

Environmental, cultural and economic drivers for the emergence of SARS

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Severe Acute Respiratory Syndrome (SARS) was first reported in February 2003 in China. When the WHO declared the outbreak over on 5th July 2003, more than 8000 cases (over 800 fatal) had been reported in 32 countries worldwide. Knowledge of the origin of emerging agents and an understanding of the factors associated with emergence are fundamental to managing the risk of subsequent spillovers and associated disease outbreaks. With SARS, a succession of phylogenetic and epidemiological findings suggested that the outbreak had a wildlife origin, and that 'wet markets' in southern China were the origin of the outbreak. But wildlife markets are complex and dynamic places, with an ad-hoc mix of farmed and wild-caught wildlife housed, sold and slaughtered side-by-side. A WHO mission to China in August 2003 developed a causal model with interacting natural, market, human, and peri-human animal components. This model was a useful tool not only for conceptualising the likely complexity of the system, but also for identifying possible transmission control points. For example, regulation (or elimination) of the trade in wild-caught wildlife might control transmission to market and farm populations, and thus to humans; elimination of infection in the farmed wildlife population and on-going monitoring might control transmission within this group, and thus to wildlife markets, and humans.

Identifying the factors associated with the emergence of SARS requires an understanding of the ecology of infection both in the natural reservoir and in secondary market reservoir species. Thus, a necessary extension of understanding the ecology of the reservoir is an understanding of the trade, and of the social and cultural context of wildlife consumption. In relation to trade, we know that a wholesale and retail structure exists in the wildlife trade in southern China, with multiple wholesalers providing multiple retailers at a city level. We know that some wildlife are farmed and some wild-caught. What about the marketing structure? Are there dealers who buy and sell from both sources? How much farm-to-farm trading occurs? Do farms periodically augment their stock from the wild?

Directly related to the above is an understanding of what drives the wildlife trade – a complex mix of economic, social and cultural factors. The demand for, and consumption of, wildlife in southern China has increased in recent years, purportedly associated with improved economic conditions. An increase in legal and illegal wildlife trade has paralleled this demand, with animals reportedly channelled from many and various locations in south-east Asia. A rich cultural heritage underlies wildlife consumption in China. Different species and dishes are favoured for a range of social, business and health reasons. For example, the masked palm civet (*Paguma larvata*), the putative source of the human outbreak, was historically eaten in winter when fresh fruit was often unavailable. People believed that eating the animal (known colloquially as the *fruit fox* or *flower fox* because of its dietary preferences) provided the same health benefits as eating the fruit. And in the markets, wild-caught civets still

attract a price premium, because people believe it is more health-giving (and tastes better) than its grain-fed farmed counterpart.

The significance of cultural and economic drivers on disease emergence are increasingly being recognised. Parallels between the 'wet markets' and SARS in China, and the bush-meat trade and HIV-like viruses in Africa are evident. The need for a combination of 'hard' and 'soft' sciences and a 'big-picture' view is increasingly evident.