then be recovered from the animal and identified.

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The next step is the development of immunization methods to reduce the population at risk. With the technological revolution, on the one hand drugs against these agents can be created, but on the other hand it can spread infectious diseases more rapidly through the 'interconnectiveness' of the world as a global village. Every community now works on the concept of 'identify, isolate, contain and eradicate'.

Finally, public education and counselling is a very important facet of the response to any infectious disease. It helps in promotion of health of the community, prolonging life and improving its quality through the organized efforts of society.

CLINICAL ASPECTS OF SARS

Severe acute respiratory syndrome medicine is an ever-changing field. SARS is a form of atypical pneumonia thought to have originated in the Guangdong province of China. Newly emerging and highly infectious, SARS has a high rate of transmission, especially among health-care workers. SARS has spread to over 29 countries in this outbreak. It is termed by epidemiologists as the 'modern epidemic'.

Typical pneumonia is characterized by bacterial infection of the lung with a combination of any of the following: tissue damage; purulent sputum; collapse of the lung lobes; and infection of the trachea. All other types of pneumonia not characterized by these are known as atypical pneumonia. The latter is commonly caused by viruses and thus is sometimes termed viral pneumonia. SARS is known to be caused by a type of coronavirus, termed SARS-associated coronavirus (SARS-CoV).^{2,3} The novel agent does not belong to any known groups of coronaviruses. The genome sequence analysis of SARS-CoV seems to be consistent with the hypothesis that it is an animal virus that has either developed the ability to infect humans or has been able to cross the species barrier.⁴ The virus is spread by droplets or by direct or indirect contact. The infectious virus is present at very high concentrations in the respiratory tract of patients. At least one serious outbreak in a public hospital in Hong Kong could have been due to the use of nebulized bronchodilator (albuterol, through a jet nebuliser delivered by oxygen at high flow rates). This is believed to cause atomization of infected secretions.

The incubation period is between 2 and 10 days and the illness begins with a prodrome of fever, often accompanied by headache, myalgia, malaise and mild respiratory symptoms. This then progresses to a lower

respiratory tract phase with dry non-productive cough and/or dyspnoea, which may be accompanied by, or progress to, hypoxaemia and hypoxia. Between 10% and 20% of patients may require intubation and ventilatory support.^{5,6} The clinical picture is variable, especially in the presence of comorbidities, among those on steroids, with immunocompromised states as well as in advanced age. In the Singapore series of patients, some of the most commonly reported symptoms included:⁷

- high fever (100%);
- cough (73%);
- myalgia (57%);
- sore throat (31%);
- malaise (23%); and
- rigors (18%).

On 12 March 2003, the World Health Organization issued a global alert on SARS. A suspected case of SARS is defined as one with documented fever ($> 38^{\circ}\text{C}$), lower respiratory tract symptoms and contact with a person with SARS or travel to an area of documented transmission.

A probable case of SARS on the other hand, is similar to a suspected case and has chest X-ray findings of pneumonia, acute respiratory distress syndrome (ARDS) or an unexplained respiratory illness resulting in death, with autopsy findings of ARDS, without any other identifiable causes.⁸⁻¹⁰

Confirmation of the diagnosis of SARS can be done using any one of the tests discussed in the section below.

Some of the laboratory features include:

- decreased lymphocyte counts;
- normal or decreased white blood cell counts;
- decreased platelet counts; and
- certain enzymes in the blood may be raised (creatinine kinase, transaminases, lactate dehydrogenase).

The chest X-ray may be normal in the early and febrile phase and later on there may be small patchy shadows which may progress to extensive interstitial or confluent infiltrates. The initial radiographic changes were indistinguishable from those associated with other causes of bronchopneumonia. There seems to be a predominant involvement of the peripheral zones of the lungs. Pleural effusions, cavitation and hilar lymphadenopathy were absent. Respiratory symptoms and auscultatory findings were disproportionately mild when compared with the chest X-ray findings.

The tests currently used in the diagnosis of SARS include:

- Polymerase chain reaction (PCR): where specimens such as nasopharyngeal secretions are subjected to analysis of the genetic material makeup of the virus

by amplification. In generating these copies, the virus can then be more readily detected.

- Enzyme-linked immunosorbent assay (ELISA): this is a technique to identify the antibodies in the serum of a person recovering from SARS.
- Isolation of the SARS coronavirus: this involves isolation of the coronavirus in cell cultures and then identification by PCR techniques.

