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EDITORIAL

Occupational risks for COVID-19 infection

Coronaviruses are enveloped RNA viruses found in mammals, birds and humans. At present, six coronavirus species are known agents for illnesses in humans. Four viruses—229E, OC43, NL63 and HKU1—are prevalent and can cause respiratory symptoms. The other two—severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV)—are zoonotic in origin and can cause fatalities [1].

SARS-CoV originated in Guangdong Province, China and was responsible for the severe acute respiratory syndrome outbreaks in 2002 and 2003. It rapidly spread across the globe and resulted in 8098 reported cases and 774 deaths (case-fatality rate, 9.6%) in 37 countries. MERS-CoV originated in the Middle East and caused severe respiratory disease outbreaks in 2012. Since 2012, there have been 2494 reported MERS-CoV cases resulting in 858 deaths (case-fatality rate, 34%) in 27 countries. There were also several rapid outbreaks reported, mainly in hospitals in Saudi Arabia, Jordan and South Korea [2].

On 31 December 2019, the World Health Organization (WHO) China office was informed of cases of pneumonia of unknown aetiology detected in Wuhan city in Hubei Province, central China [3]. By 9 January 2020, WHO released a statement on the cluster of cases, which stated that 'Chinese authorities have made a preliminary determination of a novel (or new) coronavirus, identified in a hospitalized person with pneumonia in Wuhan' [4]. The virus was initially referred to as 2019-nCoV, but has since been re-named as SARS-CoV-2 by the WHO on 12 February 2020.

Early indications are that the overall case-fatality rate is around 2%. An analysis of the first 425 cases provided an estimated mean incubation period of 5.2 days (95% confidence interval [CI] 4.1–7.0) and a basic reproductive number (R_o) of 2.2 (95% CI 1.4–3.9) [1]. It is possible that people with Coronavirus Disease 2019 (COVID-19) may be infectious even before showing significant symptoms [5]. However, based on currently available data, those who have symptoms are causing the majority of virus spread. The WHO declared this disease as a Public Health Emergency of International Concern (PHEIC) on 30 January 2020 [6].

A significant proportion of cases are related to occupational exposure. As this virus is believed to have originated from wildlife and then crossed the species barrier to infect humans, it is not unexpected that the first documented occupational groups at risk were persons working in seafood and wet animal wholesale markets in Wuhan. At the start of the outbreak, workers and visitors to the market comprised 55% of the 47 cases with onset before 1 January 2020, when the wholesale market was closed. In comparison, only 8.5% of the 378 cases with onset of symptoms after 1 January 2020 had a link with exposure at the market [1].

As cases increased and required health care, health care workers (HCWs) were next recognized as another high-risk group to acquire this infection. In a case series of 138 patients treated in a Wuhan hospital, 40 patients (29% of cases) were HCWs. Among the affected HCWs, 31 (77.5%) worked on general wards, 7 (17.5%) in the emergency department, and 2 (5%) in the intensive care unit (ICU). There was apparently a super-spreader patient encountered in the hospital, who presented with abdominal symptoms and was admitted to the surgical department. This patient infected >10 HCWs in the department [7]. China's Vice-Minister at the National Health Commission said that 1716 health workers had been infected in the country as of Tuesday 11 February 2020, among whom 6 have died [8].

Outside of China, the first confirmed case of COVID-19 infection in Singapore was announced on 23 January 2020 by the Ministry of Health, Singapore (MOH-Sg). The MOH-Sg issues daily press reports to describe case details of confirmed COVID-19 patients. As of 11 February 2020, a total of 47 cases have been confirmed [9]. Among the first 25 locally transmitted cases, 17 cases (68%) were probably related to occupational exposure (Table 1). They included staff in the tourism, retail and hospitality industry, transport and security workers, and construction workers.

An international business meeting for 109 staff was organized by a multinational company from 20–22 January 2020 in Singapore. At this event, healthy company workers interacted with other infected participants, which resulted in the transmission of the virus to three employees based in Singapore. Besides those infected from Singapore, one employee from Malaysia, two participants from South Korea and one staff member from the UK were also infected. They presented as cases after leaving Singapore.

