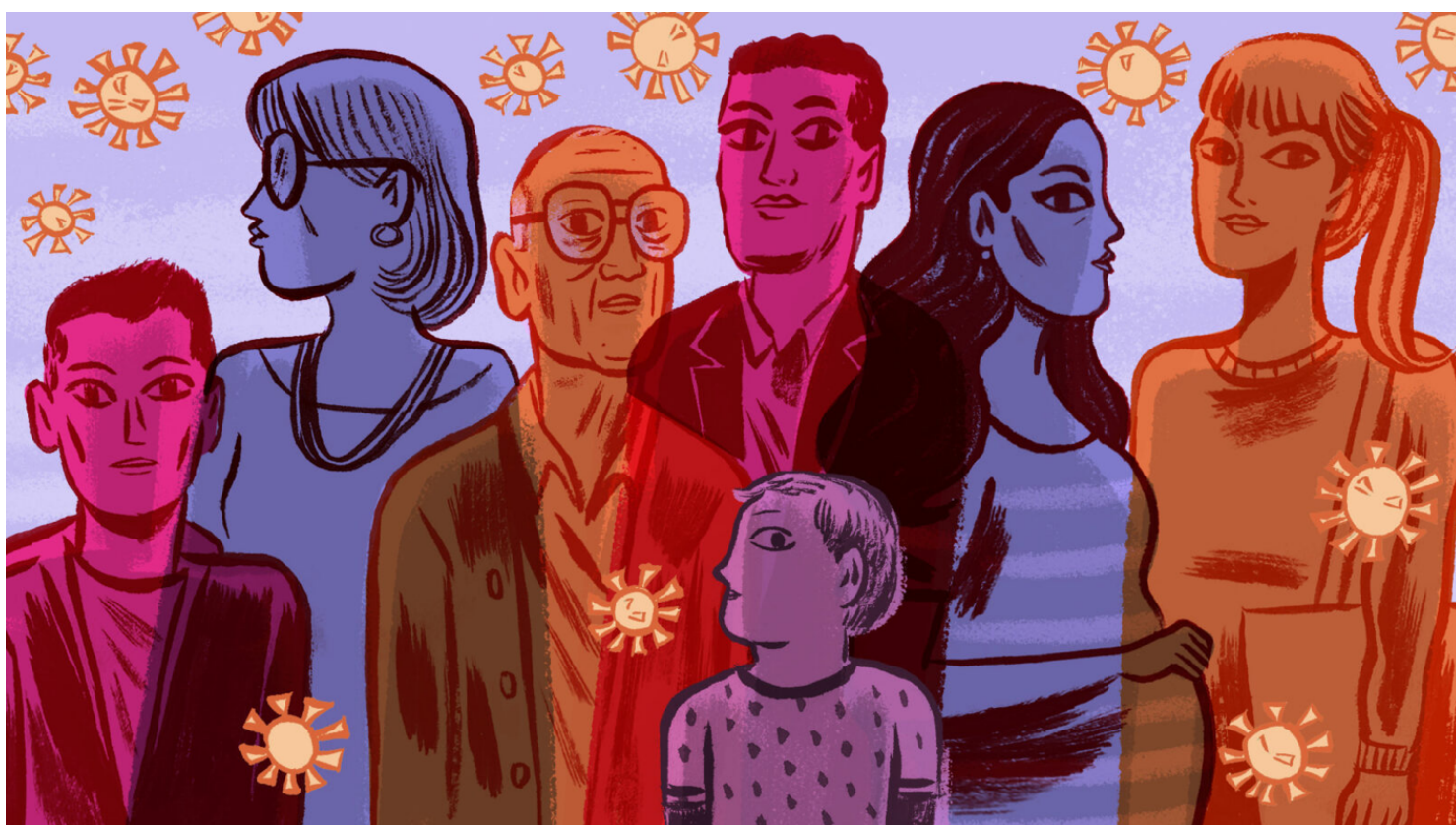


# STAT

## Who is getting sick, and how sick? A breakdown of coronavirus risk by demographic factors

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Mike Reddy for STAT

The new [coronavirus](#)<sup>4</sup> is not an equal-opportunity killer: Being elderly and having other illnesses, for instance, greatly increases the risk of dying from the disease the virus causes, Covid-19. It's also possible being male could put you at increased risk.

