
RAPID REPORTS

Global spread of COVID-19 and pandemic potential

C Raina MacIntyre¹

¹ Biosecurity Program, Kirby Institute, University of New South Wales, Sydney, Australia

The WHO has not yet declared a pandemic of SARS-CoV-2, the virus that causes COVID-19. The epidemic began in December 2019 (1). Extraordinary and unprecedented measures taken in China, which involved travel restrictions for almost half the population and lockdown of a population greater in size than the entire population of the United States, has resulted in a decline in cases in China. Figure 1 shows the epidemic in China peaked on February 5th, 2020 and has been declining since. This shows the impact of the lockdown of Wuhan, commencing on January 23rd, with a decline evident toward the end of 1 incubation period from the lockdown. This is good evidence of an impact of the lockdown strategy.

However, as the epidemic came under control in China, outbreaks on a cruise ship docked Japan, in the Republic of Korea, Italy and Iran have raised concerns about a pandemic being imminent. Whilst there are several different definitions of a pandemic, we are waiting to see evidence of sustained domestic transmission in two or more continents. The virus has pandemic potential as it is a respiratory virus with a R_0 of 2.2,(2) which is comparable to influenza (3). Outbreaks have also occurred in closed settings such as prisons, hospitals and aged care facilities, with growing localised epidemics in other countries. In Iran, [a high ratio of deaths to cases](#) suggests a substantial proportion of undiagnosed cases and community transmission.

The most important difference in transmission of COVID-19 compared to SARS in 2003 is that substantial transmission is possible with mild symptoms or no symptoms. The clinical illness is characterised by a long, mild prodrome that can last 5-9 days before people seek medical attention, which is a risk period for community transmission (4). Further, the highest viral shedding is at the start of the illness when symptoms are mild (5). Asymptomatic transmission has been documented (6) Further, the viral load in symptomatic and asymptomatic people is not significantly different, so the infectiousness may be the same in asymptomatic cases (5). This makes control much more challenging than for SARS, which was only contagious while people were symptomatic. The Japanese were the first to begin testing all at-risk return travellers, regardless of symptoms. They found 5/8 positive in 565 people evacuated from Wuhan (7). Based on these data and the number of cases confirmed in China at the time, it is estimated that

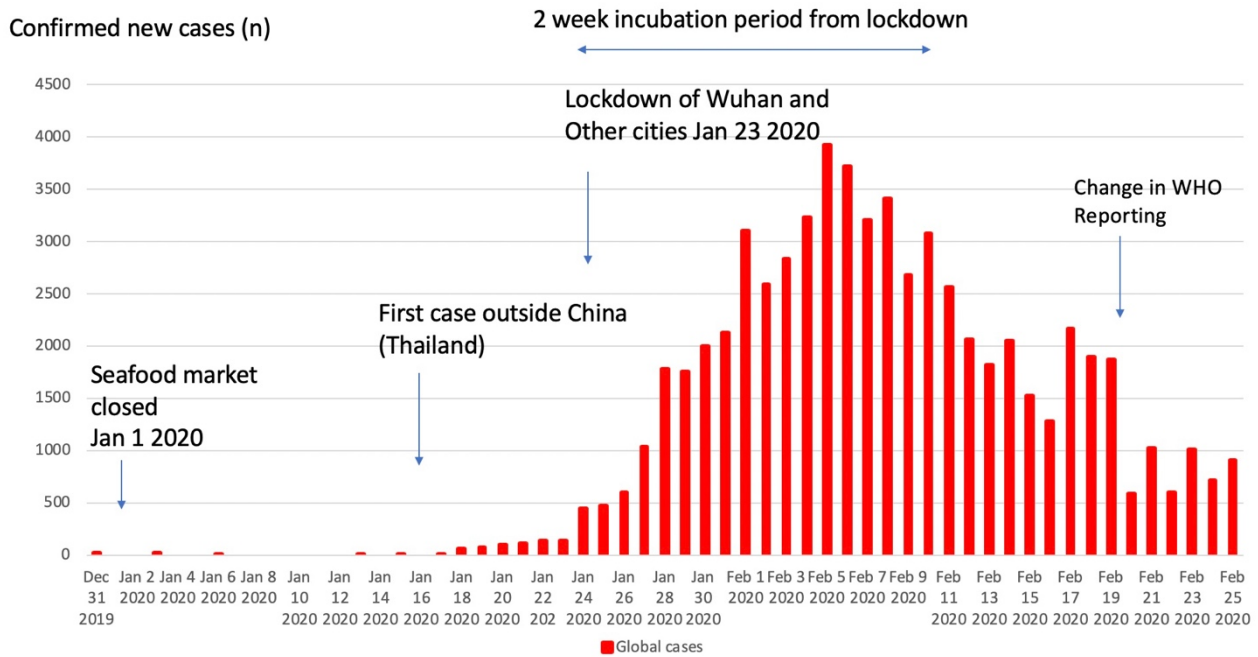
over 90% of cases are undetected (7). Children and young people are more likely to have asymptomatic or mild infection, so may be contributing to silent transmission (8).

Figure 2 shows the epidemic curves in South Korea, Italy and Iran. Using the incubation period of 2 weeks and working back, it appears that an undetected transmission event may have occurred in South Korea around the 4th of February, in Italy around the 8th of February and in Iran around the 9th of February. In South Korea, 1 case was identified on February 4th, and six more cases in the next two days. It is likely there were other missed, asymptomatic or mildly symptomatic cases in this small cluster, which has given rise to the much larger outbreak evident by February 19th. At this point, enhanced testing and case finding may have identified more cases rapidly. In Italy, there was 1 case reported on February 7th, which may have been associated with other undetected cases or been a super-spreader event. In contrast in Iran, there were no cases reported until February the 20th, which points to the initial transmission event around February the 9th being missed entirely.

