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Post-Acute COVID-19

“Long” COVID-19

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Special Thanks

- Patricia Phillips (RN. COHN)
- Maria Vieira



- Conflict of interest – Nil to declare
- Learning objectives
 - Basic science
 - COVID 19 infection does not end at day 14
 - Possibility of asymptomatic / undiagnosed having long-term illness
 - Poor outcomes involves more than those diagnosed with COVID 19



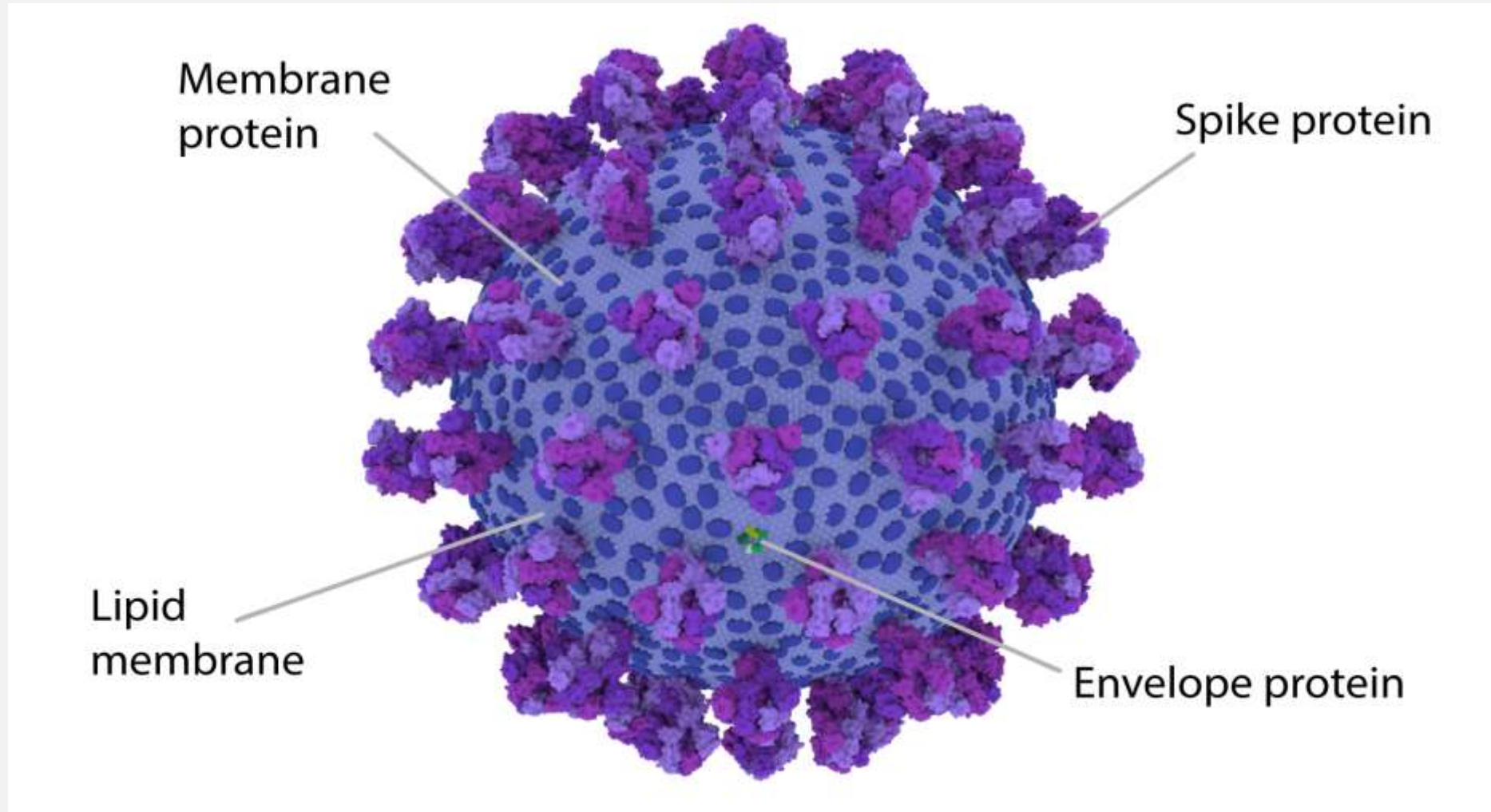


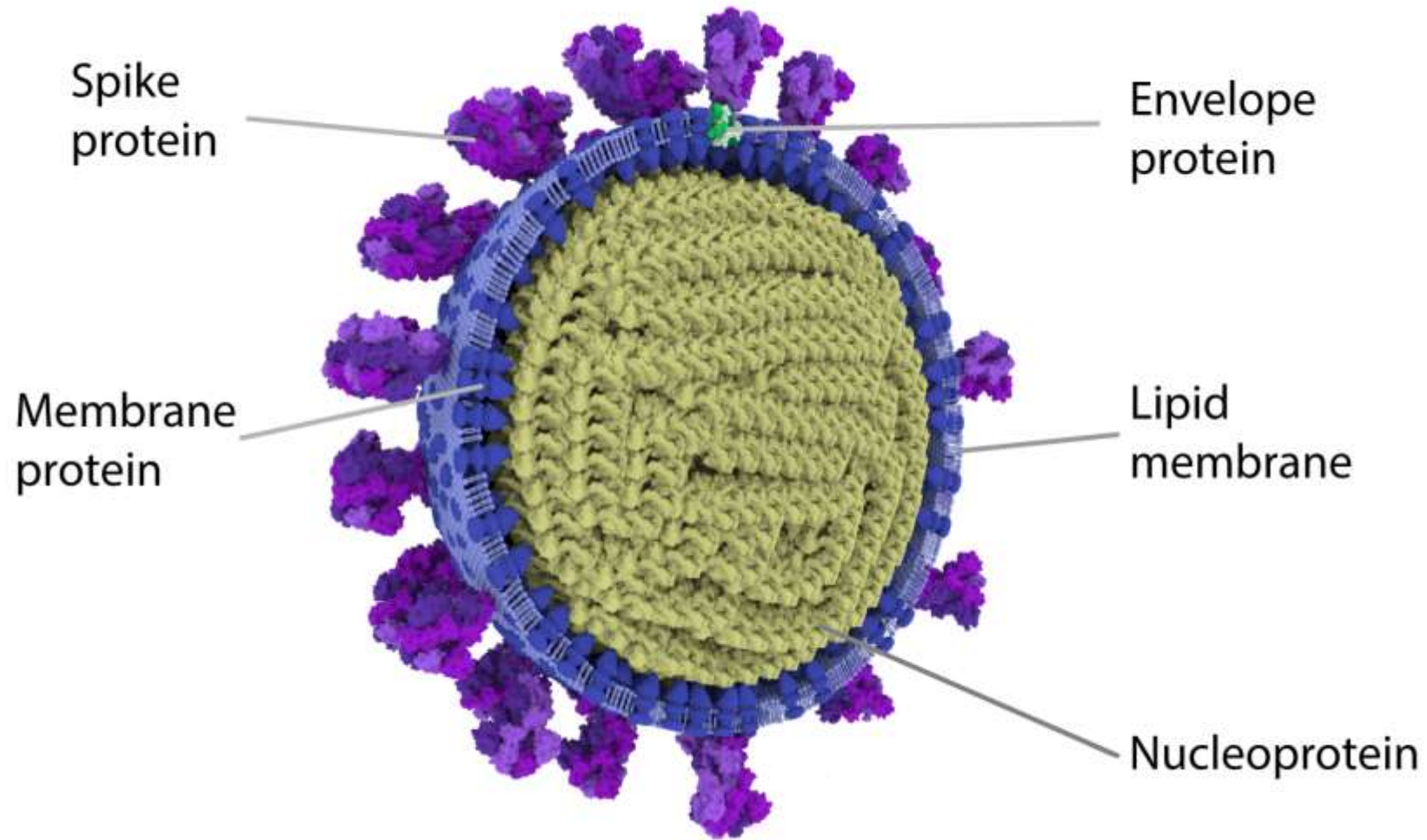
What is coronavirus?

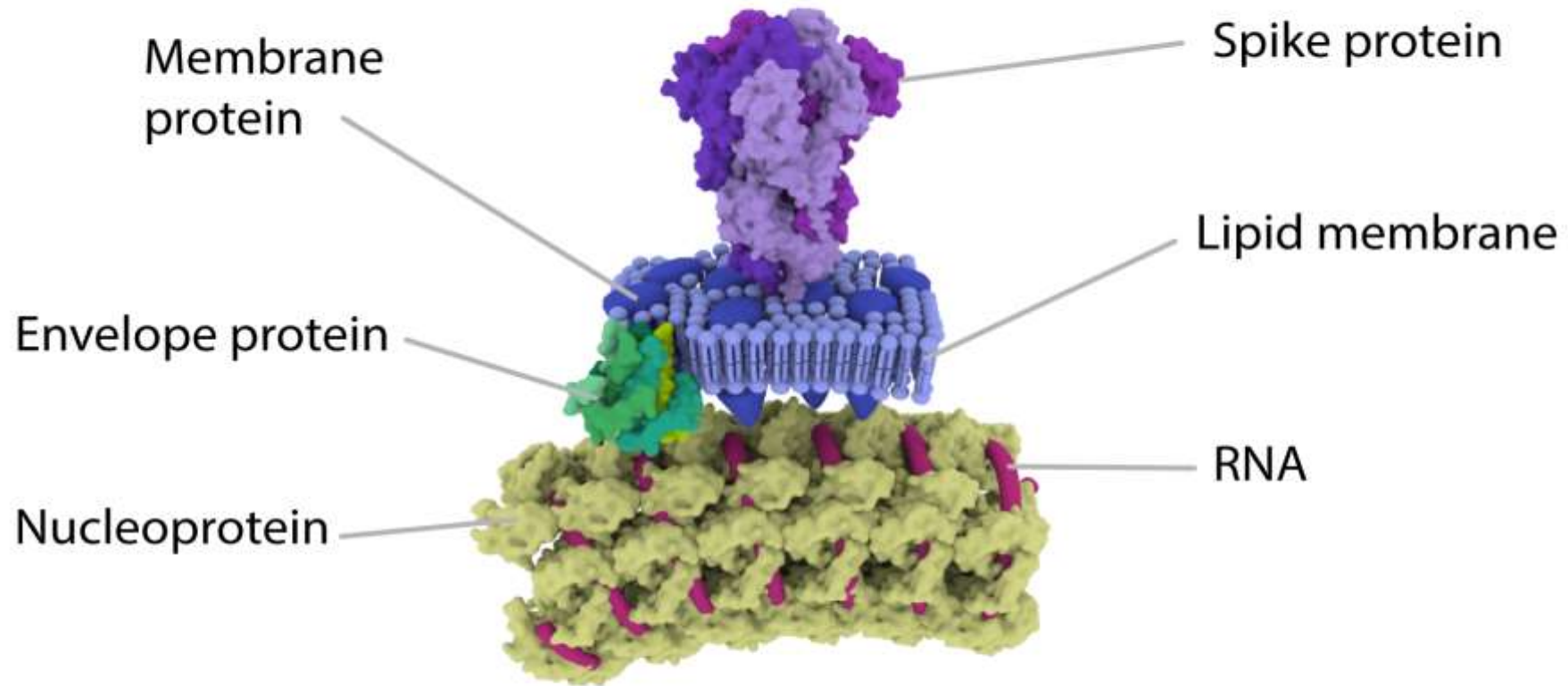
Coronaviruses are a family of viruses that cause respiratory and intestinal illnesses in humans and animals.

They usually cause mild colds

Can cause severe disease – SARS (2002-2003), MERS (2012) and COVID-19 epidemics.

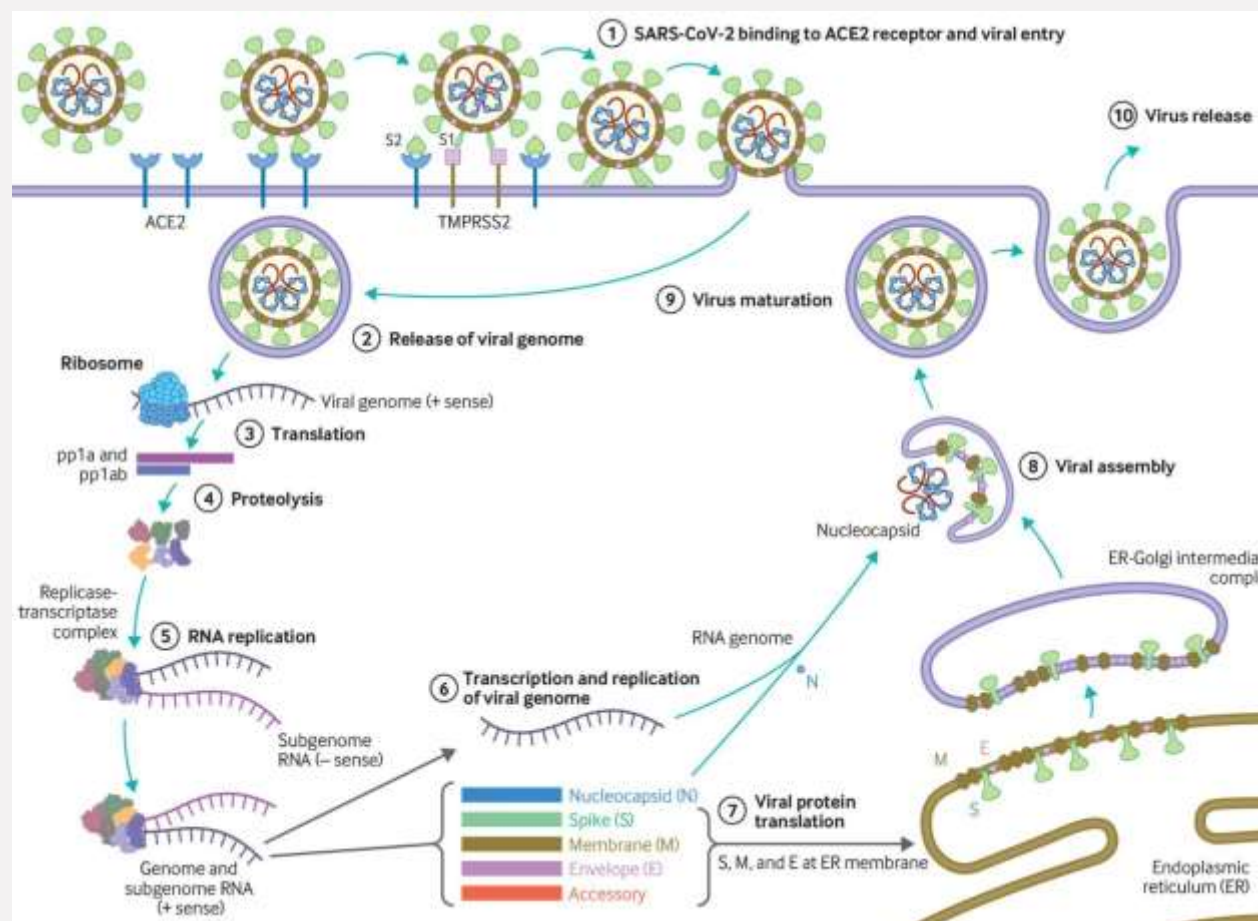








(1) The virus binds to ACE 2 as the host target cell receptor in synergy with the host's transmembrane serine protease 2 (cell surface protein), which is principally expressed in the airway epithelial cells and vascular endothelial cells.