For both medical and public health reasons, researchers want to figure out who's most at risk of being infected and who's most at risk of developing severe or even

lethal illness. With that kind of information, clinicians would know whom to treat more aggressively, government officials would have a better idea of steps to take, and everyone would know whether they need to take special, additional precautions.

Here's what research has shown three months into the outbreak:

## Old and young

The vast majority of cases in China — 87% — were in people ages 30 to 79, the China Center for Disease Control [reported](#)<sup>5</sup> last month based on data from all 72,314 of those diagnosed with Covid-19 as of Feb. 11. That probably reflects something about biology more than lifestyle, such as being in frequent contact with other people. Teens and people in their 20s also encounter many others, at school and work and on public transit, yet they don't seem to be contracting the disease at significant rates: Only 8.1% of cases were 20-somethings, 1.2% were teens, and 0.9% were 9 or younger. The World Health Organization mission to China found that 78% of the cases reported as of Feb. 20 were in people ages 30 to 69.

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The death toll skews old even more strongly. Overall, China CDC found, 2.3% of confirmed cases died. But the fatality rate was 14.8% in people 80 or older, likely reflecting the presence of other diseases, a weaker immune system, or simply worse overall health. By contrast, the fatality rate was 1.3% in 50-somethings, 0.4% in 40-somethings, and 0.2% in people 10 to 39.

The age-related death risk probably reflects the strength, or weakness, of the respiratory system. About half of the 109 Covid-19 patients (ages 22 to 94) treated at Central Hospital of Wuhan, researchers there [reported](#)<sup>7</sup>, developed acute respiratory distress syndrome (ARDS), in which fluid builds up in the small air

sacs of the lungs. That restricts how much air the lungs can take in, reducing the oxygen supply to vital organs, sometimes fatally; half of the ARDS patients died, compared to 9% of patients who did not develop the syndrome.

The ARDS patients had an average age of 61, compared to an average age of 49 for those who did not develop ARDS. Elderly patients “were more likely to develop ARDS,” the researchers wrote, suggesting how age can make Covid-19 more severe and even fatal: age increases the risk that the respiratory system will basically shut down under viral assault.

Youth, in contrast, seems to be protective. The WHO mission reported a relatively low incidence in people under 18, who made up only 2.4% of all reported cases. In fact, through mid-January, zero children in Wuhan, the epicenter of the outbreak, had contracted Covid-19. It’s not clear whether that’s because children do not show signs of illness even if infected.

Even cases among children and teens aged 10 to 19 are rare. As of Feb. 11 there were 549 cases in that age group, 1.2% of the total, China CDC found. Only one had died.

One intriguing explanation for the apparent resilience of youth: in regions near Hubei province, young children seem especially likely to be exposed to other [coronaviruses](#)<sup>8</sup>, scientists in China [reported](#)<sup>9</sup> in 2018. That might have given them at least partial immunity to this one.

## Men and women

The effect of sex on susceptibility to Covid-19 is less clear than the age effect, but preliminary data suggest men might be more susceptible. China CDC found that 106 men had the disease for every 100 women, while the WHO mission found that men make up 51% of cases. A study of 1,099 Covid-19 patients in Wuhan through Jan. 29 found a greater imbalance: 58% were male, the China Medical Treatment Expert Group for Covid-19 [reported](#)<sup>10</sup> last week in the New England Journal of Medicine.

It's possible the apparent sex imbalance reflects patterns of travel and contacts that make men more likely to be exposed to carriers of the virus, not any inherent biological differences. It's also possible the apparent worse disease severity in men could skew the data. Among hospitalized patients, there is "a slight predominance of men," U.S. researchers [wrote](#)<sup>13</sup> last week in JAMA. If the virus hits men harder than women, health care systems will see, test, and count more men.

To determine if there are sex differences in susceptibility to infection would require an unethical experiment: expose 1,000 otherwise similar men and women to the virus and see who gets sick.

