SARS-CoV-2: WHO IS AT RISK?

COVID Science evolves rapidly. This information is up to date as of July 23, 2020.

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Who is most at risk is a key question driving decision-making during the COVID-19 pandemic. The way this question is framed gives us very different answers: we can ask who is most at risk for getting infected with the SARS-CoV-2 virus or we can ask who is most at risk for developing symptoms and dying from COVID-19 disease.

Though this volume of CanCOVID’s State of the Science Report will only focus on the risk factors for infection, severe disease, and death, there are other important questions such as who is most at risk for long-term negative social or economic consequences of the pandemic.

Who is most at risk for getting infected with SARS-CoV-2?

The single most important risk factor for acquiring SARS-CoV-2 is exposure to a person who is infectious. Infectious people may not show signs of illness, and even those who never develop symptoms (or are asymptomatic), can still spread the virus to others.
People are most infectious in the 2-3 days prior to symptoms and for 1-2 days after fever and cough develop. The virus spreads through silently exhaled respiratory droplets. Most people do not realize they are infectious as they exhale this material through their mouth and nose (see Volume 3: Viral Transmission for greater detail).

Risk factors for getting infected

- Close face-to-face contact with infectious individuals
- Being in a confined indoor space with infected people
- Long periods of exposure to infectious individuals (greater than 10 or 15 minutes)
- Being in a room with poor air ventilation
- Not wearing a mask or other personal protective equipment

The likelihood of rapid viral spread, even originating from only one infected person, is higher in settings that have a greater combination of these factors.
Outbreaks have occurred in workplaces which require close working quarters, over long periods of time such as meat-packing plants or factories. Mines also keep individuals in closed, confined spaces. Indoor spaces with poor ventilation where individuals congregate create conditions for easy spread.

Examples include spaces used for office work, religious purposes (such as churches), education (such as school classrooms), sports events (such as arenas, locker rooms), commuting or travel purposes (such as cruise ships, buses, trains, airports), eating (such as restaurants, cafeterias and common eating rooms), or sleeping (such as homeless shelters with multiple beds per room.) Interactions at border control and pharmacy counters require face-to-face conversations, increasing viral transmission exposure time.

Healthcare workers are at very high risk of infection because they are most likely to be exposed to infectious patients. Healthcare workers move from one patient to another, not only increasing their own risk of exposure, but also of passing on the virus to others. Personal care assistants, such as those working in long-term care facilities, are at greatest risk because they spend long periods of time in close contact with infected residents. Once infected, healthcare workers become new vectors for viral transmission, spreading the virus to their colleagues.
Healthcare workers may unknowingly spread the virus to their families and home communities or, if they work in multiple locations, to other long-term care or acute hospital settings. Household members and friends of healthcare workers are at a higher risk of being exposed because of their contact with infectious healthcare workers, particularly before symptoms develop (if any).

The probability of an outbreak in a virus-free community increases when infected workers commute between work and home. Travel may be between countries, between communities, or even between healthcare settings. For example, introduction of the virus by dialysis patients has caused new hospital outbreaks. Furthermore, in the agricultural sector, temporary foreign workers may be housed in high-risk quarters with many beds in a single room. Attention to industry sectors that employ migrant workers, and to the communities that house workers from these industries, particularly in rural and remote areas or near Indigenous reserves, could help identify high-risk areas for future outbreaks.
In Canada, women, immigrant and racialized individuals have higher infection rates as a consequence of the risk factors associated with their characteristic work and residential environments. These groups are disproportionately represented among personal care assistants and long term care facility workers, increasing the risk of the virus being transmitted to their home communities. In Canada and the U.S., health regions with a higher percentage of Black residents have significantly higher SARS-CoV-2 infection rates. A one percentage point increase in the share of Black residents in a health region has been associated with the doubling of coronavirus infection and death rates. Foreign-born residents also appear to be at slightly higher risk, with a 3% rise in infection rates and a 5% rise in deaths. These associations are a consequence of systemic social conditions that disproportionately put these populations in settings with a higher risk for work and community exposure to the virus.

Who is most at risk for developing severe symptoms?

It is challenging to predict whose symptoms will progress and who will recover. What is clear so far is that one of the most important risk factors for poor outcomes is older age. Children are less likely to develop severe symptoms. However, older adults, especially those over age 65 years are more likely to develop severe symptoms and require hospital admission. A person with COVID-19 is more likely to require hospitalization if they have high blood pressure, diabetes, cancer, obesity or a combination of pre-existing conditions. Once in hospital, individuals with a history of cancer and those who cough up blood, become short of breath, lose consciousness or exhibit chest x-ray abnormalities are more likely to deteriorate and require admission to the intensive care unit and ventilator support.
Our understanding of other biological factors such as genetics and immune status as risk factors for the severity of COVID-19 are still incomplete. Individuals who have recovered from COVID-19 and develop antibodies seem to be protected from new infections of the virus, at least in the short term. To date, there have been no reports of re-infection among SARS-CoV-2-recovered individuals within 3 months of their first exposure.