Muge Cevik et al. BMJ 2020;371:bmj.m3862

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What are viral mutations?



Mutation is a natural process.

It occurs more frequently in viruses (RNA>DNA viruses).

Multiple rounds of replication in the host, roughly every 30 minutes, also increase the chances of mutations occurring. e.g. RNA influenza viruses, rapid mutation - which means that a new flu vaccine is needed every year.

Mutation refers to the actual change in sequence in the genome

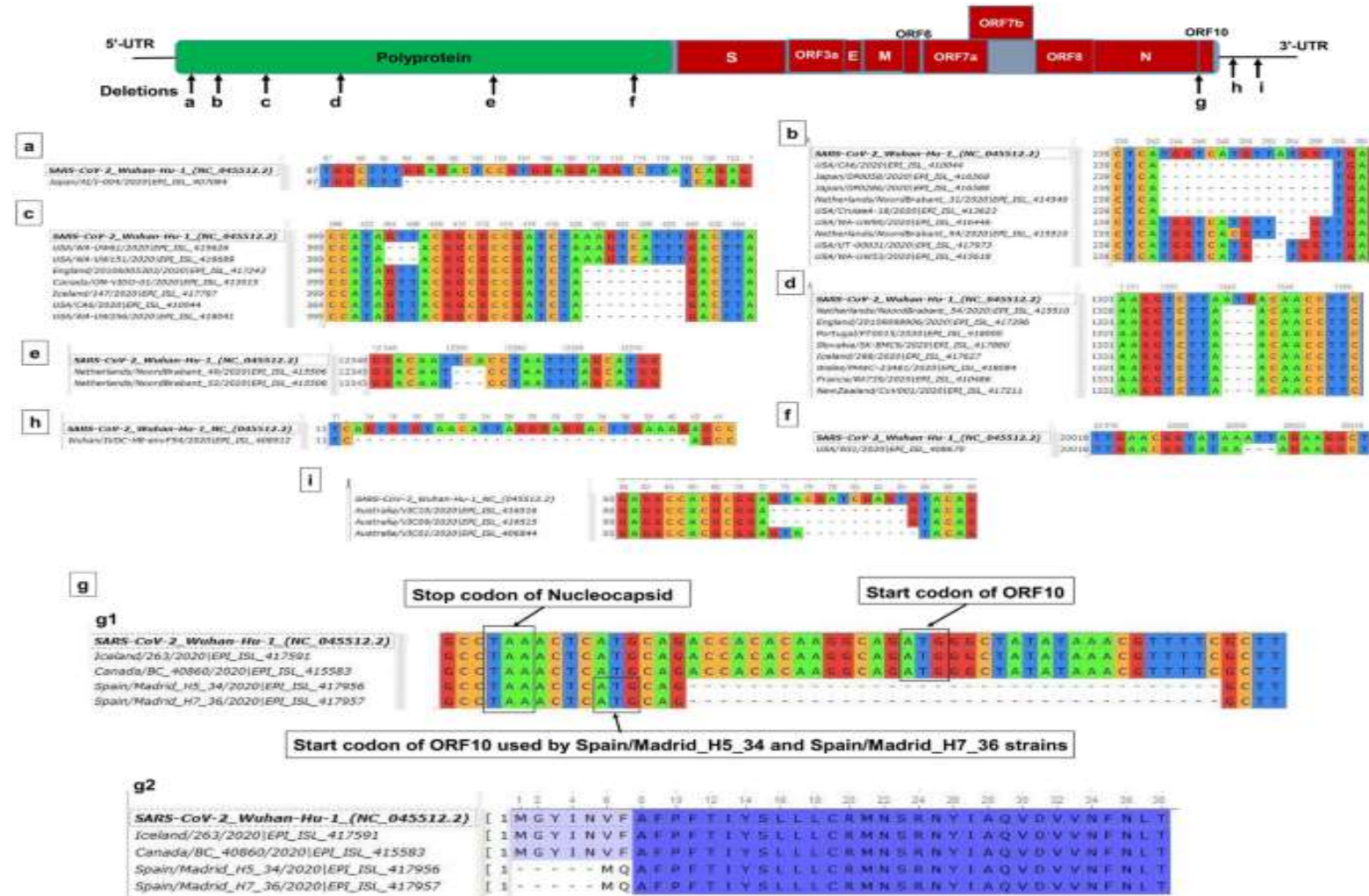
What are viral variants?

Genomes that differ in sequence are called “variants”. A genetically distinct virus lineage, distinguishable by one or more mutations from another strain. Strains may or may not be biologically (functionally) distinguishable from one another and some virologists use the term strain only for the former.

Two strains would be biologically different if they elicited different responses from the human immune system, or if they varied in their transmission characteristics.

What are Strains?

A variant is a strain when it has a demonstrably different phenotype (eg, a difference in antigenicity, transmissibility, or virulence)





European Centre for Disease Prevention and Control

The emergence of new variants is an expected occurrence and not in itself a cause for concern; SARS-CoV-2 is no exception. A diversification of SARS-CoV-2 due to evolution and adaptation processes has been observed globally.

While most emerging mutations will not have a significant impact on the spread of the virus, some mutations or combinations of mutations may provide the virus with a selective advantage, such as increased transmissibility or the ability to evade the host immune response. In such cases, these variants could increase the risk to human health and are considered to be variants of concern.

UK new SARS-CoV-2 variant, 20B/501Y.V1, VOC 202012/01, or B.1.1.7 lineage
South Africa has reported another SARS-CoV-2 variant, 20C/501Y.V2 or B.1.351 lineage
Brazilian variant



Emerging Variants (CDC)

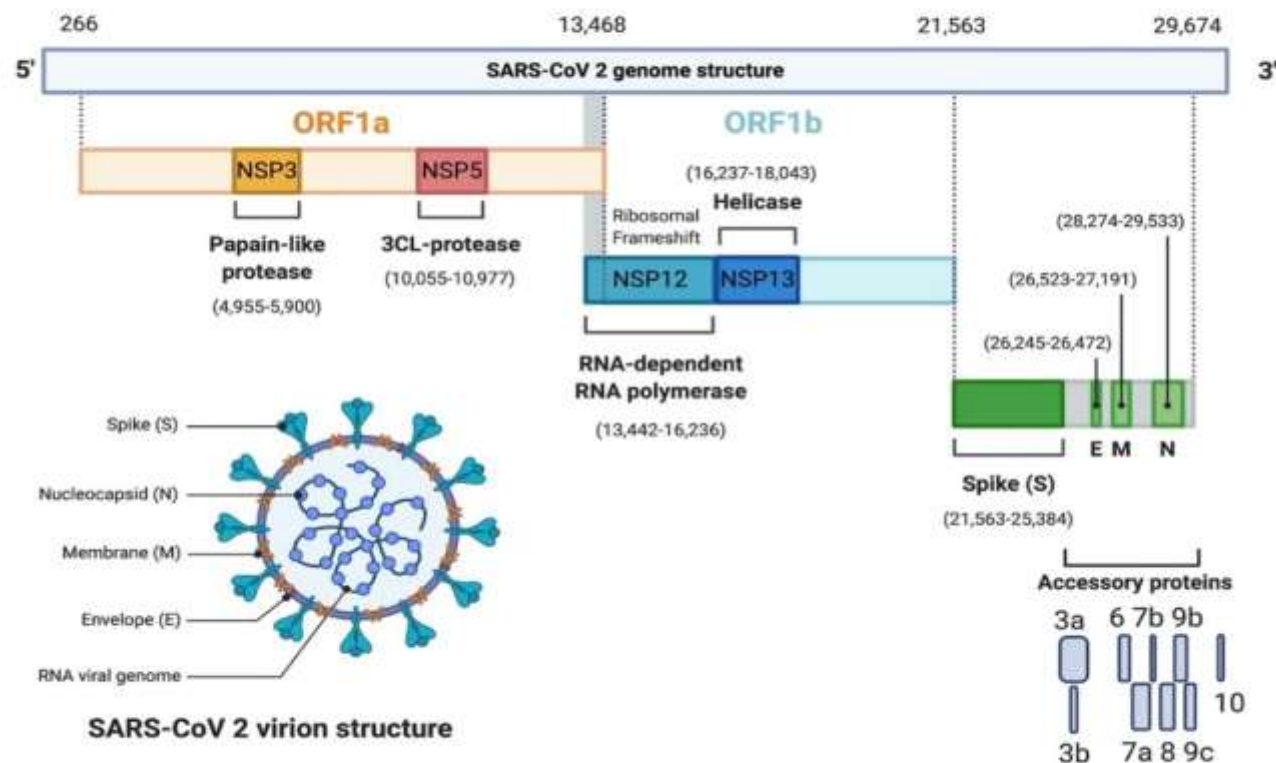
B.1.1.7 lineage (a.k.a. 20B/501Y.V1 Variant of Concern (VOC) 202012/01)

- This variant has a mutation in the receptor binding domain (RBD) of the spike protein at position 501, where amino acid asparagine (N) has been replaced with tyrosine (Y). The shorthand for this mutation is N501Y. This variant also has several other mutations, including:
 - 69/70 deletion: occurred spontaneously many times and likely leads to a conformational change in the spike protein
 - P681H: near the S1/S2 furin cleavage site, a site with high variability in coronaviruses. This mutation has also emerged spontaneously multiple times.
 - ORF8 stop codon (Q27stop): mutation in ORF8, the function of which is unknown.
- This variant is estimated to have first emerged in the UK during September 2020.
- Since December 20, 2020, several countries have reported cases of the B.1.1.7 lineage, including the United States and Canada.
- Preliminary epidemiologic indicators suggest that this variant is associated with increased transmissibility (i.e., more efficient and rapid transmission).
- Currently there is no evidence to suggest that the variant has any impact on the severity of disease or vaccine efficacy.
- The U.K. variant had 17 mutations at the same time, eight of which are on the surface of the virus



B.1.351 lineage (a.k.a. 20C/501Y.V2)

- This variant has multiple mutations in the spike protein, including N501Y. Unlike the B.1.1.7 lineage detected in the UK this variant does not contain the deletion at 69/70.
- This variant was first identified in Nelson Mandela Bay, South Africa, in samples dating back to the beginning of October 2020, and cases have since been detected outside of South Africa.
- The variant also was identified in Zambia in late December 2020, at which time it appeared to be the predominant variant in the country.
- Currently there is no evidence to suggest that this variant has any impact on disease severity or vaccine efficacy.



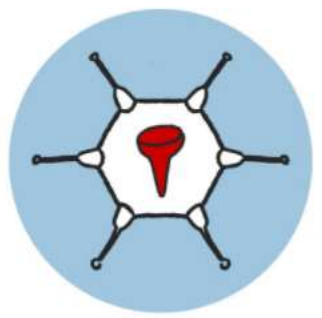
The four main types of Covid-19 vaccines in development

Even before coronavirus broke out in 2019, pharmaceutical companies were working on designs for vaccines they could quickly adapt to a pandemic strain of virus. Their work paid off in some of the new Covid-19 vaccines being tested and prepared for rollout as illustrated below.



mRNA VACCINE

Used by: Pfizer, Moderna
Doses: 2
mRNA vaccines are the newest approach. They use genetic material called messenger RNA, a kind of genetic software that instructs cells to make a piece of the coronavirus spike protein. That will get the attention of the immune system. The mRNA is coated in soft fatty lipids to protect it.



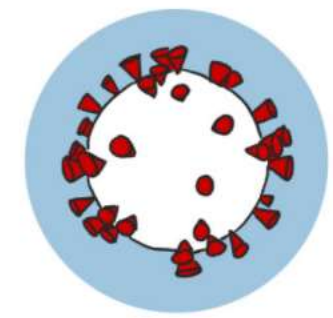
VECTOR VACCINES

Used by: AstraZeneca, Janssen, Sputnik
Doses: 1-2
Vector vaccines use another virus to carry in the genetic instructions to make the spike protein. For coronavirus they all use adenoviruses, a type of common cold virus. They attach to cells and inject DNA that tells the cells to make coronavirus spike protein.



