

How are the most serious COVID-19 cases treated, and does the coronavirus cause lasting damage?

Written by Peter Wark, Conjoint Professor, School of Medicine and Public Health, University of Newcastle

As the number of COVID-19 cases around the world continues to climb, hospitals are under increased pressure to provide emergency care for the most severely ill patients. What does this involve, and how does the coronavirus damage the respiratory system?

The virus first invades our bodies by [attaching to a protein called ACE2](#) on cells in the mouth, nose and airways. For the first week of infection, symptoms are relatively mild, with sore throat, cough and fever. Some people, [particularly children](#), may carry the virus with [few if any symptoms](#) at all.

Read more: [**Coronavirus: how long does it take to get sick? How infectious is it? Will you always have a fever? COVID-19 basics explained**](#)

But this early stage also seems to be the time at which people are [most infectious to others](#).

The Wuhan data

As the place where the pandemic originated, the Chinese city of Wuhan has yielded the [biggest and most useful set of cases](#) from which we can analyse the disease's typical progression.

From days four to nine after infection, the symptoms worsen, with increasing breathlessness and cough. In those ill enough to be admitted to hospital, more than half require assistance with oxygen, usually in a standard hospital ward. Some patients suffer worsening breathing difficulties that necessitate admission to an intensive care unit (ICU), typically eight to fifteen days after the illness began.

What happens in ICU?

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In ICU, various treatments can support these more serious breathing problems. This includes high-flow humidified oxygen, delivered via a nasal mask. The oxygen is warmed and its humidity artificially increased so as to avoid uncomfortable dryness. It is gently pumped into the lungs at a comfortable rate that still allows the patient to speak and eat.

If breathing worsens further, the patient is then intubated. This involves inserting a tube through the mouth and into the windpipe, through which oxygen is delivered via a ventilator. Intubated patients need to be sedated (kept asleep) until their lungs recover enough to work without assistance.

In the most severe cases, where the lungs fail and it is not possible to deliver enough oxygen by ventilator, patients are given [extracorporeal membrane oxygenation](#), which effectively outsources the work normally done by the heart and lungs to an external machine. Blood is carried from the body, and carbon dioxide removed and oxygen added, before it returns to the patient's circulation. This is the most advanced form of life support, but also carries the highest risks and the longest recovery times.

An [analysis of adult COVID-19 patients treated at two Wuhan hospitals](#) found that 50 of the 191 cases studied required ICU treatment.

Of these 50 ICU patients, 41 received high-flow humidified oxygen, 33 were intubated, and 3 received extracorporeal membrane oxygenation.

Only 8 of the 41 patients treated with high-flow oxygen survived, and just one of the intubated patients. Overall, 11 of the 50 ICU patients survived. But those who did recover seemed to do so reasonably rapidly: 75% were discharged within 25 days.

Data from outside China is more limited, but offers more grounds for optimism. A [review](#) of 18 hospitalised patients in Singapore found that six needed oxygen support with oxygen, but just two were admitted to ICU and only one was intubated, and this patient was able to go home a mere six days after coming off respiratory support.

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From Washington state in the US, among [21 cases admitted to the ICU](#), 17 were admitted to ICU within 24 hours of hospital admission and 15 required intubation. Besides their respiratory distress, seven developed heart damage, four suffered kidney failure, and three liver damage. As of March 17, 11 of the patients had died, two had left the ICU, and eight still needed ventilation.

Does the disease cause long-term symptoms?

At this stage there is no data on the long-term effects of COVID-19. But we can look at the after-effects of other acute viral respiratory diseases such as [influenza, SARS and Middle East respiratory syndrome \(MERS\)](#)

In these diseases, collectively called acute respiratory distress syndromes (ARDS), the fragile small airways and air sacs become damaged by inflammation, can become blocked by fluid and blood, and are replaced by scar tissue as they heal. This can stiffen the lungs – at first from fluid and then from scar tissue – impairing their ability to transfer oxygen and making breathing more laboured. In SARS and MERS this damage appears to occur as the virus is being destroyed by the immune response.

Read more: [How does coronavirus kill?](#)

How long does it take to recover from ARDS? One [survey of 396 German patients](#) found that 50% were hospitalized for 48 days or longer during the year following their original recovery. A smaller review of [37 ICU survivors of pandemic influenza in 2009](#), found that roughly half still complained of severe breathlessness on exertion but, more promisingly, 83% had returned to work.

At this stage our best course of action is to focus on slowing the coronavirus's spread and protecting the most vulnerable. The death rate from COVID-19 is worse in countries where health services have become overwhelmed. Our best bet is to maximise our resources by minimising the number of people who suffer severe symptoms.

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