rural environments — how to protect yourself from nature", she says. "They don't really cover urban field safety — what to do if you're getting harassed by the public."

And the advice that is often offered to researchers working in towns and cities — to call the police if they feel unsafe — isn't practical for everybody, Perkins says. "I've never called the police; I don't feel comfortable calling the police," she says. "Safety definitely looks different depending on who you are."

As a woman, Perkins has been cat-called, and because she's Black, she's been stared at warily by residents of wealthy neighbourhoods she's worked in. To minimize these risks, she prepares herself for a day in the field by wearing university-branded clothing, carrying literature describing the project and letting residents know in advance when she'll be conducting research in their area.

Course collision

Some students have had to confront potentially unsafe fieldwork courses at their universities when their identities weren't taken into consideration. At Imperial College London, the master's degree programme in petroleum geoscience used to include a compulsory field course in Oman — one of the more than 70 countries around the world where same-sex relations are criminalized. No guidance or alternatives were provided to scientists from sexual and gender minorities (LGBT+) who might have been endangered by the trip. This didn't sit right with Chris Jackson, a geoscientist at Imperial.

He was met with resistance when he first brought his concerns to the department, in late November 2019. But the department eventually agreed to allow students to opt out if they had any safety concerns ahead of the trip in February. The programme also pledged to prepare explicit guidance for assessing risks to LGBT+ scientists.

But that solution wasn't good enough, Jackson says, so he, along with others at the university, kept pushing. In late June, the department responded to the efforts by replacing the trip with a classroom experience using data from Oman, along with a machine-learning course to address skills used in the modern energy industry. A spokesperson for Imperial says that the university is committed to creating an environment where all students "feel safe, included, and able to be themselves".

It's not enough to consider the hazards that field scientists think of as "classically risky", Jackson says. "We need to take a slightly more full-spectrum view for all the population demographics."

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The risk of dying from COVID-19 increases significantly with age.

THE CORONAVIRUS IS MOST DEADLY IF YOU ARE OLD AND MALE

A slew of detailed studies has now quantified the increased risk the virus poses for various groups.

By Smriti Mallapaty

For every 1,000 people infected with the coronavirus who are under the age of 50, almost none will die. For people in their fifties and early sixties, about five will die — more men than women. The risk then climbs steeply as the years accrue. For every 1,000 people in their mid-seventies or older who are infected, around 116 will die. These are the stark statistics obtained by some of the first detailed studies into the mortality risk for COVID-19.

Trends in coronavirus deaths by age have been clear since early in the pandemic. Research teams looking at the presence of antibodies against SARS-CoV-2 in people in the general population — in Spain, England, Italy and Geneva in Switzerland — have now quantified that risk, says Marm Kilpatrick, an infectious-disease researcher at the University of California, Santa Cruz.

"It gives us a much sharper tool when asking what the impact might be on a certain population that has a certain demographic," says Kilpatrick.

The studies reveal that age is by far the strongest predictor of an infected person's risk of dying — a metric known as the infection fatality ratio (IFR), which is the proportion of people infected with the virus, including those who didn't get tested or show symptoms, who will die as a result.

"COVID-19 is not just hazardous for elderly people, it is extremely dangerous for people in their mid-fifties, sixties and seventies," says Andrew Levin, an economist at Dartmouth College in Hanover, New Hampshire, who has estimated that getting COVID-19 is more than 50 times more likely to be fatal for a 60-year-old than is driving a car.

But "age cannot explain everything",

says Henrik Salje, an infectious-disease epidemiologist at the University of Cambridge, UK. Gender is also a strong risk factor: men are almost twice as likely as women to die from the coronavirus (see 'Vulnerable men'). And differences between countries in the fatality estimates for older age groups suggest that the risk of dying from coronavirus is also linked to underlying health conditions, the capacity of health-care systems and whether the virus has spread among people living in elderly-care facilities.

To estimate the mortality risk by age, researchers used data from antibody-prevalence studies. In June and July, thousands of people across England received a pinprick antibody test in the post. Of the 109,000 randomly selected teenagers and adults who took the test, some 6% harboured antibodies against SARS-CoV-2. This result was used to calculate an overall IFR for England of 0.9% — or 9 deaths in every 1,000 cases. The IFR was close to zero for people between the ages of 15 and 44, increasing to 3.1% for 65–74-year-olds and to 11.6% for anyone older (see 'Risk with age'). The results of the study have been posted to the medRxiv preprint server[1].

Another study from Spain that started in April, and tested for antibodies in more than 61,000 residents in randomly selected households, observed a similar trend. The overall IFR for the population was about 0.8%, but it remained close to zero for people under 50, before rising swiftly to 11.6% for men 80 years old and over; it was 4.6% for women in that age group. The results also revealed that men are more likely to die of the infection than are women — and the gap increases with age.

"Men face twice the risk of women," says Beatriz Pérez-Gómez, an epidemiologist at the Carlos III Institute of Health in Madrid, who was involved in the Spanish study. The results have also been posted to the medRxiv server[2].

Differences in the male and female immune-system response could explain the divergent risks, says Jessica Metcalf, a demographer at Princeton University, New Jersey. "The female immune system might have an edge by detecting pathogens just a bit earlier," she says.