PROTEIN SUBUNIT VACCINE

Used by: Novavax, Sanofi
Doses: 1-2
Protein subunit vaccines just get little pieces of the target virus circulating in the system for the immune system to find and recognize. Instead of using the human body as the vaccine factory, genetically engineered insect viruses are used to infect moths, whose cells then produce the pieces of coronavirus spike protein. These are harvested and made into a vaccine.



WHOLE, KILLED VACCINES

Used by: Sinovac
Doses: 1
Whole inactivated virus vaccines take longer to make because batches of the coronavirus must first be grown and then killed using a chemical or heat, and then made into a vaccine that can be injected to elicit an immune response.

More from CNN



Mitch McConnell has one more card to play against Donald Trump



Anne Hathaway reveals we've all been calling her the wrong name





What is COVID-19?

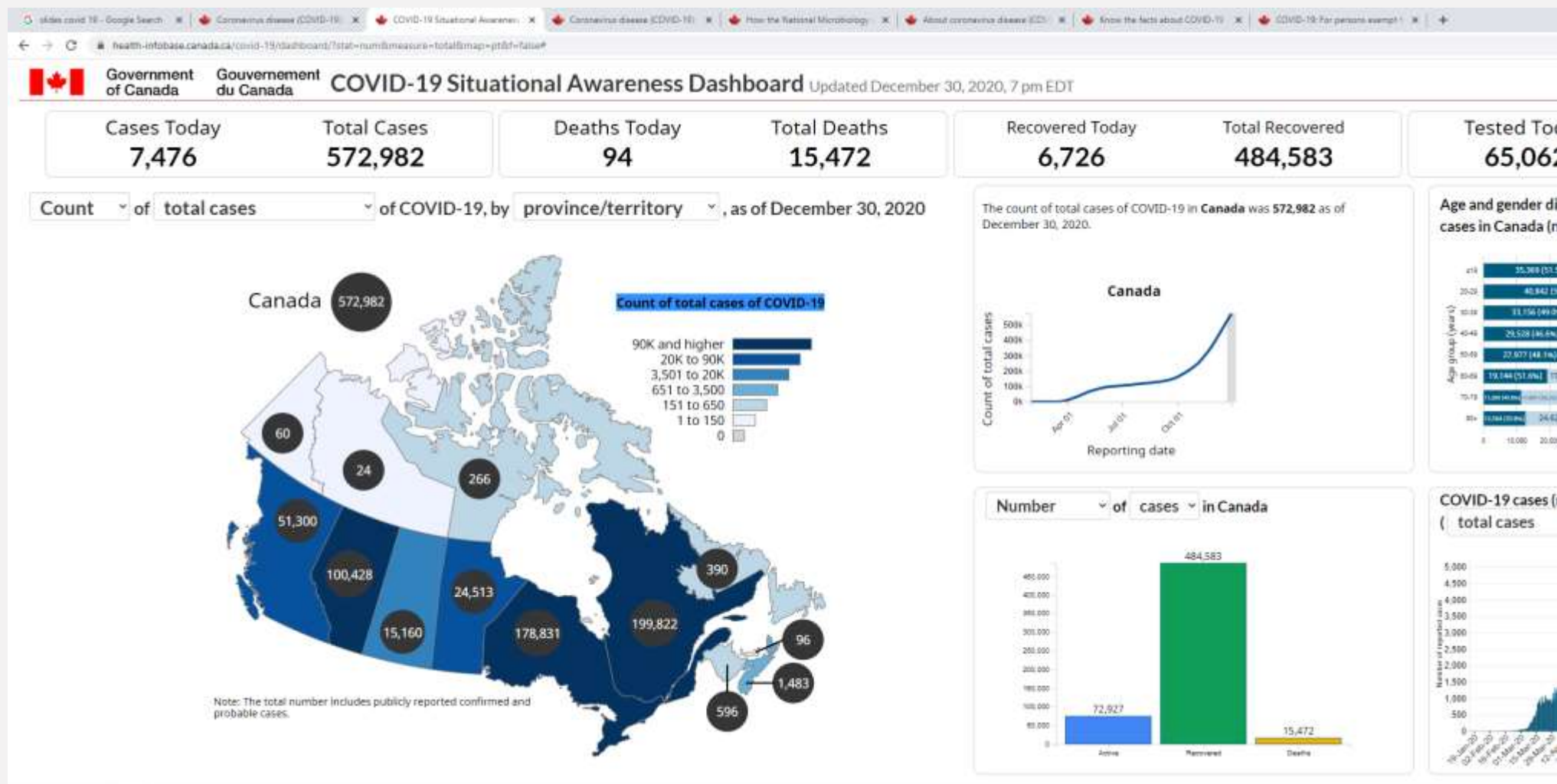
COVID-19 is the disease caused by the coronavirus SARS-CoV-2.

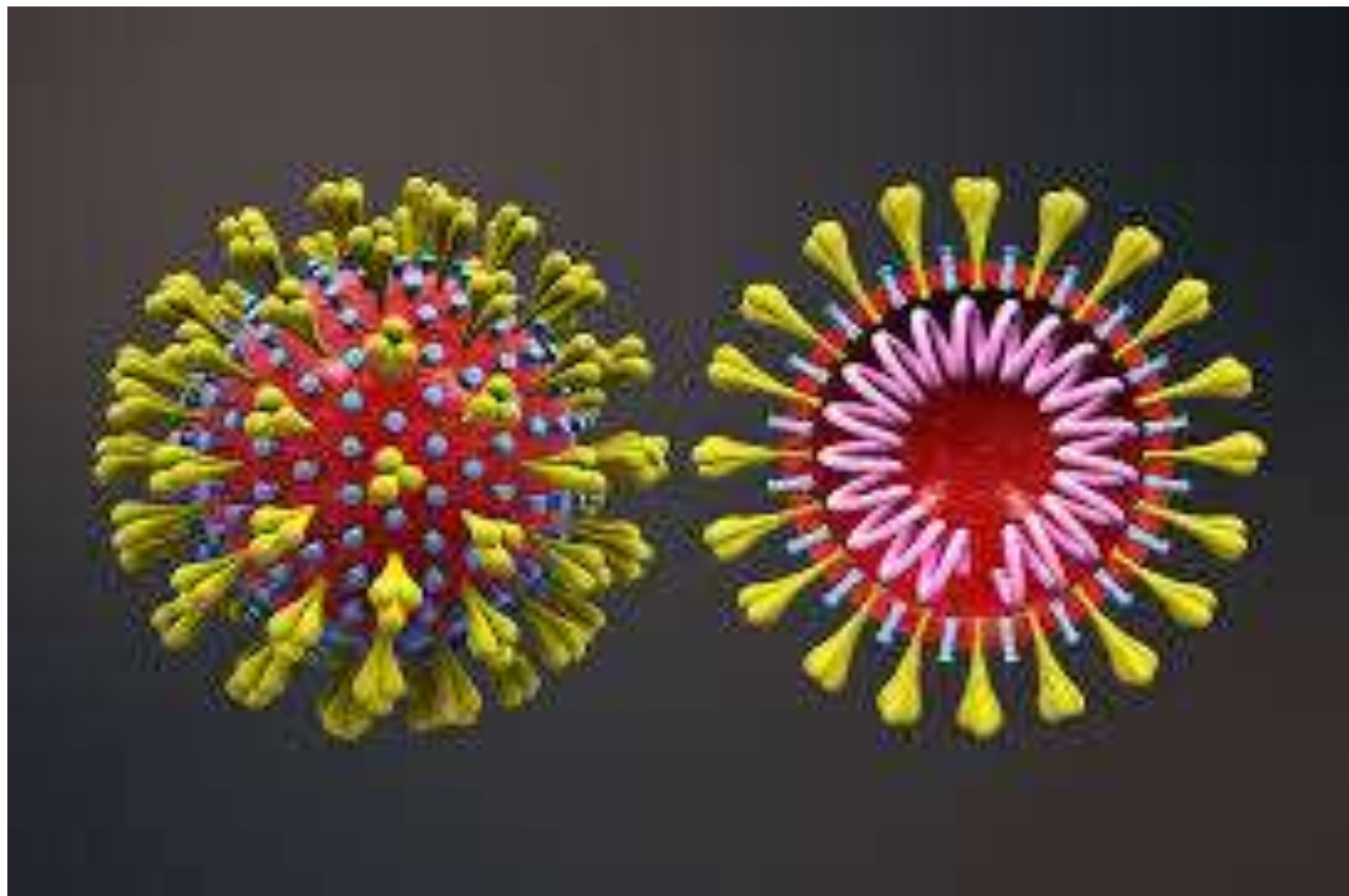
WHO first learned of this new virus on 31 December 2019, following a report of a cluster of cases of 'viral pneumonia' in Wuhan, China.

COVID-19 pandemic

- The World Health Organization (WHO) declared the situation a pandemic on 11 March 2020 signifying
- Widespread human-to-human transmission
- Large number of affected countries









Risk stratification for severe disease in patients with coronavirus disease 2019 (COVID-19)

High risk
■ Age ≥ 65 years
■ Residence in a nursing home or long-term care facility
■ Immunocompromising condition
■ Chronic lung disease or moderate to severe asthma
■ Cardiovascular disease (including hypertension)
■ Severe obesity (body mass index ≥ 40 kg/m ²)
■ Diabetes mellitus
■ Chronic kidney disease (undergoing dialysis)
■ Cerebrovascular disease
■ Chronic liver disease
■ Tobacco use disorder
Moderate risk
■ Age 20 to 64 years with none of the specific comorbidities listed above
■ Age <20 years with underlying medical conditions other than those listed above
Low risk
■ Age <20 years without underlying medical conditions

COVID-19: coronavirus disease 2019.

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Symptoms associated with coronavirus disease 2019 (COVID-19) ^[1]

Symptoms that may be seen in patients with COVID-19
■ Cough
■ Fever
■ Myalgias
■ Headache
■ Dyspnea (new or worsening over baseline)
■ Sore throat
■ Diarrhea
■ Nausea/vomiting
■ Anosmia or other smell abnormalities
■ Ageusia or other taste abnormalities
■ Rhinorrhea and/or nasal congestion
■ Chills/rigors
■ Fatigue
■ Confusion
■ Chest pain or pressure

Most patients with confirmed COVID-19 have fever and/or symptoms of acute respiratory illness. However, various other symptoms have been associated with COVID-19; this list is not inclusive of all reported symptoms. These symptoms are also not specific for COVID-19, and the predictive value of a single symptom in the diagnosis of COVID-19 is uncertain.

COVID-19: coronavirus disease 2019.

Reference:

1. Centers for Disease Control and Prevention. Interim Clinical Guidance for Management of Patients with Confirmed Coronavirus Disease (COVID-19). Available at: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-guidance-management-patients.html>.

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Infected

- Aware / Known
- Unaware / unknow



Those that do not know that they were infected

- Asymptomatic and well
- or may have had some minor symptoms that were ignored / misattribution
- diagnosed with blood serology (currently not routinely funded by OHIP)
- long-term consequences are unknown and currently unstudied.



Asymptomatic Infections

Asymptomatic infections have been well documented [4-12].

The proportion of infections that are asymptomatic has not been systematically and prospectively studied.

One literature review estimated that it is as high as 30 to 40 percent, based on data from three large cohorts that identified cases through population-based testing [12,13]. However, in most of these and other studies, longitudinal follow-up to assess for symptom development was not performed.

Additionally, the definition of "asymptomatic" may vary across studies, depending on which specific symptoms were assessed. The range of findings in studies evaluating asymptomatic infections is reflected in the following examples:

Studies – cruise ships / nursing homes / higher percentage in younger population (aircraft carrier)

Patients with asymptomatic infection may have objective clinical abnormalities [9,23]. As an example, in a study of 24 patients with asymptomatic infection who all underwent chest computed tomography (CT), 50 percent had typical ground-glass opacities or patchy shadowing, and another 20 percent had atypical imaging abnormalities [23]. Five patients developed low-grade fever, with or without other typical symptoms, a few days after diagnosis. In another study of 55 patients with asymptomatic infection identified through contact tracing, 67 percent had CT evidence of pneumonia on admission; only two patients developed hypoxia, and all recovered [9].

As above, some individuals who are asymptomatic at the time of diagnosis go on to develop symptoms (ie, they were actually presymptomatic).

The risk of transmission from patients with asymptomatic infection is discussed elsewhere.

(See "[Coronavirus disease 2019 \(COVID-19\): Epidemiology, virology, and prevention](#)", section on 'Viral shedding and period of infectiousness'.)