Crew on board cruise ships with infected passengers are also at risk. At least 10 cases have been reported among

Table 1. Probable occupationally acquired COVID-19 among 25 locally transmitted cases in Singapore, 4–11 February 2020

Case description (case no.[a])	No. of cases
Staff working in a retail store selling complementary health products primarily serving Chinese tourists (Cases 19, 20, 34, 40)	4
Domestic worker who worked for Case 19 (Case 21)	1
Tour guide who led tour group from China (Case 24)	1
Jewellery store worker who served Chinese tourists (Case 25)	1
Multinational company staff attending an international business meeting in Singapore (Cases 30, 36, 39)	3
Taxi driver (Case 35)	1
Private hire car driver (Case 37)	1
Resorts World Sentosa employee (Case 43)	1
Security officer who served quarantine order to two persons (Case 44)	1
Casino worker (Case 46)	1
Cluster of two workers at the same construction site[b] (Cases 42 and 47)	2

[a]The case no. denotes the order of cases according to the time of announcement by the Ministry of Health, Singapore. The first 18 cases were imported cases.
[b]Two other cases (Cases 52 and 56) were reported from the same worksite 2 days later.

the 1035 crew on the liner Diamond Princess, which is currently docked in Yokohama with around 3600 people quarantined since 3 February 2020. A Hong Kong man boarded the ship on 20 January in Yokohama at the beginning of a 14-day round trip cruise. The passenger sailed from Yokohama to Hong Kong, where he disembarked on 25 January. The ship continued its journey, until news was received that the passenger tested positive on 1 February 2020. The Diamond Princess returned to Yokohama a day early, and has been quarantined since then, with guests isolated in their cabins and screened [10]. The quarantine period will end on 19 February 2020. Another cruise ship, the Dutch liner Westerdam, sailed out of Hong Kong on 1 February 2020. It was turned away by the Philippines, Taiwan, Korea, Japan, Thailand and the US territory of Guam, because of fears arising from the COVID-19 outbreak—even though there was apparently no confirmed case on board [11]. The ship was finally allowed to dock in Sihanoukville, Cambodia after 13 days at sea.

Besides fears of contagion from people on board cruise ships, which have been likened to 'floating petri dishes', fears are also widespread on land. There are increasing reports of HCWs being shunned and harassed by a fearful public because of their occupation. A Member of Parliament in Singapore highlighted what he termed as 'disgraceful actions' against HCWs stemming from fear and panic [12]. Some examples of behaviour described were:

> Taxi drivers reluctant to pick up staff in medical uniform.
>
> A healthcare professional's private-hire vehicle cancelled because she was going to a hospital.
>
> A nurse in a lift asked why she was not taking the stairs and that she was spreading the virus to others by taking the lift.
>
> A nurse scolded for making the Mass Rapid Transit train "dirty" and spreading the virus.
>
> An ambulance driver turned away by food stall workers.

However, not all the reactions from the public towards HCWs have been negative. There are probably an equal number of stories of public support and encouragement. Members of the public have showed their appreciation for HCWs and have volunteered to help the more vulnerable in society [13]. For example, a ride-hailing transport operator started a new service offering a dedicated 24-h service for HCWs travelling from work. Volunteers have also stepped forward to distribute hand sanitizers and masks to the elderly and vulnerable in their community, while sharing important public health messages.

Such reactions are reminiscent of behaviour during the 2003 SARS outbreak, where not only the general public, but even close family members were afraid of being infected by HCWs exposed to the disease. A survey of over 10 000 HCWs in Singapore during the SARS outbreak of 2003 reported that many respondents experienced social stigmatization. Almost half (49%) thought that 'people avoid me because of my job' and 31% felt that 'people avoid my family members because of my job'. For example, some parents of schoolchildren forbade their children to play or be close to children of HCWs. A large number (69%) of HCWs also felt that 'people close to me are worried they might get infected through me' [14]. On the other hand, there was also massive public support for HCWs, who were hailed as heroes in the fight against the disease. Most of the HCWs (77%) felt appreciated by society.