Pre-existing immune conditions may play a role in disease progression, but more research is needed. To date there is no evidence that individuals with multiple sclerosis or inflammatory bowel disease, or those taking immunosuppression medications, have a risk of poorer outcomes. However, these are imperfect studies and it is worth taking a conservative approach until more information is available.

Sex, gender and age appears to be linked to COVID-19 deaths. In Canada, women aged 80 years and older have experienced the highest mortality. This is because the majority of Canadian deaths occurred during outbreaks in long-term care, where older women are disproportionately represented. In other countries such as China and Italy, men over the age of 65 have the highest reported death rates.
There are elements of the immune system that may make men more susceptible to poorer SARS-CoV-2 infection outcomes: expression of the ACE-2 receptor for viral cell entry is linked to the sex chromosomes, male hormones (androgens) may promote viral entry into the cell, and men produce fewer antibodies than women for other viral infections and vaccine challenges.

More research is needed to determine whether men are really at a higher biological risk of mortality from COVID-19, or whether sex differences in mortality simply reflect the higher degree of exposure that certain groups have depending on their occupations and social setting.

As Canada does not systematically collect identity information on race, immigration or Indigenous status during SARS-CoV-2 viral testing or on death certificates, there are gaps in our knowledge about who else is at greater risk of disease progression or death. Data from the U.S. indicates that Black Americans may be dying at 3 times the rate of white people from COVID-19. Investigations looking for similar trends in Canada are warranted.

Other biases in our statistics exist because we do not routinely collect information on asymptomatic individuals or those with symptoms who do not get tested. As a result, we have an inaccurate picture of how many people per age, sex or race group were actually infected by SARS-CoV-2. This makes it difficult, if not impossible, to accurately report actual risks of mortality by various identity characteristics.
Strategic Considerations for Policy Makers

Improvement in Identity Data Collection and Reporting

The first wave of SARS-CoV-2 infections revealed important deficiencies in collecting and reporting identity characteristics among Canadians. The development of effective programs and strategies to protect those who are most at risk of infection, hospitalization and mortality during second wave SARS-CoV-2 infections will require improved data collection methods. Governments should prioritize new systems for collecting, analysing and transparently reporting social and geographic data on sex, race, Indigenous status and occupation for the entire Canadian population.

Changing the SARS-CoV-2 viral testing forms and death certificates to systematically collect identity information on race and Indigenous status is one simple approach. A more thorough approach involves expansion and digitization of workplace identification information to enable rapid tracing of the people potentially exposed (or contacts) to infected individuals in communities at high-risk for transmission and poor outcomes. For example, modifying the employment contracts and/or tracking employee’s signing in/out during an outbreak.

Guidance from the Canadian Institute of Health Information regarding collecting information on race in government forms should be implemented. Information on sexual and gender minorities, as well as Indigenous identity, should also be considered. A commitment to respecting OCAP® (Ownership, Control, Access and Possession) principles for First Nations, Metis and Inuit data collection is essential for addressing privacy concerns. Transparency with racialized groups and others about how the information will be used is critical. Assurance that the aim of information collection is to support solutions that will be co-developed using the strengths and knowledge base of the community and do not point to “vulnerabilities” is essential.
Applying Gender-Based Analysis plus (GBA+) through an intersectional lens

Individuals most at risk during the COVID-19 pandemic reside at the intersections of age, sex, race, occupation, social, housing and travel circumstances. At the household level, intersections of inequalities exist among racialized, low income and high-density households, and among individuals who commute to communal workplaces.

- Measuring race and Indigenous status is only a first step towards better supporting those at risk.
- The second step is appropriate analysis for differences in outcomes by cumulative layers of identity characteristics.
- The third and most important step is asking why differences exist. Making connections between biology, identity characteristics and specific workplace and housing factors that place certain groups at higher risk of viral exposure will provide the why and best direct resources and solutions to where they are needed most.

GBA+ refers to more than just data analysis. It recognizes that communities can contribute to creatively finding effective solutions to challenging problems. The use of empathy-mapping techniques, design thinking, and respectful community engagement is foundational to appropriate program and policy development. Culturally safe co-creative approaches will lead to the most effective risk-reduction strategies. Expanded data collection approaches and the use of GBA+ will best support the development of related health, economic and social policy priorities to get us through and beyond the COVID-19 pandemic.
Identification and monitoring of work settings and communities at high risk for rapid viral transmission is required. Identification is the first step to find the locations of these workplaces and facilities, and the commuter pathways and housing of the workers. Spatial-clustering software could be used to identify potential hotspots, cross-linked with race, foreign-born or Indigenous identity data, postal codes or geographic areas with high census-known deprivation indices. Preventative measures to reduce viral transmission should be designed in concert with municipalities, workplaces and housing managers. Emergency testing and containment plans can then be developed for each of these hotspots.

Critical Research Questions

- Why do some individuals who acquire SARS-CoV-2 progress to severe symptoms while others recover?
- What is the best way forward to help predict and contain outbreaks? How can we work with at risk communities to best meet their needs?
REFERENCES


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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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