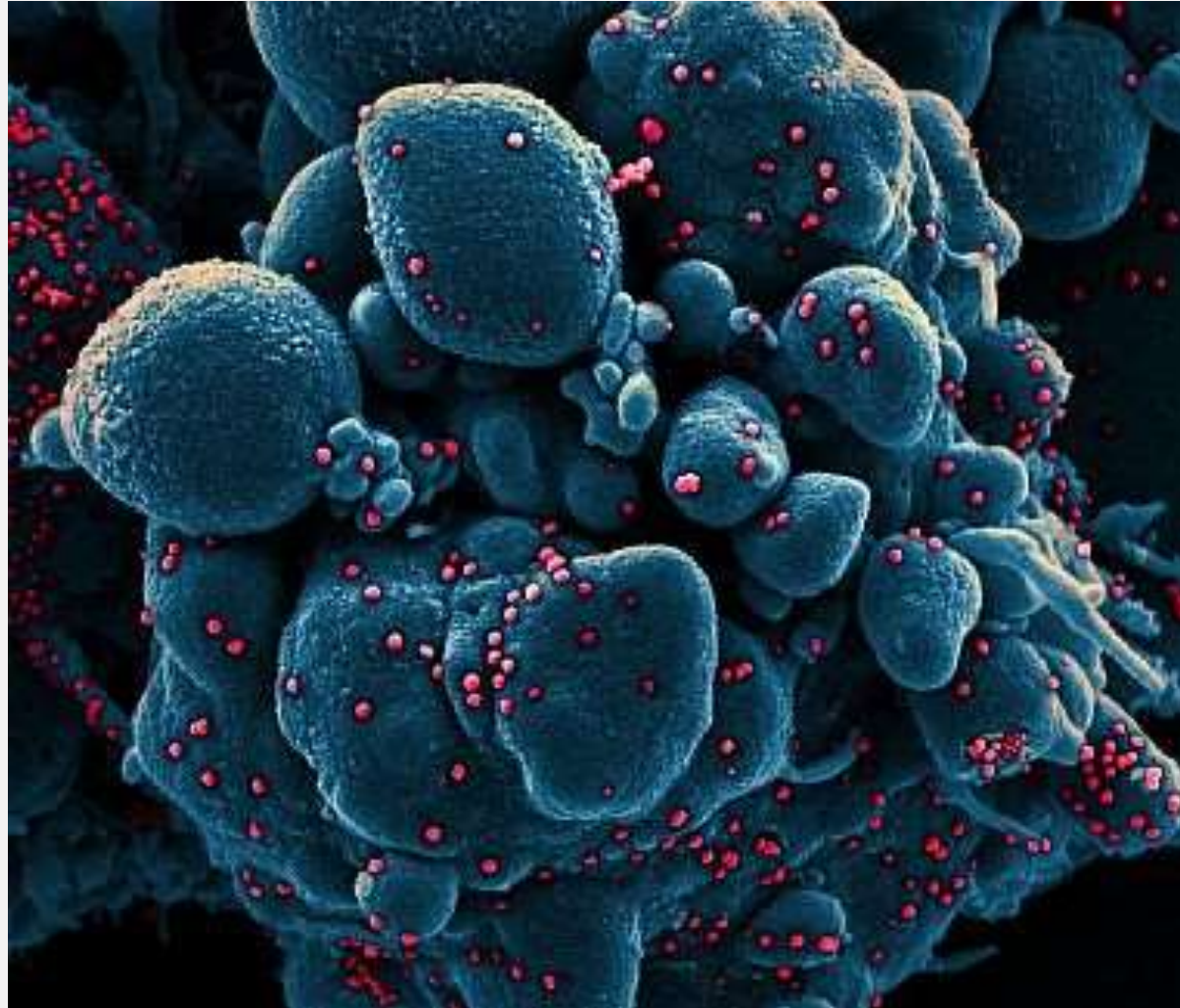


	China ⁸ (n = 72,314)	Japan ⁹ (n = 565)	Diamond Princess ¹⁰ (n = 3711)	Korea ¹¹ (n = 28)	Washington ¹² (n = 76)	Wuhan Children ¹³ (n = 1391)
RT-PCR positive cases	56,128	13	634	28	23	171
Asymptomatic cases	889	4	328	3	13	27
Incidence rate (%) ^a	1.6	30.8	51.7	10.7	56.5	15.8

The incidence of asymptomatic infections with COVID-19 in different studies.

^a As of the data published in the literature, the proportion of asymptomatic infections in the population with positive nucleic acid test.

<https://www.clinicalkey.com/#!/content/journal/1-s2.0-S1684118220301134>





Diagnostic tests for COVID-19^[1,2]

Test category	Primary clinical use	Specimen type	Performance characteristics	Comments
NAATs (including RT-PCR)	Diagnosis of current infection	Respiratory tract specimens*	<ul style="list-style-type: none"> High analytic sensitivity and specificity in ideal settings. Clinical performance depends on the type and quality of the specimen and the duration of illness at the time of testing. Reported false-negative rate ranges from <5 to 40%, depending on the test used.[†] 	<ul style="list-style-type: none"> Time to perform the test ranges from 15 minutes to 8 hours.^Δ Turnaround time is influenced by the test used and laboratory workflow. Some assays allow home collection of specimens that are mailed in.
Serology (antibody detection)	Diagnosis of prior infection (or infection of at least 3 to 4 weeks' duration)	Blood	<ul style="list-style-type: none"> Sensitivity and specificity are highly variable. Detectable antibodies generally take several days to weeks to develop; IgG usually develops by 14 days after onset of symptoms. Cross-reactivity with other coronaviruses has been reported. Individual results should be interpreted with caution in settings of low seroprevalence; serologic tests that have high specificity still have a low positive predictive value. 	<ul style="list-style-type: none"> Time to perform the test ranges from 15 minutes to 2 hours. Turnaround time is influenced by the test used and laboratory workflow. It remains uncertain whether a positive antibody test indicates immunity against future infection.
Antigen tests	Diagnosis of current infection	Nasopharyngeal or nasal swabs	<ul style="list-style-type: none"> Antigen tests are generally less sensitive than nucleic acid tests. Sensitivity is highest in symptomatic individuals within 5 to 7 days of symptom onset. 	<ul style="list-style-type: none"> Time to perform the test is <1 hour.

COVID-19: coronavirus disease 2019; NAAT: nucleic acid amplification test; RT-PCR: real-time polymerase chain reaction; IgG: immunoglobulin G; CDC: United States Centers for Disease Control and Prevention.

* Nasopharyngeal swabs, nasal swabs (from the mid-turbinate area or from both anterior nares), nasal or nasopharyngeal washes, oropharyngeal swabs, and saliva are recommended by the CDC. Nasal swabs can be self-collected by the patient on-site or at home. Mid-turbinate swabs and saliva can be collected by the patient while supervised. Lower respiratory tract specimens can be collected in hospitalized patients with suspected lower respiratory tract infection if an upper respiratory tract specimen tests negative.

† A single positive test generally confirms the diagnosis. If initial testing is negative and clinical suspicion remains, performing a second test can enhance diagnostic yield.

Δ Low-complexity rapid tests can be performed at the point of care and provide results in less than 1 hour. Most moderate- to high-complexity laboratory-based tests result in several hours. However, the time for a clinician or patient to receive a result depends on how frequently the test is run and other processing factors.

References:

- Cheng MP, Papenburg J, Desjardins M, et al. Diagnostic Testing for Severe Acute Respiratory Syndrome-Related Coronavirus 2: A Narrative Review. *Ann Intern Med* 2020; 172:726.
- Weissleder R, Lee H, Ko J, Pittet MJ. COVID-19 Diagnostics in Context. *Sci Transl Med* 2020; 12:eabc1931.

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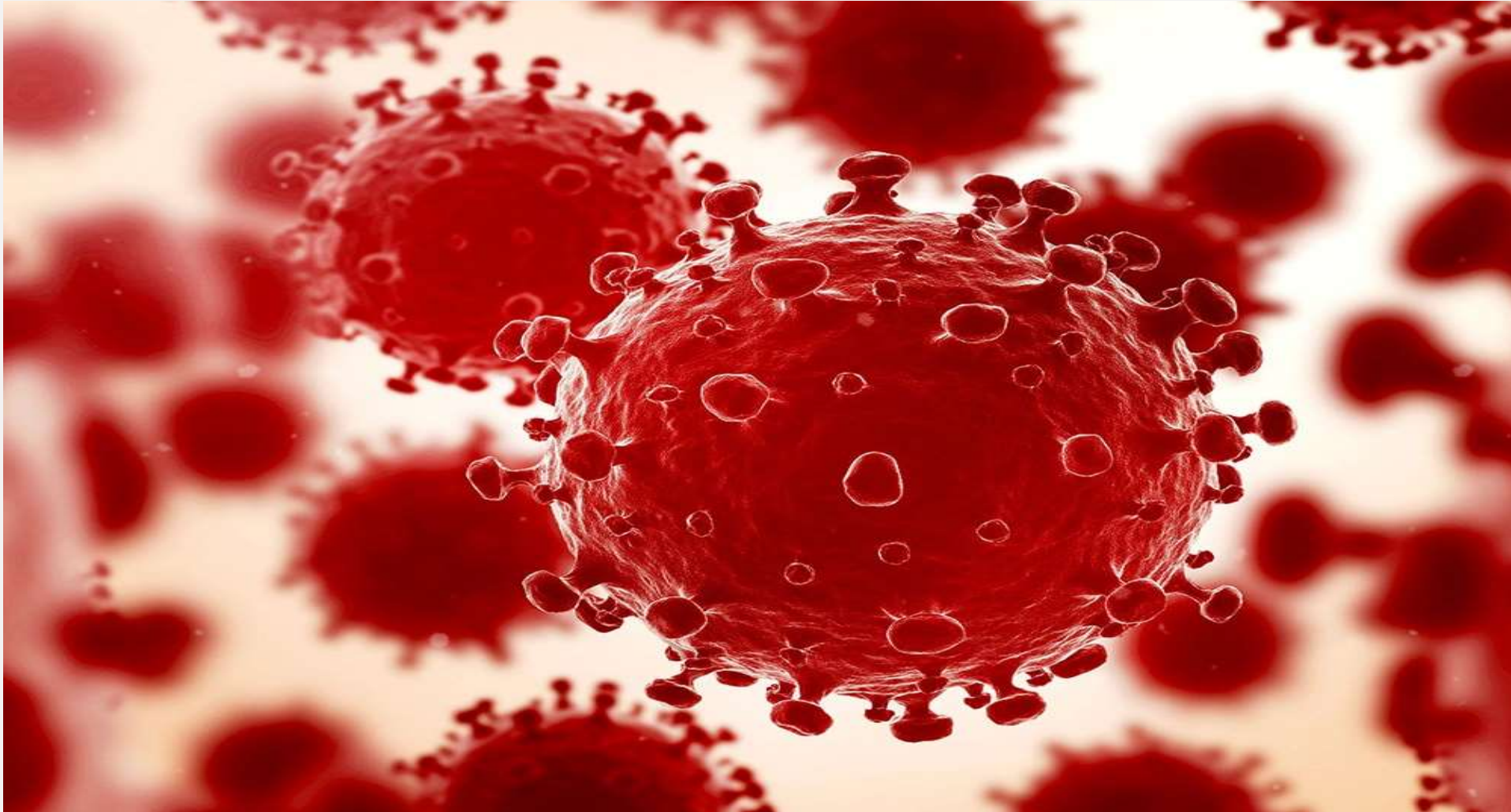
I want to find out if I had COVID-19 in the past, what test could I take?

Serological Antibody tests

Blood test

Even if previously asymptomatic.

Cannot be used to diagnose COVID-19.





Known infected / Diagnosed

- Mild, moderate, or severe
- Mild and moderate generally resolve
- Severe disease may result in hospital admission - this may require ICU admission



What happens to people who get COVID-19?

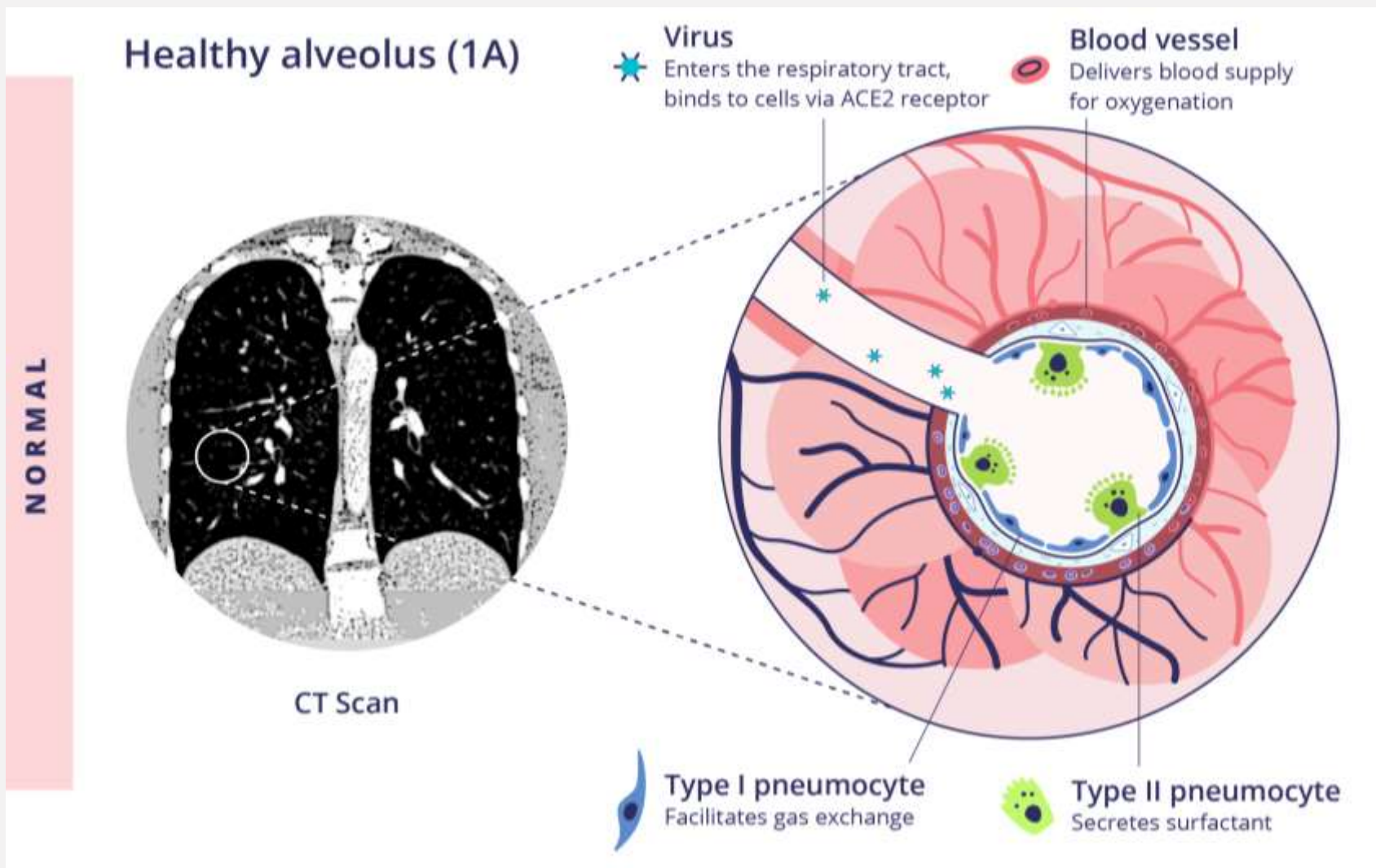
Most symptomatic (about 80%) recover from the disease.
About 15% become seriously ill and require oxygen.
About 5% become critically ill and need intensive care.