All tests for SARS-CoV so far have limitations. Extreme caution is thus necessary when management decisions are based on virological tests results. WHO recommends that sequential samples be stored for future use. This is particularly important for the first case(s) recognized in countries that have not previously reported SARS. WHO also encourages each country to designate a reference laboratory for investigations and/or referral of specimens from possible SARS patients.

There is currently no specific definitive treatment for SARS. For patients with progressive deterioration, intensive and supportive care is of primary importance. Therapies utilized include antivirals, immunomodulation with steroids and broad spectrum antibiotics. The best way of managing SARS is to prevent its spread. Precautionary measures and strict/sensible hygiene practices cannot be over-emphasized. The best strategy to adopt is to have a high index of suspicion and be vigilant at all times when dealing with front-line patients. As shedding of the virus is also known to occur in the urine and faeces, there should be great caution when handling these biological products.

PAEDIATRIC SARS

There is growing evidence that SARS has a less aggressive clinical course in younger children. This is associated with a lower load of viral shedding from the respiratory tract and thus a minor degree of infectivity. In a series on paediatric SARS patients, all of them were found to have persistent cough, fever, progressive chest X-ray changes and lymphopenia.¹¹ Teenagers tended to complain of malaise, myalgia, chills and rigors, similar to adults. The clinical course of SARS in children was also milder and shorter. Their chest X-ray findings were also milder and resolved more quickly compared to adults. Treatment, which comprised of ribavirin, oral prednisolone or intravenous hydrocortisone, did not appear to give rise to any short-term adverse effects. In the Hong Kong series of patients, those who were attending school at the time of presentation (8 out of 10 children), there was no evidence of spread to any of their classmates.¹¹

LEGAL RESPONSES TO INFECTIOUS DISEASES

Public health laws are necessary for effective international health regulation. As a response to individual health risks, public health laws have focused on the biological causes of diseases and the avenues of spread. The enforcement of public health laws falls on public bodies and is dependent on the social responsibility and the willingness of individuals and pressure groups to protect public health interests. With SARS, it is vital to keep good personal hygiene, such as frequent hand-washing, avoiding crowded places, not spitting or sneezing in the open and proper disposal of waste.

Legislation is necessary to maintain the health of the population, subject to an individual's private rights. Public health education is important to achieve such a balance to support a legal framework of public interference and private rights. This can reduce litigation that intrudes on private rights. Public health laws are needed as a public health tool aimed at protecting the public from health risks. The emergence of infectious diseases such as type A Fujian influenza, ebola, monkey pox, HIV and now SARS and bird flu, has shown how vulnerable countries can be when exposed to a global health risk.

Most countries have epidemiological surveillance of infectious diseases that are governed by statutory laws on notification. Timeliness and the speed in notifying infectious diseases are very important. The statutory notification of infectious diseases is directly linked to community health cases. Public health laws are needed to stem the tide of SARS as countries now face SARS as an infectious disease with a mortality rate of 14–15%, and especially so as there is presently no known cure for SARS.

The judicial response that SARS is a threat to health and public safety can be seen in measures taken, for example, quarantine orders and their penalties. Vaccination programs when available, for example the compulsory immunization against infectious diseases such as diphtheria and measles, are also legal responses to combat communicable diseases.

POPULATION SURVEILLANCE AND THE LAW

Population surveillance for communicable disease control is necessary to identify and detect new problems, monitor trends and evaluate diseases-control measures to control epidemics. Information and data must be

fed back in a timely fashion to those who take control of actions. Continuing surveillance is needed to evaluate the control action.

The measuring of trends in diseases and the monitoring of changes in microbial agents are essential for preventive programs, as well as to detect changes in health practices. A good example of this is the CDC network of Wales, UK, in which through joint surveillance, there has been successful recognition and early investigation of salmonella serotypes outbreaks.

Law is essential for enforcing an effective control and surveillance of infectious diseases. To ensure a safe environment, there are quarantine laws in force. What is the role of law in infectious diseases? The compulsory notification of 'notifiable' diseases under the Infectious Diseases Act illustrates this. This act of notification is an exception to the law of medical confidentiality, as statutory law authorizes it. Further, timely information about the occurrence and spread of infections is crucial for the effective control of infectious diseases.

Under the Infectious Diseases Act, any person who is or is suspected to be, a case or contact or carrier of an infectious disease, may be ordered to undergo surveillance for a specified time-period. If such a person fails to comply with any condition regarding his surveillance, he shall be guilty of an offence.

