Why do some people get sick from SARS-CoV-2 infection and others not?

The answer is a function of the **viral challenge** and human immune response. It depends on how much virus you are exposed to and how your body reacts to it.

- The number of virus particles that a person is exposed to is the **viral challenge**.
- The body's **immune response** is a person's department of defense, made up of specialized cells, and molecules such as antibodies that are designed to sound the alarm and fight off foreign invaders.

When a small number of virus particles are breathed in and/or if individuals mount a strong successful first line of defense, the infection may be controlled without showing signs of sickness.

When larger numbers of virus particles are inhaled, and/or if a person's initial immune defences fail, then the virus begins to make more copies of itself and symptoms such as fever and cough can develop. After exposure, the average time before symptoms develop is about 4–6 days, with 97.5% of people who will show signs of sickness within 11 days. However, 80-90% of infections are mild and may even be **asymptomatic**.

**People with no symptoms can be hidden virus carriers, and can pass the virus to others unknowingly.**
Symptoms generally show what the body is doing to try and clear the virus from the system. Fever develops when immune cells release a protein called interleukin 1 (IL-1). IL-1 activates a type of white blood cells known as a T-lymphocyte to produce other signals, such as IL-6, which serve as homing devices to recruit additional T-lymphocytes and other white blood cells like monocytes and macrophages to fight the virus. Coughing occurs due to irritation in the lungs as these immune cells arrive in the infected airway tissues and release toxic substances to kill infected lung cells to stop the spread of the virus.

Individuals who experience symptoms due to infection with SARS-CoV-2, such as fever, dry cough and shortness of breath meet the definition of COro나Virus Disease, or “COVID.”

Approximately 15% of symptomatic adults who test positive for the virus experience severe symptoms requiring hospitalization, and 1/3 of these (5% of COVID patients) will be admitted to the intensive care unit (ICU). Severe disease can lead to low oxygen levels in the blood. Low oxygen levels occur when inflammation and debris in the lungs prevent inhaled oxygen from reaching the blood. In severe cases, an overactive immune response to the virus is called cytokine storm, and is characterized by high levels of IL-6, interferon and other inflammatory signals being released at the same time.

Inflammation in the lung can be seen on a lung x-ray as ‘ground-glass’ white spots filling up the normally clear lungs. SARS-CoV-2 infection can also result in “thickening” of the blood, and the formation of clots within the lung that prevent oxygen from reaching the bloodstream and the rest of the body.

Patients with clots may require treatment with blood thinners.

The first step is to give oxygen through the nose or mask, or oxygen therapy.

If lung disease is severe enough and the body’s needs cannot be met with oxygen therapy, a mechanical ventilator may be required to forcibly push oxygen into a person’s lungs and keep them alive.

Patients who are admitted to the ICU may require ventilator support for 2-28 days.

Approximately 40-85% of ICU patients recover.
Strategic Considerations for Policy Makers

- The fraction of infected people who will become very sick is important for allocating and deploying hospital resources, ventilators, PPEs and healthcare worker reserves.

- The effects of the virus on children and their role in passing the virus along to others will impact plans to re-open elementary schools.

Critical Research Questions

- Why are some people able to fight off the virus without acquiring symptoms while others cannot?

  Essential elements of an effective first line of immune response may be useful for preventing infection (prophylactically).

  Predicting who is at risk for severe disease will help direct appropriate care to those who need it the most.

- Why do some people recover from their symptoms on their own while others develop more severe symptoms?

  Finding a treatment that reduces the severity of infection is also an important question.
REFERENCES


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About CanCOVID

CanCOVID is Canada’s transdisciplinary rapid response network for science-to-policy COVID-19 research.

CanCOVID uses digital collaboration tools to rapidly co-create and mobilize knowledge across Canada’s diverse healthcare, research, policy, industry, and partner communities.

Our mission is to support needs-driven research and agile, evidence-based decision-making to help Canada steer quickly, safely, and compassionately through the COVID-19 pandemic.

Our members are affiliated a wide range of organizations from across Canada’s universities, hospitals, research networks, industry, public health authorities, provincial and regional governments, community non-profits, and funding agencies.

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