Complications leading to death may include respiratory failure, acute respiratory distress syndrome (ARDS), sepsis and septic shock, thromboembolism, and/or multiorgan failure, including injury of the heart, liver or kidneys.



Type	Clinical Characteristics	RT-PCR test for COVID-19
Asymptomatic	No clinical symptoms and chest imaging findings.	Positive
Mild	Mild clinical symptoms, such as fever, fatigue, cough, anorexia, malaise, muscle pain, sore throat, dyspnea, nasal congestion, headache. No abnormal chest imaging findings.	Positive
Moderate	Mild or moderate clinical features. Chest imaging showed mild pneumonia manifestation.	Positive
Severe	Suspected respiratory infection symptoms, plus any of the following: Shortness of breath, $RR \geq 30$ breaths/min; At rest, oxygen saturation $\leq 93\%$; $PaO_2/FiO_2 \leq 300$ mmHg (1 mmHg = 0.133 kPa). Chest imaging showed the lesions significantly progressed > 50% within 24–48 h was a severe disease.	Positive
Critical	Rapid progress of disease, plus any of the following: Respiratory failure, and need mechanical ventilation; Shock; Combined with other organ failure requires ICU monitoring treatment.	Positive

<https://www.clinicalkey.com/#!/content/journal/1-s2.0-S1684118220301134>





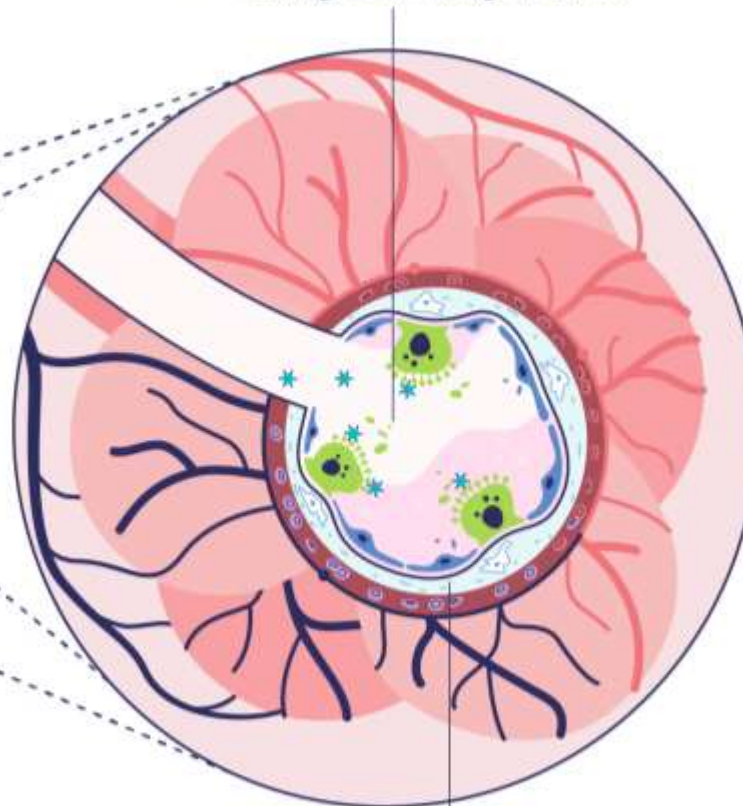
MODERATE


Pneumonia (1B)



CT Scan

 **Virus**
Damages cells lining the alveoli

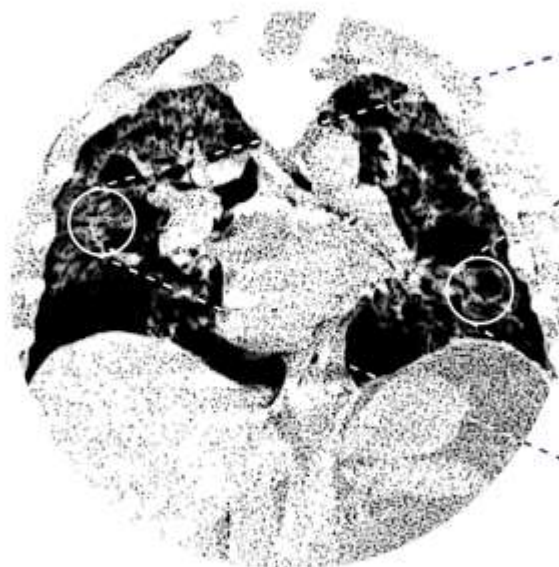


 **Inflammation**
causes fluid to collect in and around the alveoli, impairing transfer of oxygen



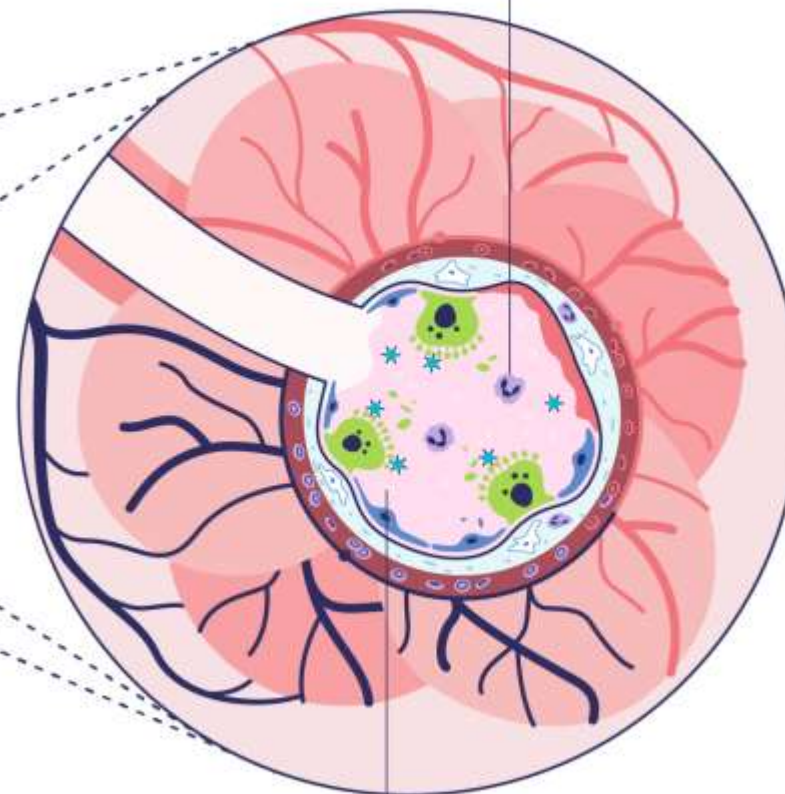
SEVERE

Severe damage to alveoli (1C)