The immune system might also explain the much higher risk of older people dying from the virus. As the body ages, it develops low levels of inflammation, and COVID-19 could be pushing the already overworked immune system over the edge, says Metcalf. Worse outcomes for people with COVID-19 tend to be associated with a ramped-up immune response, she says.

The study in England also compared results from different ethnic groups. Mortality and morbidity statistics suggest that Black and South Asian people in England are more likely to die or to be hospitalized. But the analysis, led by Helen Ward, an epidemiologist at Imperial College London, found that although Black and South Asian people were much more likely to have been infected than were white people, they were no more likely to die of COVID-19.

Researchers note that there is a marked difference in IFR estimates between some countries, especially for people aged 65 and older[3]. An antibody-prevalence study in Geneva estimated an IFR of 5.6% for people in that age group[4]. This figure was lower than were estimates in Spain, which were about 7.2% for men and women aged 80 or more, and in England, which found an IFR of 11.6% for people aged 75 or older.

There could be many explanations for the differences, says Andrew Azman, an infectious-disease epidemiologist at Johns Hopkins Bloomberg School of Public Health in Baltimore, Maryland, who was part of the Geneva study.

Countries with higher rates of co-morbidities, such as diabetes, obesity and heart disease, will have a higher IFR. However, nations with health-care systems that are better able to deal with people who are severely ill with COVID-19, or where hospitals were not overwhelmed at the peak of the epidemic, will have better survival rates, he says.

Some of the differences could be attributed to how the various studies were conducted, say researchers. For example, such differences could include the reliability of antibody tests used in the various studies, how COVID-19 deaths were recorded and how researchers chose to divide populations by age.

There is some uncertainty in the data, so the estimates between studies might not be as different as they may seem, says Lucy Okell, an epidemiologist at Imperial College London, who was involved in the English study.

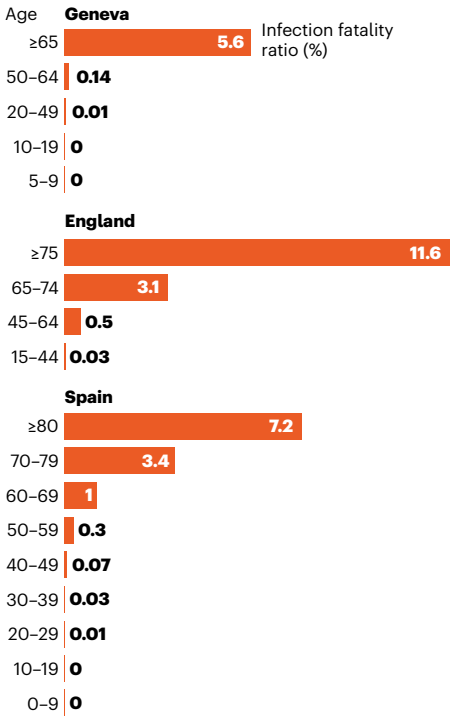
But a big factor in the different death rates reported between countries seems to be whether the virus spread in nursing homes.

In these places, people in fragile health live in close-knit environments where the virus can spread rapidly. When the English study took into account care-home deaths, the IFR in people aged 75 or older jumped from 11.6% to 18.7%. Salje estimates that the IFR for Canada, where some 85% of deaths occurred in nursing homes, would be significantly higher than that for Singapore, where nursing homes accounted for only 8% of deaths.

Although fatality estimates are important, they don't tell the full story of the toll COVID-19 takes, says Kilpatrick. "There is a fascination with death, but COVID-19 appears to cause a substantial amount of long-term illness," he adds.

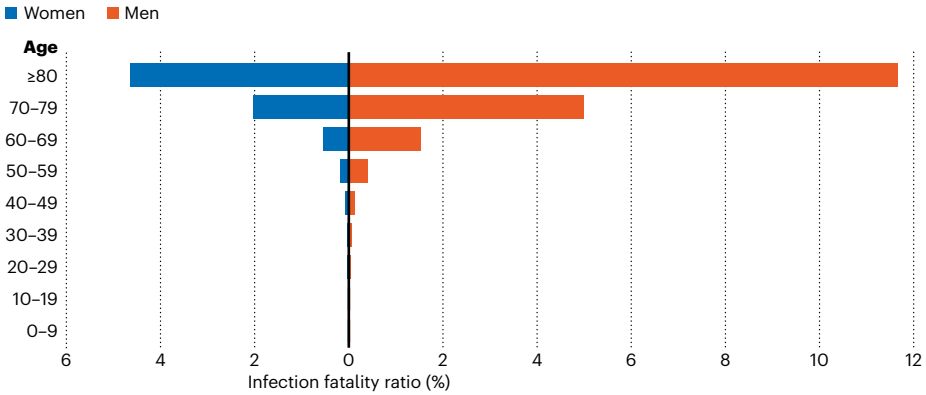
RISK WITH AGE

A person's age is the strongest predictor of their risk of dying of COVID-19. The risk increases from the age of 50.



VULNERABLE MEN

A study in Spain found that men are at higher risk of dying from COVID-19 than are women.



SOURCES: REF. 4; REF. 1; *NATURE* ANALYSIS BASED ON REF. 2

SOURCE: REF. 2

1. Ward, H. *et al.* Preprint at https://www.medrxiv.org/content/10.1101/2020.08.12.20173690v2 (2020).
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