THE SINGAPORE SARS EXPERIENCE

At the height of the SARS outbreak, a Ministerial Committee was established. A SARS Executive group was convened with the establishment of the SARS Legal Team. The Ministry of Health and other government agencies also responded swiftly and appropriately. Legal powers and statutory powers of enforcement arising from the Infectious Diseases Act, Immigration Act, Medical (Therapy, Research and Education) Act and Statistics Act were used.

The outdated Infectious Diseases Act which provided for the notification and investigation of infectious diseases and the isolation of an infected person was quickly amended to expand the powers of the Ministry of Health to prevent and control the spread of SARS. The new amended Infectious Diseases Act which came into effect on 27 April 2003 now allows Home Quarantine Orders to be issued to SARS cases or contacts and suspected SARS cases or contacts, people recently recovered from SARS or who have recently been treated for SARS.¹² New seizable offences were created for breach of the quarantine order. The Minister may declare any

premises as an isolation area and may prohibit movement of people and goods in and out of and within the isolation area.¹³ Further, the new amendments provide that the Director of Medical Services can order medical examination and treatment at a prescribed hospital or clinic, with the power also to order detention until the examination or treatment is completed.

More importantly, under the new law in section 10(1) of the Infectious Diseases Act, doctors can be required to obtain information from their patients (in a new Patient Declaration Form – a SARS order) for the purpose of investigating into any SARS outbreak. Giving false information is an offence. The Director of Medical Services may disclose such information to any person to enable that person to take steps to prevent the spread of SARS. However, the Director must approve the manner in which such information is used by that person. Using the information in a manner not approved by the Director is an offence. The Director, with the Minister's approval, may prescribe measures or procedures to investigate into any outbreak or suspected outbreak or to prevent any spread of the infectious disease.

On the disposal of SARS victims, the new law applies to deceased persons who died while being or suspected of being a case or contact of SARS. Wakes can be prohibited by the Director of Medical Services who may also impose conditions on the disposal of the body.¹⁴ There is also the power to conduct post-mortem examinations on known or suspected SARS cases to determine the cause of death and to investigate into the outbreak or prevent its spread.¹⁵

On a crucial note, people who suspect they have SARS or are contacts of SARS should not expose themselves to others. As for children, this obligation to comply will rest on their parents or guardians. Failure to comply is an offence.¹⁶

Under the new amended law, the penalties have been enhanced with the first offence of a maximum fine of \$10,000 or up to 6 months imprisonment or both. For the second or subsequent offence, it is up to a maximum of \$20,000 or a term of imprisonment up to 12 months or both. But there is a power to compound the offence up to \$5000.

Although these critical and essential measures (such as the home quarantine orders and compulsory medical examinations) seem harsh, there are provisions for a \$70 per day incentive which mitigates it with an encouraging compliance.

Strategically, Singapore responded to the SARS outbreak with public education via television and radio,

increased awareness of personal and public hygiene, a containment and isolation approach, tight border controls, close monitoring with home quarantine orders and urgent research for a diagnostic test and vaccination and possibly a cure.

Regarding the control of entry at the borders, the Immigration Act gave the power to refuse entry and provided temperature checks as a condition for entry. There is also the power to issue work permits with quarantine as a condition for the permit. There were also informal special arrangements at the Malaysian and Singapore causeway.

SARS is an infectious illness that appears to spread primarily by close person-to-person contact, such as in situations in which people have cared for or lived with a person known to be a suspected SARS case or had direct contact with respiratory secretions and/or body fluids of that person. Potential ways in which infections can be transmitted by close contact include touching the skin of other people or objects that become contaminated with infectious droplets and then touching your eyes, nose or mouth.⁵

Control measures included health declarations, travel history, compulsory temperature checks, the decanting of affected areas, restricting certain movements and the empowerment of officials.

Hospitalization of patients in designated hospitals to protect the public, tracing the contacts of suspected and probable cases and imposition of quarantine on those who are exposed to the possibility of infection are important public health measures. Once a decision is made that a person is a suspected or probable case of SARS, certain measures have to be taken to protect the healthcare workers from contracting the infection.