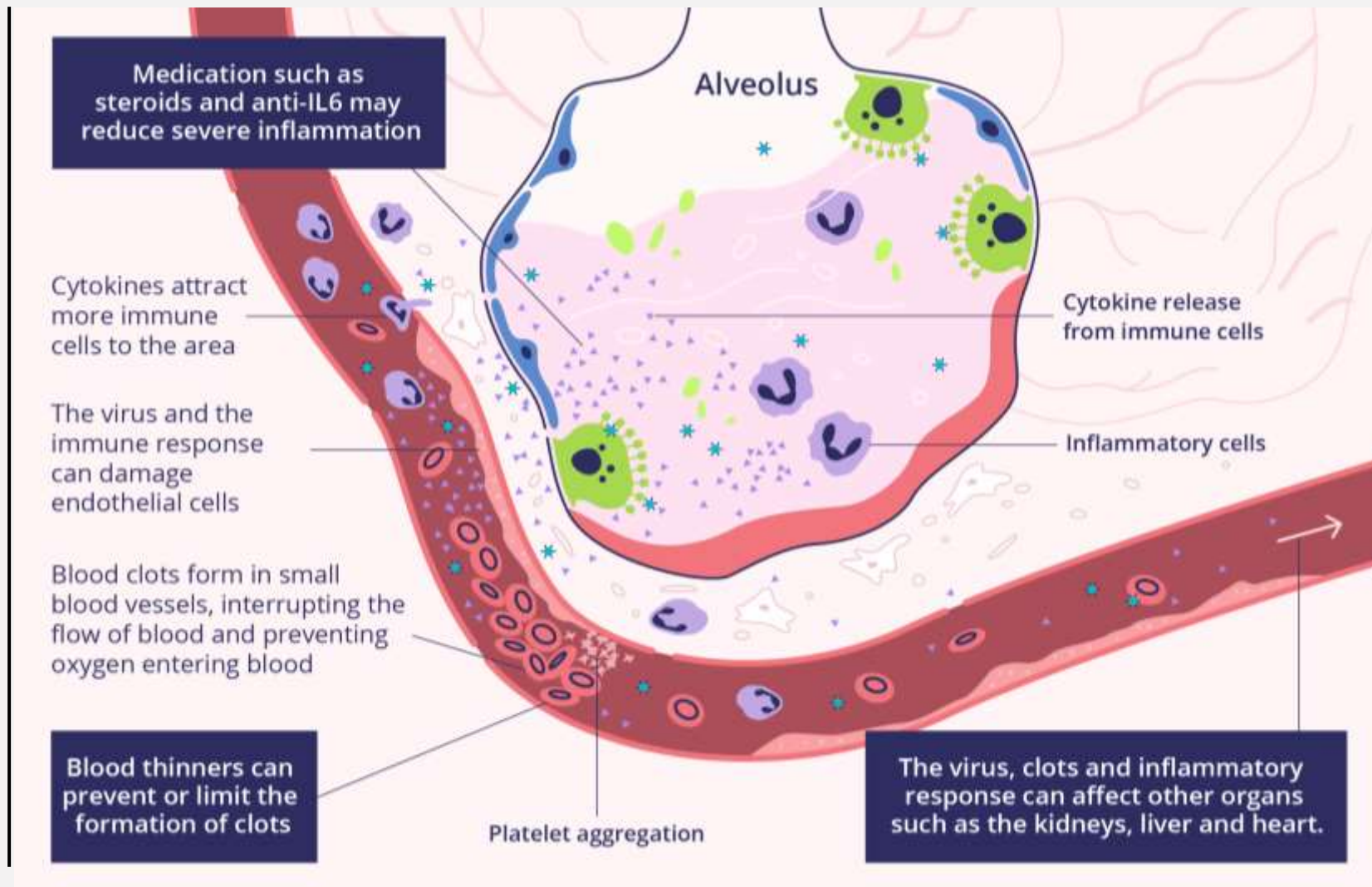


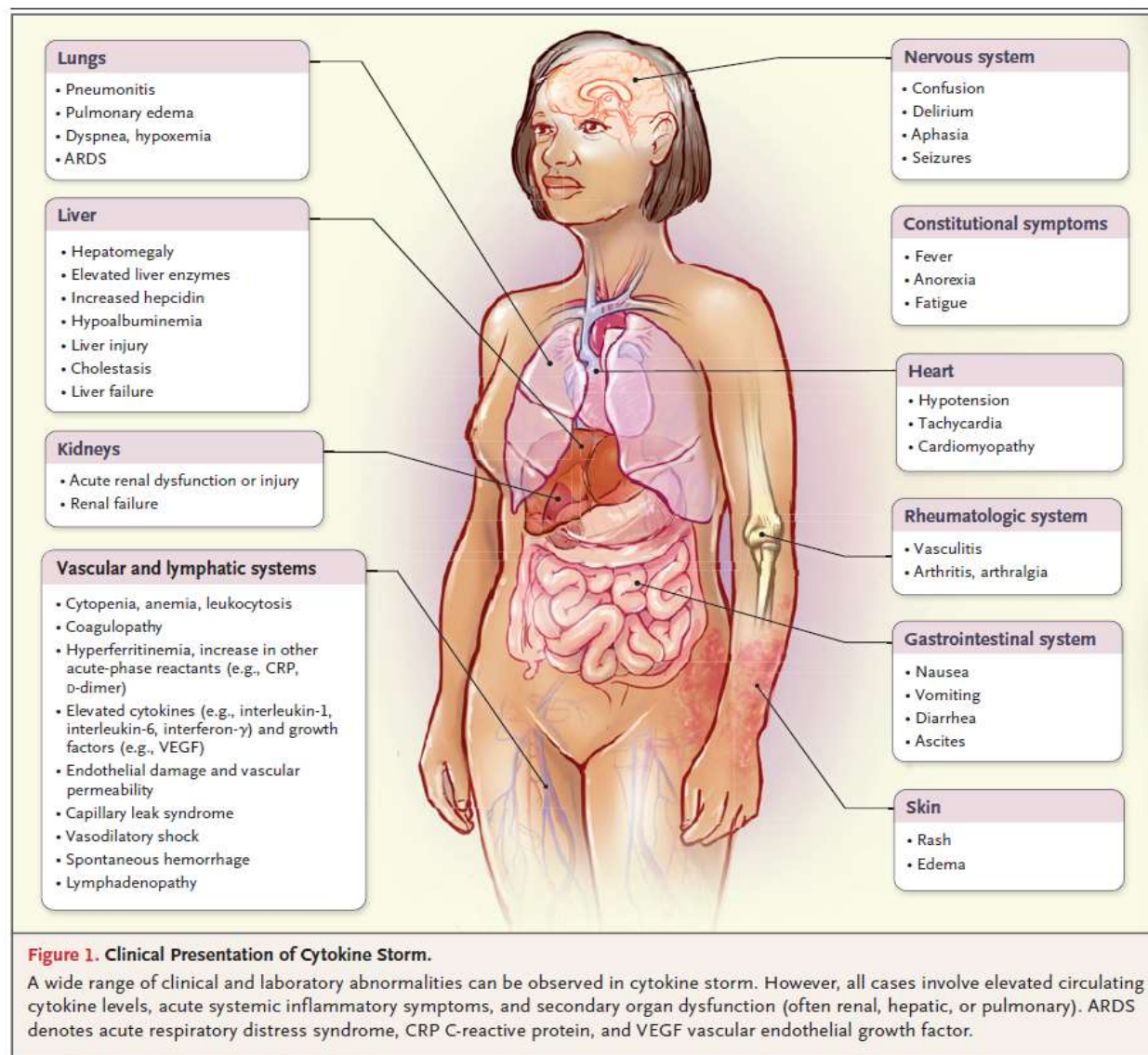
CT Scan

Inflammatory cells

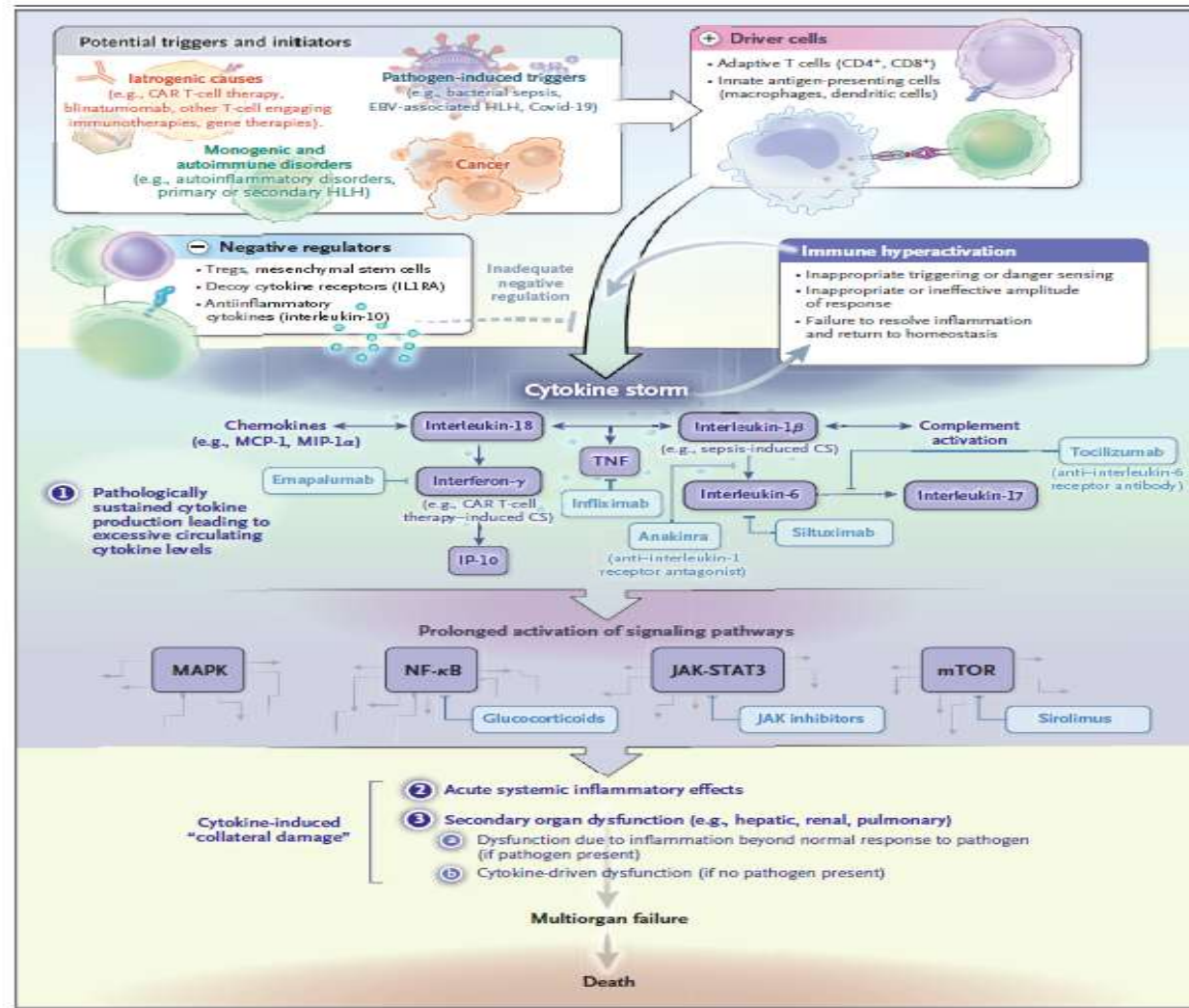


Fluid & mucous
collect in the air sacs





in determining the trend from baseline values, although these findings are typically not available in patients with septicemia. Unfortunately, it is difficult to distinguish cytokine storm due to sepsis





https://www.youtube.com/watch?v=IleOoS_A4c8&feature=youtu.be



At this stage of the COVID-19 pandemic, there are few peer-reviewed studies examining the occurrence or prevalence of long-term sequelae associated with COVID-19.



Defining post-acute covid-19

In the absence of agreed definitions:

Post-acute covid-19 as extending beyond three weeks from the onset of first symptoms.

Chronic covid-19 as extending beyond 12 weeks.

Since many people were not tested it has been suggested that a positive test for covid-19 is not a prerequisite for diagnosis.



Standardized terms

“long covid” as “signs and symptoms that develop during or following an infection consistent with covid-19 and which continue for more than four weeks and are not explained by an alternative diagnosis.”

Given that we are beginning to understand the underlying immunological and organ specific effects of SARS-CoV-2, it might have been better to define it as “signs and symptoms that continue for more than four weeks and can be attributed to covid-19 infection.” This definition would include all the post-acute medical complications of covid-19 under one unified definition rather than making long covid a vague diagnosis of exclusion.

NICE recommends using the term “post-covid syndrome” from 12 weeks after infection. But no evidence exists of any particular physiological changes (that predict chronicity) at 12 weeks, so it would be preferable to use the term long covid for symptoms of any duration beyond four weeks, as is strongly advocated by people with lived experience of this condition.



Post-acute covid-19 (“long covid”)

Possibly a multisystem disease, can occur after a relatively mild acute illness.

Clinical management requires a whole-patient perspective.

Patients whose acute illness required intensive care need specialist rehabilitation.



Even those who had mild versions of the disease may continue to experience symptoms after their initial recovery.

"long haulers"

"post-COVID-19 syndrome"

"long COVID-19."

Older people and people with many serious medical conditions are the more likely to experience lingering COVID-19 symptoms, but even young, healthy people can feel unwell for weeks to months after infection.

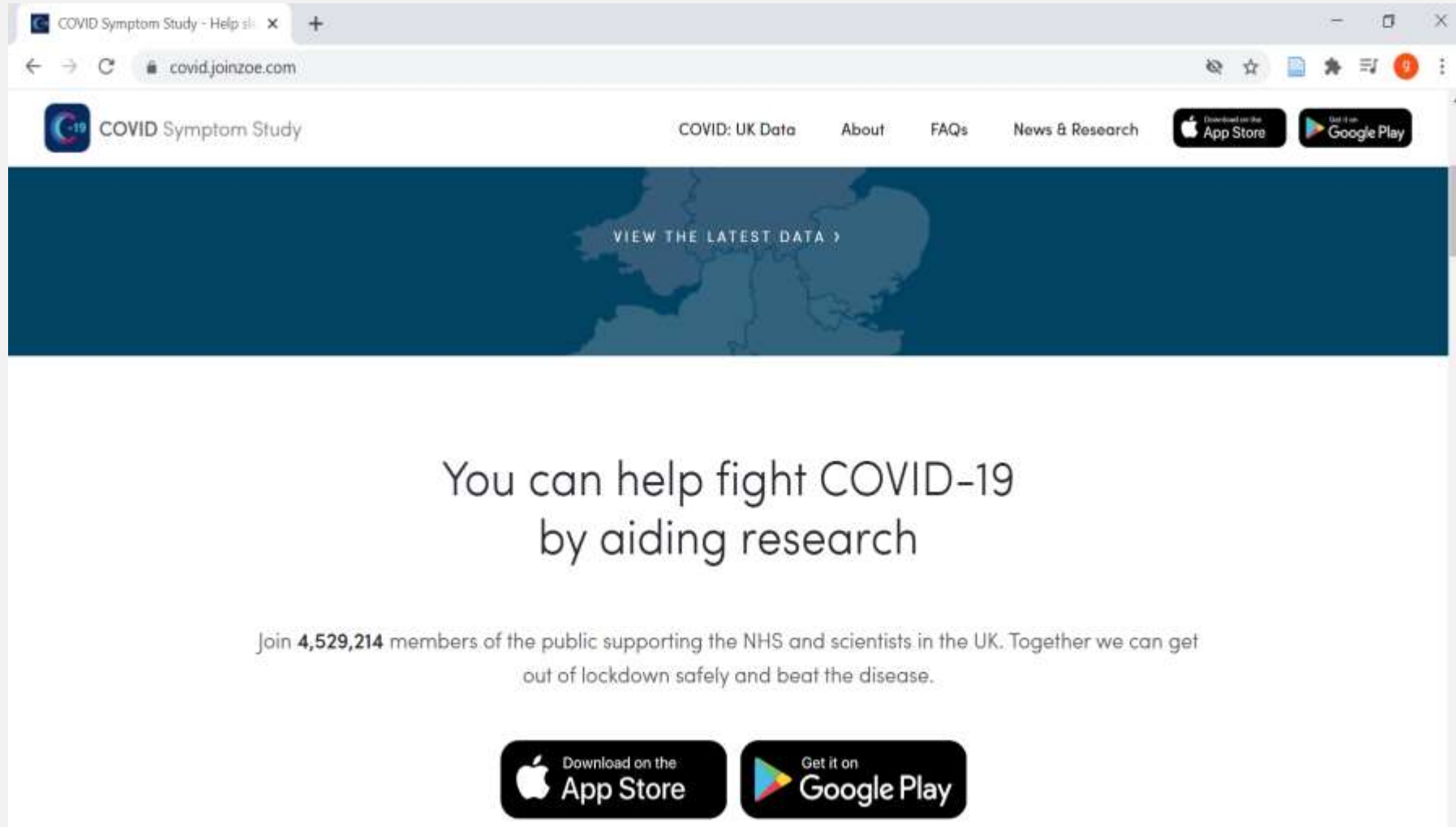


How common is it?

Around 10% of patients who have tested positive for SARS-CoV-2 virus remain unwell beyond three weeks, and a smaller proportion for months.

This is based on the UK COVID Symptom Study, in which people enter their ongoing symptoms on a smartphone app. This percentage is lower than that cited in many published observational studies, whose denominator populations were those admitted to hospital or attending specialist clinics.

A recent US study found that only 65% of people had returned to their previous level of health 14-21 days after a positive test.





Why are some people affected?

Not known why some people's recovery is prolonged.

Persistent viraemia, relapse, reinfection, inflammatory and other immune reactions, deconditioning, and mental factors such as post-traumatic stress may all contribute.

Long term respiratory, musculoskeletal, and neuropsychiatric sequelae have been described for other coronaviruses (SARS and MERS), and these have pathophysiological parallels with post-acute covid-19.



Long-term signs and symptoms may include:

- Fatigue
- Shortness of breath
- Cough
- Joint pain
- Chest pain
- Muscle pain or headache
- Fast or pounding heartbeat
- Loss of smell or taste
- Memory, concentration or sleep problems
- Rash or hair loss



Lungs

The type of pneumonia often associated with COVID-19 can cause long-standing damage to the tiny air sacs (alveoli) in the lungs. The resulting scar tissue can lead to long-term breathing problems.



Heart

Imaging tests taken months after recovery from COVID-19 have shown lasting damage to the heart muscle, even in people who experienced only mild COVID-19 symptoms. This may increase the risk of heart failure or other heart complications in the future.



Cardiovascular Long-Term Sequelae

The expression of the angiotensin-converting enzyme 2 (ACE2) receptor on myocytes, coronary endothelial cells and arterial smooth muscle increases the risk of organ damage in individuals with COVID-19, as the virus uses these receptors to gain entry into cells.

The majority of studies have focused on acute complications, but long-term sequelae may be possible based on the above mechanism.

Hypothesized that the following cardiovascular sequelae and complications may develop in individuals with COVID-19 and pre-existing cardiovascular risk factors:

acute coronary syndrome, myocardial infarction, arrhythmia, cardiogenic shock, heart failure, myocarditis and venous thromboembolism.



Brain

Even in young people, COVID-19 can cause strokes, seizures and Guillain-Barre syndrome — a condition that causes temporary paralysis.

COVID-19 may also increase the risk of developing Parkinson's disease and Alzheimer's disease.



Blood clots and blood vessel problems

COVID-19 can make blood cells more likely to clump up and form clots. While large clots can cause heart attacks and strokes, much of the heart damage caused by COVID-19 is believed to stem from very small clots that block capillaries in the heart muscle.

Other parts of the body affected by blood clots include the lungs, legs, liver and kidneys. COVID-19 can also weaken blood vessels and cause them to leak, which contributes to potentially long-lasting problems with the liver and kidneys.