The difference in fatality rates, however, is real: 1.7% for women and 2.8% for men, China CDC reported.

## **Sick or healthy**

The male-female difference in fatality rates, and perhaps in reported incidence, may arise from differences in underlying health. People with pre-existing illness are more likely to get seriously ill from Covid-19, and men have a higher incidence of such chronic illnesses as cardiovascular disease.

In the first large [study](#)<sup>14</sup> of the effect of underlying illness, researchers in China analyzed 1,590 patients from throughout the country with laboratory-confirmed disease. They calculated how "co-morbidities" — existing illnesses — affected the risk of being admitted to intensive care, being put on a ventilator, or dying.

After taking into account the patients' ages and smoking status, the researchers found that the 399 patients with at least one additional disease (including cardiovascular diseases, diabetes, hepatitis B, chronic obstructive pulmonary disease, chronic kidney diseases, and cancer) had a 79% greater chance of requiring intensive care or a respirator or both, or of dying, they reported last week in a paper posted to medRxiv, a preprint site that posts research before it has been peer-reviewed. The 130 with two or more additional diseases had 2.5 times the risk of any of those outcomes.

That fits with what's known about other respiratory viruses. People with a single co-morbidity who catch avian flu (H7N9) are 3.4 times more likely than otherwise-healthy flu patients to require ventilators and other intensive care. SARS and MERS, which are also caused by coronaviruses, are more severe in patients with underlying illnesses, too.

Breaking down the Covid-19 risk with the most common co-morbidities, the scientists found that cancer raises the risk 3.5-fold, COPD 2.6-fold, and diabetes and hypertension by about 60%. Because it isn't unusual for someone to have an underlying disease (especially diabetes and hypertension) but not know it, the last figure is likely an underestimate.

Co-morbidities also raise the risk of dying from Covid-19. China CDC's analysis of 44,672 patients found that the fatality rate in patients who reported no other health conditions was 0.9%. It was 10.5% for those with cardiovascular disease, 7.3% for those with diabetes, 6.3% for people with chronic respiratory diseases such as COPD, 6.0% for people with hypertension, and 5.6% for those with cancer.

Underlying disease might change the course of Covid-19. During the height of the epidemic in Wuhan, 37 of 230 patients receiving dialysis for kidney failure at Renmin Hospital developed the disease. Even though none were sick enough to require intensive care or a mechanical ventilator, six of them died, for a very high fatality rate of 16%. Oddly, however, none of the six died of pneumonia, Renmin researchers [reported](#)<sup>15</sup>. Instead, the causes of death were heart disease, stroke, and high blood levels of potassium (a result of kidney failure). The high fatality rate of Covid-19 in already-sick people might result not from the virus but from an exacerbation of existing disease.

About 60% of U.S. adults have at least one underlying health condition, Tom Frieden, former director of the U.S. Centers for Disease Control and Prevention, told reporters on Monday.

## Pregnancy



In early February, Chinese state media [reported](#)<sup>16</sup> that a woman infected with the virus gave birth to a baby who later tested positive for it. Newborns might become infected because of close proximity to a patient, like anyone else, but the case raised fears that a pregnant woman can transmit the virus to her fetus via the placenta.

Only one small study has investigated such “vertical transmission.” Scientists at Wuhan University [found](#)<sup>17</sup> that, of nine pregnant patients infected with the virus (all had a caesarean section) in their third trimester, none seemed to pass the virus to their babies, all of whom scored at the top of the Apgar scale of newborn health.

As for the mothers, “Covid-19 seems not to be especially severe in pregnant women, at least based on the small number in this study,” the scientists wrote. That was somewhat surprising because pregnancy suppresses the immune system (so it doesn’t attack the fetus); pregnant women are more susceptible to respiratory pathogens than non-pregnant women. Nevertheless, none of the nine women developed severe Covid-19 pneumonia.

It may be that immuno-suppression is actually helpful. Some of the most serious symptoms of Covid-19 result from an immune system on the rampage rather than a lethargic one, Chinese scientists [found](#)<sup>18</sup>: An extreme immune response called cytokine storm, a flood of immune cells and the biochemicals they produce, tears through lung tissue.

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