COVID-19 is the first new occupational disease to be described in this decade. Our experiences in coping with the previous SARS-CoV and MERS-CoV outbreaks have better prepared us to face this new challenge. While the explosive increase in cases in China has overwhelmed the health care system initially, we know that public health measures such as early detection, quarantine and isolation of cases can be effective in containing the outbreak. All health personnel should be alert to the risk of COVID-19 in a wide variety of occupations, and

not only HCWs. These occupational groups can be protected by good infection control practices. These at-risk groups should also be given adequate social and mental health support [15], which are needed but which are sometimes overlooked.

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References

1. Li Q, Guan X, Wu P *et al*. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med*, doi:10.1056/NEJMoa2001316.
2. Swerdlow DL, Finelli L. Preparation for possible sustained transmission of 2019 novel coronavirus: lessons from previous epidemics. *J Am Med Assoc*, doi:10.1001/jama.2020.1960.
3. World Health Organization. Pneumonia of Unknown Cause – China. https://www.who.int/csr/don/05-january-2020-pneumonia-of-unkown-cause-china/en/ (14 February 2020, date last assessed).
4. WHO Statement Regarding Cluster of Pneumonia Cases in Wuhan, China. https://www.who.int/china/news/detail/09-01-2020-who-statement-regarding-cluster-of-pneumonia-cases-in-wuhan-china (14 February 2020, date last assessed).
5. Rothe C, Schunk M, Sothmann P *et al*. Transmission of 2019-nCoV infection from an asymptomatic contact in Germany. *N Engl J Med*, doi:10.1056/NEJMc2001468.
6. WHO Statement on the Second Meeting of the International Health Regulations (2005) Emergency Committee Regarding the Outbreak of Novel Coronavirus (2019-nCoV). https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov) (14 February 2020, date last assessed).
7. Wang D, Hu B, Hu C *et al*. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *J Am Med Assoc*, doi:10.1001/jama.2020.1585.
8. Channel News Asia. China Says 6 Health Workers Died from Coronavirus, 1,716 Infected. https://www.channelnewsasia.com/news/asia/china-health-workers-died-from-coronavirus-thousands-infected-12435468 (14 February 2020, date last assessed).
9. Ministry of Health Singapore Press Releases. https://www.moh.gov.sg/ (14 February 2020, date last assessed).
10. Beth M. 175 Now Infected with Coronavirus on Cruise Ship, Including Quarantine Officer. https://arstechnica.com/science/2020/02/175-now-infected-with-coronavirus-on-cruise-ship-including-quarantine-officer/ (14 February 2020, date last assessed).
11. Janene P. Dutch Cruise Ship Allowed to Dock in Cambodia; Health Ministers Gather to Discuss Coronavirus. https://nltimes.nl/2020/02/13/dutch-cruise-ship-allowed-dock-cambodia-health-ministers-gather-discuss-coronavirus (14 February 2020, date last assessed).
12. Anna M. Amrin Amin Calls Out 'Disgraceful Actions' Brought about by Covid-19 Fears. https://www.msn.com/en-sg/news/singapore/amrin-amin-calls-out-disgraceful-actions-brought-about-by-covid-19-fears/ar-BBZWZ4H?li=BBr8Cnr (14 February 2020, date last assessed).
13. Tang SK, Jalelah AB. New Ways for Singaporeans to Offer Help and Support Amid Outbreak of COVID-19: Desmond Lee. https://www.channelnewsasia.com/news/singapore/covid-19-coronavirus-new-ways-for-singaporeans-to-offer-help-12427792 (14 February 2020, date last assessed).
14. Koh D, Lim MK, Chia SE *et al*. Risk perception and impact of severe acute respiratory syndrome (SARS) on work and personal lives of healthcare workers in Singapore: what can we learn? *Med Care* 2005;**43**:676–682.
15. Xiang YT, Yang Y, Li W *et al*. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *Lancet Psychiatry*, doi:10.1016/S2215-0366(20)30046-8.