Renal and Hepatic Long-Term Sequelae

There are limited reports evaluating renal and hepatic sequelae associated with COVID-19. The majority of studies report acute damage, which may lead to long-term sequelae, but the latter requires further study.



Reproductive Long-Term Sequelae

Little is currently known about the long-term reproductive sequelae associated with COVID-19 infection; however, there is one study that suggests that sperm quantity and function may be impacted.

A review indicates decreased sperm concentration and motility for up to 90 days following COVID-19 infection (Segars et al.)



Problems with mood and fatigue

Surviving ICU / Ventilation may make a person more likely to later develop post-traumatic stress syndrome, depression and anxiety.

Many people who have recovered from SARS have gone on to develop chronic fatigue syndrome. The same may be true for people who have had COVID-19.



Many long-term COVID-19 effects are still unknown

Many large medical centers are opening specialized clinics to provide care for people who have persistent symptoms or related illnesses after they recover from COVID-19.



Reports on Long-Term Sequelae from SARS-CoV-1 and MERS-CoV Infection

The most common sequelae during the period 6 months post-hospital-discharge in people with MERS or SARS were:

- impaired diffusing capacity for carbon monoxide (indicative of pulmonary fibrosis or pulmonary vascular disease)
- reduced exercise capacity
- Post-traumatic stress disorder
- Depression / Anxiety .



Reports on Treatment-Related Long-Term Sequelae

Mechanical ventilation is associated with ICU-acquired weakness, deconditioning, myopathies, neuropathies and delirium.

Confusion; agitation; altered consciousness; Dysexecutive syndrome affecting cognition.

Dysphagia, impaired gait, impaired balance, muscle weakness, myopathy, neck/shoulder pain (due to placing in prone position for extended period), neuropathy, psychological problems and reduced joint mobility.

The authors also report the need for chest physiotherapy in recovered patients due to pulmonary fibrosis.

A report has urged continued cardiac monitoring of those recovering from COVID-19 who have received hydroxychloroquine or azithromycin during acute infection, as these drugs have potential to cause arrhythmia.

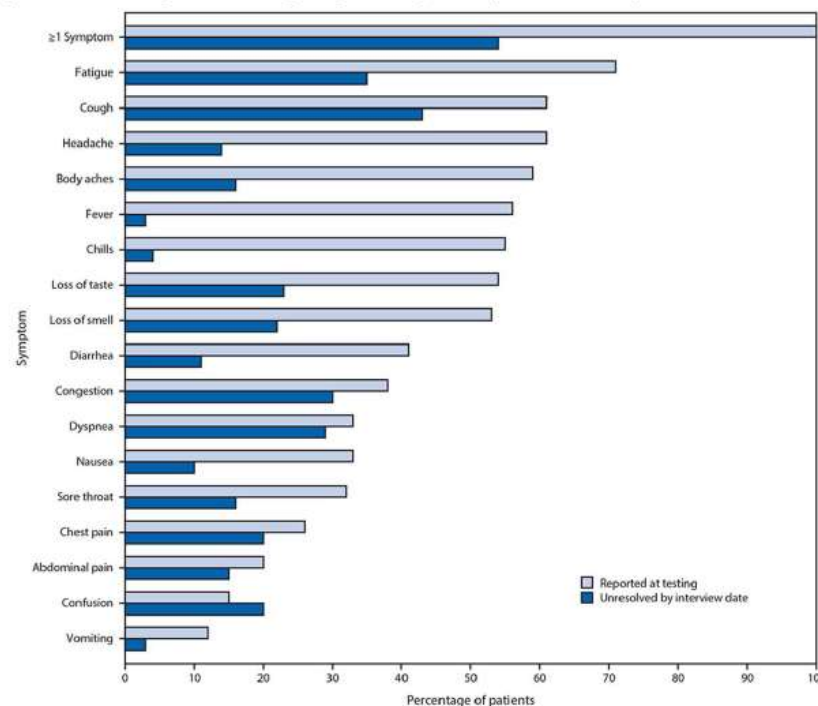


Lingering symptoms reported by participants of a multi-state phone study in the USA

Symptoms which may persist:

- Fatigue
- Cough, congestion or shortness of breath
- Loss of taste or smell
- Headache, body aches
- Diarrhea, nausea
- Chest or abdominal pain
- Confusion

Self-reported symptoms at the time of positive SARS-CoV-2 testing results and unresolved symptoms 14–21 days later among outpatients (N = 274) United States, March–June 2020



Source:

https://www.cdc.gov/mmwr/volumes/69/wr/mm6930e1.htm#F1_down



What we know about people who feel they do not fully recover from COVID-19

- **COVID-19 can sometimes result in prolonged illness**, even in young adults and children without underlying chronic medical conditions.
- There are many case reports from people who do not regain their previous health following COVID-19.
- Little is known about the clinical course of COVID-19 following milder illness.
- In a telephone survey of symptomatic adults who had a positive outpatient test result for SARS-CoV-2, 35% had not returned to their usual state of health when interviewed 2–3 weeks after testing.¹
- Among those 18 to 34 years in good health, 20% (1 in 5) reported that some symptoms were prolonged.
- **Risk factors for persistence of symptoms:** high blood pressure, obesity, mental health conditions.

¹<https://www.cdc.gov/mmwr/volumes/69/wr/mm6930e1.htm>



Long-term health effects of other coronavirus infections

A study was performed on the long term effects of severe acute respiratory syndrome (SARS), the coronavirus that emerged in 2003

- This study showed there was **persistent and significant impairment of exercise capacity** and health status in survivors of SARS over 24 months. Health workers who had SARS experienced even more marked adverse impact¹
- Another study, revealed that **40%** of people recovering from SARS still had chronic fatigue symptoms 3.5 years after being diagnosed²

¹ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7192220/>

² <https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/415378>

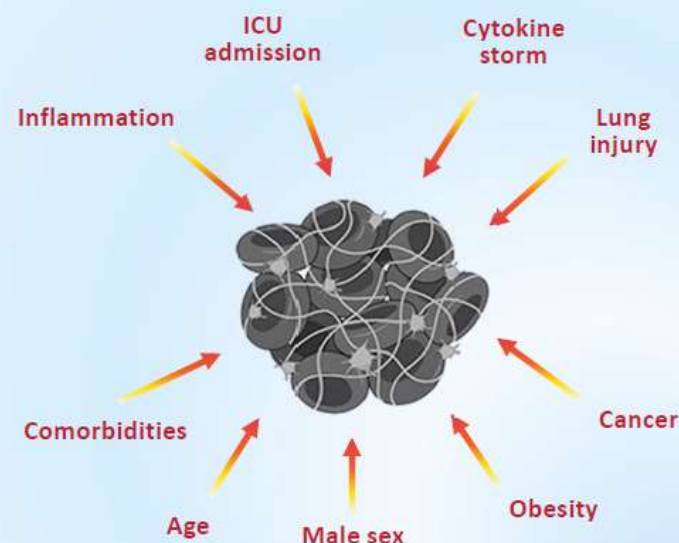


COVID-19 may increase the risk of long-term health problems

Body systems and organs that can be affected :

- **Heart**
 - Damage to heart muscle, heart failure
- **Lungs**
 - Damage to lung tissue and restrictive lung failure
- **Brain and the nervous system**
 - Loss of sense of smell (anosmia)
 - Consequences of thrombo-embolic events such as pulmonary embolism, heart attack, stroke
 - Cognitive impairment (e.g. memory and concentration)
- **Mental health**
 - Anxiety, depression, post-traumatic stress disorder and sleep disturbance
- **Musculoskeletal and others**
 - Pain in join and muscles
 - Fatigue

COVID-19 related risk factors for venous thromboembolism





What does this mean for patients?

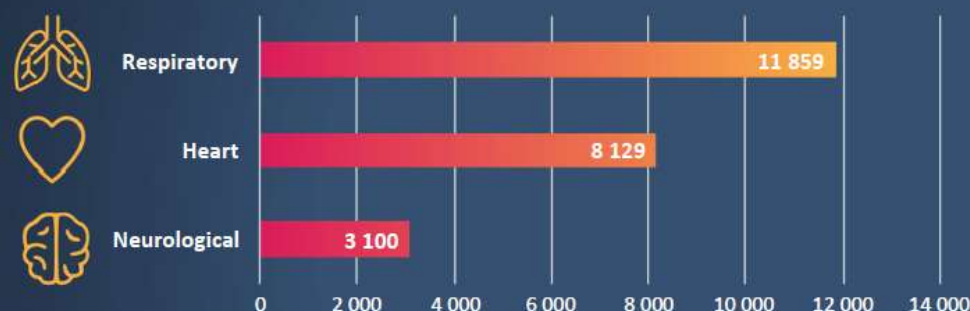
- **COVID-19 can result in prolonged illness and persistent symptoms**, even in young adults and persons with no underlying medical conditions who were not hospitalized
- **Much is still unknown** about how COVID-19 affects people over time
- **More time and research is needed** to understand:
 - the long-term effects of COVID-19
 - why symptoms persist or recur
 - how these health problems affect patients
 - the clinical course and likelihood of full recovery
- **Effective public health messaging for young adults** is warranted



Monitoring social media on long-term effects

Most discussed topics surrounding long-term effects of COVID-19 on social media

(27 AUGUST 2020 to 02 SEPTEMBER 2020)



The term '**Long COVID**' appeared in **11% of all conversation** surrounding long-term effects of COVID-19

The topic '**long-term effects of COVID-19**' has **decreased by 14%** compared to the previous week.

Examples

- **EFFECTS ON THE HEART**

Top tweets referencing a *Scientific American* review of studies on possible long-term effects of COVID-19 on the heart generated **104 000 social media engagements** (of which 60% on *Reddit*, 35% on *Facebook*, 5% on *Twitter*).

- **CHILDREN**

A science and society article in *Undark* which reported on prolonged COVID-19 illness in children had 2000 social media engagements.



Type, proportion, and duration of persistent COVID-19 symptoms*

Persistent symptom ¶	Proportion of patients affected by symptom	Time to symptom resolution Δ
Common physical symptoms		
Fatigue	15 to 87%	3 months
Dyspnea	10 to 71%	2 to 3 months
Chest discomfort	12 to 44%	2 to 3 months
Cough	17 to 26%	2 to 3 months
Anosmia	13%	1 month
Less common physical symptoms		
Joint pain, headache, sicca syndrome, rhinitis, dysgeusia, poor appetite, dizziness, vertigo, myalgias, insomnia, alopecia, sweating, and diarrhea	<10%	Unknown (likely weeks)
Psychologic and neurocognitive		
Post-traumatic stress disorder	24%	6 weeks to 3 months
Impaired memory	18%	
Poor concentration	16%	
Anxiety/depression	22%	
Reduction in quality of life	>50%	Unknown (likely weeks)

COVID-19: coronavirus disease 2019.

* These data are derived from an earlier period in the pandemic; information on patient recovery and persistent symptoms is evolving, and these figures may change as longer-term data emerge.

¶ More than a third of patients with COVID-19 experience **more than one** persistent symptom.

Δ Time course for recovery varies depending on premorbid risk factors and illness severity and may be shorter or longer than that listed. Hospitalized patients, and in particular critically ill patients, are more likely to have a more protracted course than those with mild disease.

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What are we seeing

- Mental health
- Fatigue
- Cardiac
- Respiratory
- ? Skin
- Sleep disturbance
- ? Dental



Conditions experienced by members of the UK doctors #longcovid group

- Myocarditis or pericarditis
- Microvascular angina
- Cardiac arrhythmias, including atrial flutter and atrial fibrillation
- Dysautonomia, including postural orthostatic tachycardia syndrome
- Mast cell activation syndrome
- Interstitial lung disease
- Thromboembolic disease (pulmonary emboli or cerebral venous thrombosis)
- Myelopathy, neuropathy, and neurocognitive disorders
- Renal impairment
- New-onset diabetes and thyroiditis
- Hepatitis and abnormal liver enzymes
- New-onset allergies and anaphylaxis
- Dysphonia

<https://www.clinicalkey.com/#!/content/journal/1-s2.0-S0140673620327057>



Mental Health

- As a result of these exceptional challenges, lives are being lost that could, in other circumstances, have been saved. Non-clinical professionals in other essential roles, such as the justice system, media workers, social workers, etc., may also feel the profound effects of being required to perform already highly challenging duties in a more constrained manner which may lead to risks being more difficult to manage. How such events will impact front-line, key worker teams remains unclear, but it is likely that many will experience a degree of moral distress and some moral injuries [4].
- **Moral injury** is defined as the profound psychological distress which results from actions, or the lack of them, which violate one's moral or ethical code [5]. Morally injurious events can include acts of perpetration, acts of omission or experiences of betrayal from leaders or trusted others. Unlike post-traumatic stress disorder (PTSD), moral injury is not a mental illness. Although experiences of potentially morally injurious events (PMIEs) can lead to negative thoughts about oneself or others (e.g. "I am a monster" or "my colleagues don't care about me") as well as deep feelings of shame, guilt or disgust. These, in turn, can contribute to the development of mental health problems, including depression, PTSD and anxiety [6].



People who spend time in the hospital and require mechanical ventilation may also experience other difficulties. A July 2020 study lists the following complications of ventilator treatment:

- chipped teeth
- lacerated lips, tongue, or throat
- injured vocal cords
- infection
- hypoxia
- hypotension
- collapsed lung
- heart rhythm problems

People who leave the hospital after having COVID-19 need ongoing support and rehabilitation to help them recover.



