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SARS: FOREWARNED, FOREARMED?

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What if the outbreak had taken off in the vast rural areas, or urban slums, of Southern Africa? Would we be able to contain it? In the era of globalisation, air travel makes any place on earth just a few hours away. Large human populations encroaching on the remaining forests, and living closely with animals, make the next major emerging disease only a matter of time.

Only two new infectious diseases have had a major global impact in the last 20 years: AIDS, and SARS (severe acute respiratory syndrome). AIDS forced us to re-examine sexual behaviour. SARS reminded us of deadly diseases spread by casual contact.

It has happened before: in 1918 Spanish Flu spread around the world and killed perhaps 40 million people. It was a major new influenza variant, possibly with recombined genes from animal strains. Humans had no previous or similar exposures to build immunity. We have been waiting for the next 'big one' ever since....

Cases of atypical pneumonia began to be noticed in Guandong, China in November 2002. Crucially, it was not until mid February, with an outbreak in Hong Kong, that the World Health Organization (WHO) was notified and the world realised this was a dangerous new disease. A frantic battle started to identify and contain the infection.

The initial picture was confusing: cases presented with fever and pneumonia, plus a wide variety of other symptoms. Clusters of cases among close contacts, and negative sputum cultures, suggested a virus. Health workers and researchers became infected, and several died. Case fatality approached 50% in the elderly, but for unknown reasons few children were affected. Investigators quickly deduced this was a new virus; they began to trace and isolate contacts, and followed elaborate infection control measures. But with no known organism and no specific treatment, it was all they could do to prevent a panic.

The most disturbing aspect was a small number of 'superspreading' events which suggested airborne transmission: microscopic aerosols from dried droplets, spreading long distances in the air. This is far more difficult to interrupt than spread via water or food, dirty hands, or even larger droplets from coughs or sneezes, which reach only a small distance. The Metropole Hotel in Hong Kong was a key superspreading event early in the epidemic. One visitor to the hotel originating from Guandong transmitted the virus to 12 others who spread the disease to Canada and Singapore. The Amoy Gardens apartments in Hong Kong became a cluster of 331 cases from one index case. Many health workers were infected despite very thorough precautions. Eventually, cases and secondary epidemics were reported in 29 countries around the world.

Meanwhile, known chains of infection suggested an incubation period of about 10 days, followed by a period of infectiousness proportional to severity. By March a newly discovered coronavirus (related to cold viruses) was found in many patients, but there was no reliable test for it.

In March 2003 WHO issued a Global Alert, followed by a rare Travel Advisory, to postpone trips to affected countries. The suspected case definition was a febrile disease with respiratory symptoms and travel to an affected area. Working in the dark, experts quickly issued the advice that would eventually control the epidemic: early identification and isolation of suspected cases; strict infection control measures starting with hand washing; tracing close contacts and quarantine (restricted movement of well persons) for 10 days of observation.

The outbreak led to 8 098 probable cases and 812 deaths over seven months. Truly heroic measures were needed to find and contain new outbreaks, particularly in China. For example, whole isolation hospitals were constructed within days to handle the thousands of suspected cases. Millions in Asia wore facemasks, in largely unnecessary efforts to ward off the disease. International air passengers from affected cities were subjected to temperature checks and interviews – airlines and tourist facilities lost billions.

WHO set up 3 global networks, laboratory, clinical and epidemiological, coordinating work to contain the disease. Out of necessity, international scientists began to cooperate and share results, rather than competing to publish. Fortunately, the picture that began to emerge was of a virus spread mainly by close contact and failures of ordinary hygiene. 'Superspreading' events were exceptional – but still not fully explained.

A handful of suspected cases in South Africa were investigated by the National Institute of Communicable Diseases in Johannesburg. Only one of them turned out to be a 'probable' case and there was no local spread. By July 2003 the last confirmed cases of SARS were successfully contained in China. Human transmission was declared to have ceased, and the world breathed a sigh of relief.

The virus 'SARS-CoV' is a newly emerged human pathogen, probably crossing from wild animals in contact with humans. The RNA genetic sequence is almost identical to coronaviruses in civet cats and other mammals in China, sold live in open-air markets for food. A series of mutations seem to have allowed the virus to spread more easily in humans. It is thought to have a reproductive rate (R_0, the number of secondary infections per case) of only about 3, much lower than more infectious diseases such as influenza or measles. The overall death rate is about 9.6%. The virus can be detected in special laboratories and serological tests have been developed to detect rising antibodies. Although we now have enough knowledge to contain it, the animal reservoir makes eradication of the virus unlikely. And even with the unprecedented pace of research progress, many other questions about the disease remain.

The exact modes of transmission are not known; it is possible that rats or cockroaches helped spread the disease via faecal contamination. Treatments such as antiviral drugs and steroids are still experimental; and a vaccine is not available. The interaction with other diseases such as AIDS and TB is not defined. Since the outbreak, a few isolated cases of SARS have been confirmed in China in the winter of 2003-4. Another large outbreak is still possible.

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Already, the attention has shifted to avian influenza A (type H5N1). This relatively harmless virus in ducks has jumped into Asian chicken farms, with disastrous mortality. It has killed several humans too, but so far does not spread easily between people. If it does, this could be the next major influenza pandemic.

The lessons from the SARS epidemic are vitally important to everyone. The bad news is that new, dangerous infections and outbreaks will certainly occur. The good news is that basic public health measures – sanitation, infection control, early case detection and isolation – can contain an infectious disease even before the organism or its treatment are understood; the same early success as with cholera nearly 200 years ago.

To ensure that success, South Africa needs to collaborate with global surveillance, reference laboratories, and the facilities that could quickly produce new drugs and vaccines. But even more so, we must have a basic infrastructure of experienced clinicians, epidemiologists, microbiologists in laboratories, and hospitals with isolation wards and good infection control. To borrow another phrase: the price of peace is eternal vigilance.

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