WHAT THE CRUISE-SHIP OUTBREAKS REVEAL ABOUT COVID-19

Closed environments are an ideal place to study how the new coronavirus behaves.

By Smriti Mallapaty

When COVID-19 was detected among passengers on the cruise ship *Diamond Princess*, the vessel offered a rare opportunity to understand features of the new coronavirus that are otherwise hard to investigate. Some of the first studies from the ship have provided estimates of the disease's severity and allowed researchers to investigate the share of infections with no symptoms.

Information gleaned from such outbreaks is crucial for people making decisions on how to manage the epidemic, say researchers.

"Cruise ships are like an ideal experiment of a closed population. You know exactly who is there and at risk and you can measure everyone," says John Ioannidis, an epidemiologist at Stanford University in California. This is different from studying the spread in a wider population, where only some people, typically with severe symptoms, are tested and monitored.

On 1 February, a passenger who had disembarked from the *Diamond Princess* days earlier in Hong Kong tested positive for the COVID-19 coronavirus. The ship was quarantined immediately after it arrived in Japanese waters on 3 February, with 3,711 passengers and crew members on board. Over the next month, more than 700 people were infected.

Outbreaks seed easily on cruise ships because of the close confines and high proportions of older people, who tend to be more vulnerable to the disease. Since the *Diamond Princess*, at least 25 other such vessels have confirmed COVID-19 cases — including 78 cases on the *Grand Princess*, which was quarantined off the coast of California.

Japanese officials ran more than 3,000 tests aboard the *Diamond Princess*. Testing almost all of the passengers and crew helped researchers to understand a key blind spot in many infectious-disease outbreaks — how many people are actually infected, including those who have mild symptoms or none at all. These cases often go undetected in the population.

One team reports in *Eurosurveillance* that by 20 February, 18% of all infected people on the ship had no symptoms (K. Mizumoto *et al*. *Euro Surveill*. **25**, 2000180; 2020). "That is a substantial number," says co-author Gerardo Chowell, an epidemiologist at Georgia State University in Atlanta.

Another team used data from the ship to estimate that in China, the proportion of deaths among people confirmed to have the disease — the case fatality rate (CFR) — was 1.1% (T. W. Russell *et al*. Preprint at medRxiv http://doi.org/dqrk; 2020), lower than the 3.8% estimated by the World Health Organization.

The agency divided China's total number of deaths by the number of confirmed infections, says Timothy Russell, an epidemiologist at the London School of Hygiene and Tropical Medicine. This does not take into account that only a fraction of infected people are tested, and makes the disease seem more deadly than it is, he says.

Russell and his colleagues used data from the ship — where almost everyone was tested, and all 7 deaths recorded — and compared it with more than 72,000 confirmed cases in China, making their CFR estimate more robust.

The group also estimates that the infection fatality rate (IFR) in China — the proportion of all infections, including asymptomatic ones, that result in death — is even lower, at roughly 0.5%. The IFR is especially tricky to calculate in the population, because some deaths go undetected if the person didn't show symptoms.

The IFR helps public-health officials to understand disease severity and how to intervene, says Marc Lipsitch, an infectious-disease epidemiologist at the Harvard T.H. Chan School of Public Health in Boston, Massachusetts.

RARE OZONE HOLE OPENS OVER THE ARCTIC — AND IT'S BIG

Cold temperatures created the hole, which is about three times the size of Greenland.

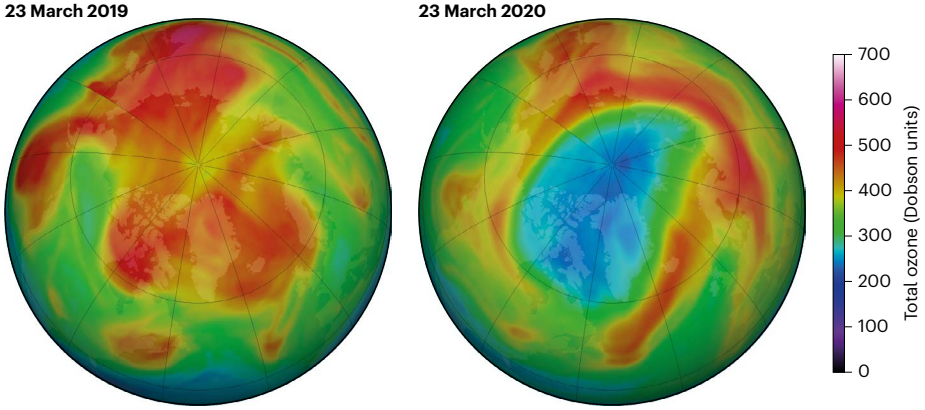
By Alexandra Witze

A vast ozone hole — probably the biggest on record in the north — has opened in the skies above the Arctic. It rivals the better-known Antarctic ozone hole that forms in the Southern Hemisphere each year.

Record-low ozone levels currently stretch across much of the central Arctic, covering an area about three times the size of Greenland (see 'Arctic opening'). The hole doesn't threaten people's health, and will probably disappear in the coming weeks. But it is an extraordinary atmospheric phenomenon that will go down in the record books.

ARCTIC OPENING

A rare and record ozone hole has formed over the Arctic. An opening in the ozone layer appears each spring over the Antarctic, but the last time this phenomenon was seen in the north was in 2011.



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