Personal protective equipment (PPE) is worn by all healthcare workers and these include long sleeved impervious gowns, proper scrub suits, N95 masks (these are designed for respiratory protection of the use with a filter efficiency level of 95% or greater, against particulate aerosols free of oil; they reduce the exposure to airborne particles ranging from 0.1 to > 10.0 microns and provide > 99% bacterial filtration efficiency against user-generated organisms), protective eyewear or goggles, head and shoe covers as well as gloves. Proper hand-washing technique is also very important. When performing certain high-risk duties such as endotracheal intubation and suctioning of respiratory secretions, a powered air-purifying respirator (PAPR) is used, preferably in a negative pressure room. The routine use of these PPE are not recommended in the general workplace (outside the healthcare setting).⁵

In most organizations and institutions, temperature surveillance for all staff is mandatory. Those with fever and respiratory tract symptoms are kept away from work and public places. Cleaning is also stepped up in most work areas and especially in commonly used areas such as washrooms.

To their credit some companies in Singapore also actively participated in the 'Cool Workplace' program and many even appointed a 'cool manager' to oversee the surveillance practices. The tripartite teamwork between the public/employees, the management and the government contributed toward Singapore's successful control of the spread of SARS.

LEGAL IMPLICATIONS: LITIGATION AND SARS

The tort of negligent exposure to infectious and communicable diseases is recognized at common law, allowing infected persons to recover damages. Causes of action may include battery, fraudulent misrepresentation, negligence and occupier's liability.

Negligence

Where, through the negligence of one's actions (e.g. a caregiver), an infected person escapes his care, thereby exposing another to his germs, the caregiver may be liable for negligence in the level of care. Under the tort of negligence, one is liable if this result of his actions is not too remote and would have been foreseen by a reasonable, prudent person.

Suffering and death can be seen as an avoidable malfunction, for example in hospital-acquired infections. In the health system, such malfunction would be medical malpractice such as in cross-infection cases, and transfusion-associated HIV and hepatitis B and C infections.

Adhering to certain measures can reduce cases of negligence:

- avoiding poor practice such as not washing one's hands;
- having detailed protocols, such as antibiotic prophylaxis;
- rapid reporting of laboratory results;
- keeping adequate records, including laboratory documentation;
- maintaining a continuous hospital-acquired infection surveillance program, having adequate communication with patient/family and informing them on current infectious epidemiological issues.

Occupier's liability

The occupier's duty is found at common law as well as in the statutes of the Factories Act, Environmental

Public Health Act, Penal Code, Infectious Diseases Act and the Employment Act. Generally, the occupier is liable to an entrant who contracts SARS as a result of a breach of the occupier's duty of care, such as allowing entry to people under home quarantine. But there are a few defences such as *volenti-non-fit injuria* and contributory negligence.

Employer-employee rights and obligations

An employer who does not provide a safe place of work where an employee is infected is liable to the employee either in tort, in contract or implied by the law. The scope of the employer's liability extends to employees who are on overseas work assignment. The standard of care would be satisfied if the guidelines from WHO or the Ministry of Health are complied with. If an employee has SARS and infects another third person (a visitor) in the course of his work, the employer may be liable to the third person.

Individual responsibility

Statutory obligations are imposed on an individual by the newly amended Infectious Diseases Act. These include notifying the Director of Medical Services of any suspected SARS cases, including the individual himself, obeying the quarantine order and not going to public places if infected with SARS. Possible civil claims against another person can include negligence, battery and intentionally causing shock.

A negligence suit may be made against a person who infects another person with SARS if the infector knew or suspected he was infectious and failed to take reasonable precautions and caused the infection to that person.

The sending of false rumours or fabricated information about SARS through telecommunication services is a criminal offence under the Telecommunications Act.

It is defamatory to make false statements alleging that a certain person is suffering from SARS which cause others to avoid or think less of that person.

Contractual implications: the doctrine of frustration?

If a party to a contract is unable to perform his obligations due to SARS, would the contract be discharged by frustration? It is submitted that it would be wise to now include a *force majeure* clause in the contract to provide for this unforeseen situation. A properly drafted clause to specifically cover the event of *force majeure* should provide for the modification or termination of obligations under the contract, since *force majeure* clauses in existing contracts would not have provided for SARS-

related events, as SARS is a new, emerging fatal disease. If a contract is discharged for frustration, then performance is excused. Another impact to consider is the insurance policies for coverage.

Some ethical and legal considerations

A doctor or dentist must not refuse to treat a patient because of his infectious condition. Medical and dental treatment and nursing care should continue to be provided to medically compromised patients by following established communicable disease protocols and taking routine precautions.