There may still be a prospect of the epidemics in Italy and Iran being controlled, although the open borders in the European Union may enable onward transmission across Europe. Similarly, the porous borders between Iran and its neighbours including Pakistan, Afghanistan and Iraq, may result in a pandemic. Countries with weak health systems and poor diagnostic capacity may be susceptible to large epidemics. It is also possible that the pandemic definition will be met, but that some countries will manage to contain the spread better than others. Importantly, China has reported almost 80,000 cases by February 25th. Even if only 10% of cases are being diagnosed in China, and the true case number is closer to 8 million, this represents a very low attack rate from a population of almost 1.4 billion people. This means the majority of people in China remain uninfected and susceptible to the infection. An undetected transmission event anywhere in the country could begin a new epidemic chain of transmission.

In high income countries with ageing populations, such as The United States, Australia, Japan and Italy, may see proportionately higher morbidity and mortality impact compared to China. In Australia, for example, 16% of people are aged >65 years, compared to 9% in China.

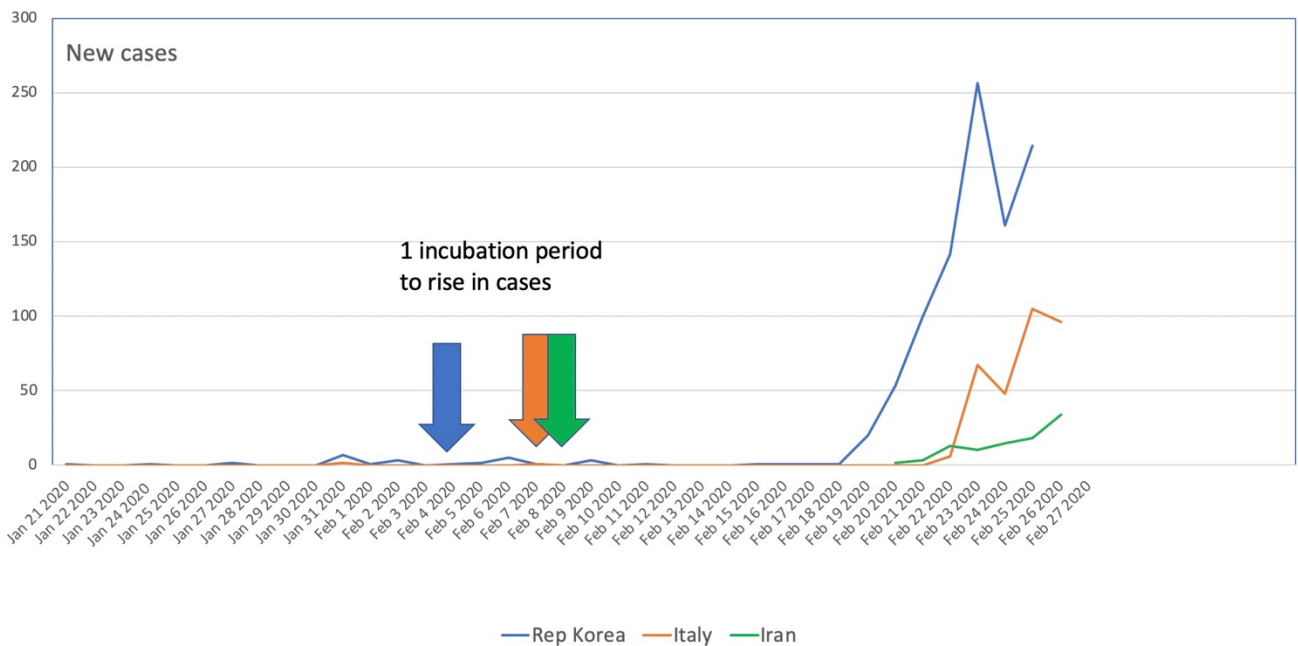
Figure 1. COVID-19 epidemic curve, China, Dec 31 2019 – February 25th 2020*



Data sources: [PROMEDmail](#), WHO, media reports

*Data sourced from media reports, ProMED-Mail and WHO situation reports (available since Jan 21, 2020).

Figure 2. COVID-19 epidemic curve, South Korea, Italy and Iran – February 27th 2020



We have previously modelled the health system surge capacity requirements for a different infection, smallpox, and showed that hospital beds, PPE and other supplies may rapidly run out (9). If an epidemic lasted 6 months, we would need 30 million masks and respirators for our health workers (9). As such, countries that have managed to contain it should persist with all possible measures such as restricting travel and quarantine (3). Even delaying the peak will be beneficial. Delay provides more for preparedness, expansion of health system capacity and a shorter window toward having a vaccine. Meanwhile, all efforts should be made to contain the current epidemics in South Korea, Italy and Iran, as well as to trace the source of these epidemics. It is clear now that anyone at risk, whether contacts or high risk return travellers, should be tested, given the data on asymptomatic transmission (5). The efforts of China in stopping the epidemic must be matched by other countries, or a pandemic will occur.

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How to cite this article: MacIntyre, CR. Global spread of COVID-19 and pandemic potential. *Global Biosecurity*, 2020; 1(3).

Published: February 2020

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