By strictly following the current infection control procedures (which include N95 masks, gloves, disposable gowns and eye protection), the risk of transmission of blood-borne pathogens or the SARS virus can be much eliminated and there should be no cross-infection between doctors, dentists and health care staff.

Praise for their courage should be given to health care workers world-wide who work and provide care to SARS patients despite the attendant risks to their own health. Dr Carlos Urbani himself, the first person to detect SARS and alert WHO, sacrificed tremendously in this cause, which eventually led to his demise. Medical ethics is best expressed by such true courage and dedication by health care staff.

CONCLUSION

The newly amended infectious disease laws seem adequate and are necessary to assist in eradicating and containing any infectious disease, including the SARS disease, with Singapore being declared SARS-free by the World Health Organization on 31 May 2003.

Still, one must be vigilant and prepare for the next SARS outbreak as viruses are known to have cycles of increased and decreased incidence, garnered by altered virulence of the infective agent and changes in the herd immunity of the populace.

Both the social will and the legal will are needed to successfully contain the fatal SARS disease. Some of the lessons learnt from this outbreak include the following:

- emerging infectious diseases are not confined to geographical boundaries in this new century of highly mobile and interconnected world;
- it serves as a dry run for the potential threat of bioterrorism. SARS has helped us realize the amount of manpower, resources and coordination required to successfully mount a national health campaign. Infectious agents utilized in bioterrorism are likely to be more infective and lethal;

- hospital-acquired infections are not confined to patient-to-patient transmission. Healthcare workers are vulnerable and can transmit and acquire infectious diseases as well. Stringent safety practices and guidelines must be adhered to with high vigilance.

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REFERENCES

- Vetter N, Matthews I (1999) *Epidemiology and public health*. Churchill Livingstone, London, 23–43.
- Peiris J, Lai S, Poon L *et al.* (2003) Coronavirus as a possible cause of SARS. *Lancet* **361**, 1319–25.
- Drosten C, Gunther S, Preiser W, *et al.* (2003) Identification of a novel coronavirus in patients with SARS. *New Engl J Med* **348**, 1967–76. (Available at: <http://SARSReference.com/lit.php?id=12690091>)
- Ludwig B, Kraus FB, Allvolin R, *et al.* (2003) Viral zoonoses: a threat under control? *Intervirolgy* **46**, 71–8. (Available at: <http://SARSReference.com/lit.php?id=12684545>)
- World Health Organisation (2003) Severe acute respiratory syndrome. *Wkly Epidemiol Rec* **78**, 86.
- Gerberding JL (2003) Faster, but fast enough? Responding to the epidemic of SARS. *New Engl J Med* **348**, 2030–31.
- Ministry of Health, Singapore (2003) *Manual for SARS infection control in hospitals*. Ministry of Health, Singapore.
- Atlanta Centre for Disease Control and Prevention. (2003) *Severe acute respiratory syndrome*. Atlanta Centre for Disease Control and Prevention, Atlanta, GA. (Accessed 3 July, 2003 at: <http://www.cdc.gov/ncidod/sars/>)
- World Health Organisation (2003) *Case definition for surveillance of SARS*. World Health Organisation, Geneva. (Accessed 3 July, 2003 at <http://www.who.int/csr/sars/casedefinition>)
- Ministry of Health, Singapore (2003) *Guide for healthcare professionals*. Ministry of Health, Singapore. (Accessed at: <http://app.moh.gov.sg>).
- Hon KL, Leung CW, Cheng WTE, *et al.* (2003) Clinical presentations and outcome of SARS in children. *Lancet* **361**, 1701–03. (Published online at: <http://image.thelancet.com/extras/03let4127web.pdf>)
- Singapore Government (Cap.) *Infectious Diseases Act*. Singapore Government, Singapore, Section 15(1): (Cap. 137).
- Singapore Government (Cap.) *Infectious Diseases Act*. Singapore Government, Singapore, Section 17: (Cap. 137).
- Singapore Government (Cap.) *Infectious Diseases Act*. Singapore Government, Singapore, Section 14: (Cap. 137).
- Singapore Government (Cap.) *Infectious Diseases Act*. Singapore Government, Singapore, Section 9: (Cap. 137).
- Singapore Government (Cap.) *Infectious Diseases Act*. Singapore Government, Singapore, Section 21A: (Cap. 137).