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Brain, Behavior, and Immunity
Volume 88, August 2020, Pages 957–958

Letter to the Editor
A brewing storm: The neuropsychological sequelae of hyperinflammation due to COVID-19

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Mask-associated 'de novo' headache in healthcare workers during the COVID-19 pandemic

José María Ramirez-Moreno, David Ceberino, Alberto Gonzalez Plata, Belen Rebollo, Pablo Macias Sedas, Roshan Hariramani, Ana M Roa, Ana B Constantino

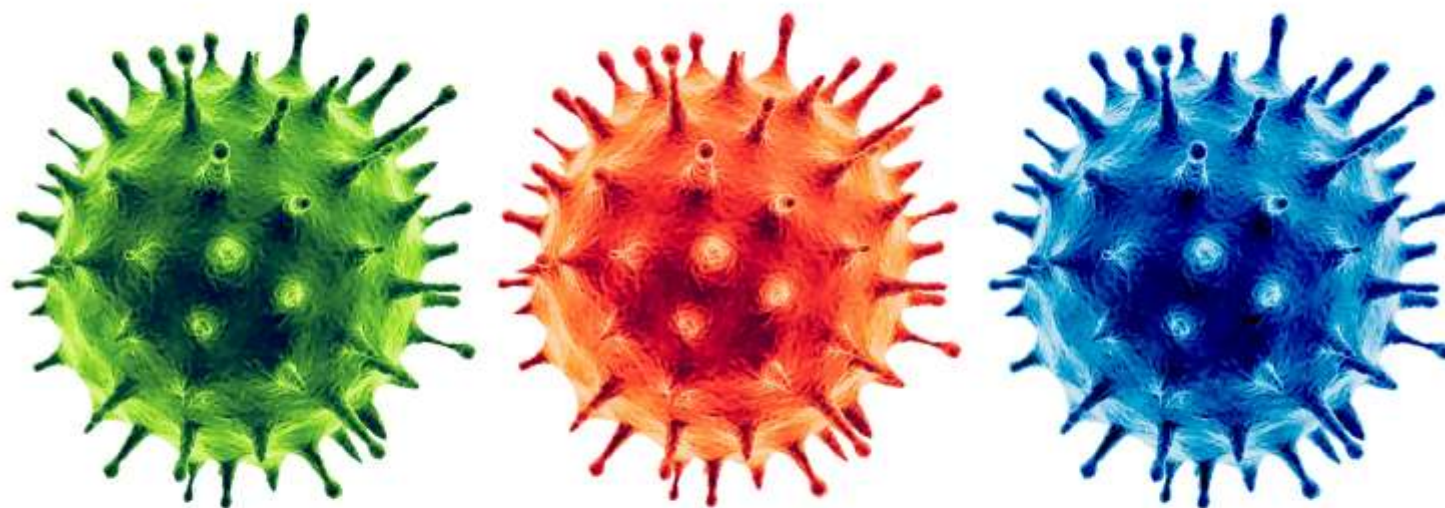
Occupational and Environmental Medicine 2020 December 30

OBJECTIVES: The pandemic caused by the new coronavirus (COVID-19) has changed care activities of health professionals. We analysed the possible association between the appearance of 'de novo' headache according to the type of mask used, the related factors and the impact of the cephalalgia on health professionals.

METHODS: Cross-sectional study in a tertiary hospital in Extremadura, Spain. We provided an online questionnaire to healthcare workers during the period of maximum incidence of COVID-19 in our setting.

RESULTS: The subjects are n=306, 244 women (79.7%), with an average age of 43 years (range 23-65). Of the total, 129 (42.2%) were physicians, 112 (36.6%) nurses and 65 (21.2%) other health workers. 208 (79.7%) used surgical masks and 53 (20.3%) used filter masks. Of all those surveyed, 158 (51.6%) presented 'de novo' headache. The occurrence of a headache was independently associated with the use of a filter mask, OR 2.14 (95% CI 1.07 to 4.32); being a nurse, OR 2.09 (95% CI 1.18 to 3.72) or another health worker, OR 6.94 (95% CI 3.01 to 16.04); or having a history of asthma, OR 0.29 (95% CI 0.09 to 0.89). According to the type of mask used, there were differences in headache intensity, and the impact of a headache in the subjects who used a filter mask was worse in all the aspects evaluated.

CONCLUSION: The appearance of 'de novo' headache is associated with the use of filter masks and is more frequent in certain healthcare workers, causing a greater occupational, family, personal and social impact.





Pandemic closure

- Mental Health - worsening of pre-existing condition / precipitation of new mental health diagnosis (MDD / GAD / Suicide)
- SUD – worsening / precipitation of new condition

Work isolation

Decreased income / financial uncertainty

Health uncertainty

Exposure potential / unknowns / uncertainty / exposure from co-workers / public / transport to & from

Vulnerable workforce e.g MFW / Food processing

Suspension of regular screening requirements e.g designated substances monitoring

- Delayed diagnosis e.g breast cancer (all regular screening was stopped)
- Delayed treatment e.g breast cancer surgery (all surgery was stopped)
- Increased complications from known medical issues e.g DM – poor control
- Decreased physical activity
- PPE complications – Mental / Respiratory / Skin / ocular /? dental



What risks does COVID-19 pose to society in the long-term?



- Inequalities and social deprivation may increase.
- World Economic Forum's recently published *COVID-19 Risks Outlook* report.
- Record levels of unemployment due to lockdown measures to control transmission and have re-learned hard lessons, in particular that social deprivation determines health outcomes.



COVID-19 


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Early lockdown
studies found that



up to 37%
showed signs
of psychological
distress and



up to 45% of adults
felt adverse effects on
mental health,



up to 70% felt
this period was the
most stressful of
their careers.

Source: COVID-19 Risks Outlook 2020: A Preliminary Mapping and its Implications



COVID-19 

Employers will need to manage the **psychological effects** of the lockdowns on their workforce as they return to office/factory.

Source: COVID-19 Risks Outlook 2020: A Preliminary Mapping and its Implications



low morale

hyper-stress



general fear




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Inequalities – here to stay?

The timing and speed of the economic recovery, dependent as it is on solving the health crisis, is likely to exacerbate inequality, mental health problems, and lack of societal cohesion. It is also likely to widen the wealth gap between young and old /rich and poor, as well as pose significant educational and employment challenges.



COVID-19 


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COVID-19 is a threat
to the **old**, right?

Wrong – likely effects on
the world's youth include:



Disrupted education, with
80% of enrolled students
suffering **enforced hiatus**
+ more **dropouts** likely
through **reduced**
parental finances.

Source: COVID-19 Risks Outlook 2020: A Preliminary Mapping and its Implications



The COVID-19 economic crisis has already hit poorer people and those in more socially disadvantaged groups disproportionately harder.

The economic and societal disruptions of the lockdowns are taking a toll on young people's mental health and wellbeing. As one teenager puts it: "The life you thought was boring, is the life you're hoping to get back to right now."

Even more concerning are the long-lasting effects to their prospects. Youth employment in developed economies has only just recently returned to pre-2008 financial crisis levels. In developing economies, youth unemployment has risen steadily, creating a real risk of social unrest.

For young people in education, the pandemic is likely to cause new inequalities. Currently 80% of the world's students - more than 1.6 billion young people - are not attending school.

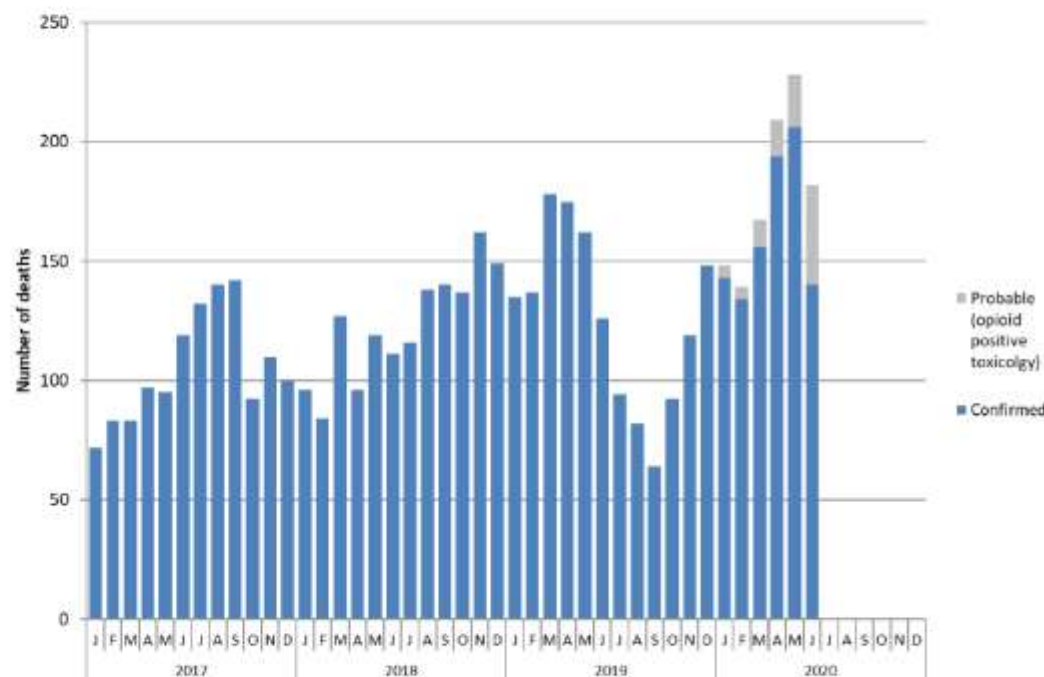
Many students in poorer communities lack the necessary tools to access online courses or face difficulties working at home. The consequences of these educational inequalities, especially for girls and young women, will disadvantage them in labour markets and further exacerbate inequality.



Opioid-Related Deaths Jan-June 2020 in Ontario

- Since the COVID-19 pandemic began concerns about:
 - an increasingly toxic unregulated drug supply,
 - barriers to access to harm reduction services and treatment,
 - physical distancing requirements leading to more people using drugs alone
- 1003 opioid-related deaths confirmed to date from Jan-June 2020 (+74 cases pending confirmation)
 - Record number of deaths reported in May (229 deaths)
- The vast majority of these deaths are deemed to accidental

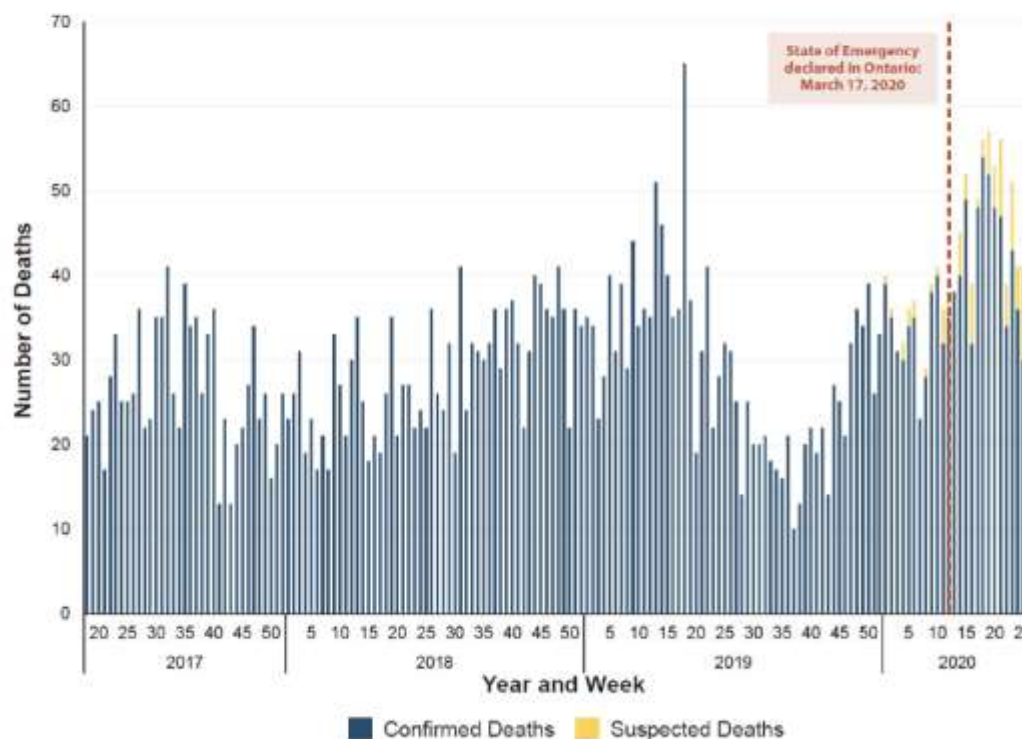
Opioid-related Deaths in Ontario, 2017 to June 2020



Source: Office of Chief Coroner (OCC) - Data effective Nov 1, 2020
Data is preliminary and subject to change



Weekly Number of Opioid-Related Deaths in Ontario prior to, and during, the COVID-19 Pandemic



8

Note: Epi-week (Monday – Sunday)

Overall, there was a **38.2% increase** in opioid-related deaths in the first 15 weeks of the COVID-19 pandemic compared to the 15 weeks immediately prior:

695 deaths; average of 46 deaths weekly
compared to
503 deaths; average of 34 deaths weekly.

If the number of opioid-related deaths continues at the weekly pandemic rate for the rest of 2020, it is anticipated that there will be **2,271** opioid-related deaths in the province by the end of the year.

This would represent a 50% increase over the year prior (1,512 opioid-related deaths in 2019).

Ontario



Summary

- In the first 15 weeks of the COVID-19 pandemic in Ontario, almost 700 people died of a confirmed or suspected opioid-related death, representing a 38% increase compared to the 15 weeks immediately preceding the pandemic
- If the current trends continue 2271 opioid related deaths are expected in 2020, 50% increase compared to 1512 in 2019
- Need for policies and programs designed to provide access to harm reduction, a range of low-barrier opioid agonist treatment options, a safer supply of drugs, other health and social supports
- There is a clear need to act quickly to provide adequate support for people who use drugs during current and anticipated future waves of this pandemic.



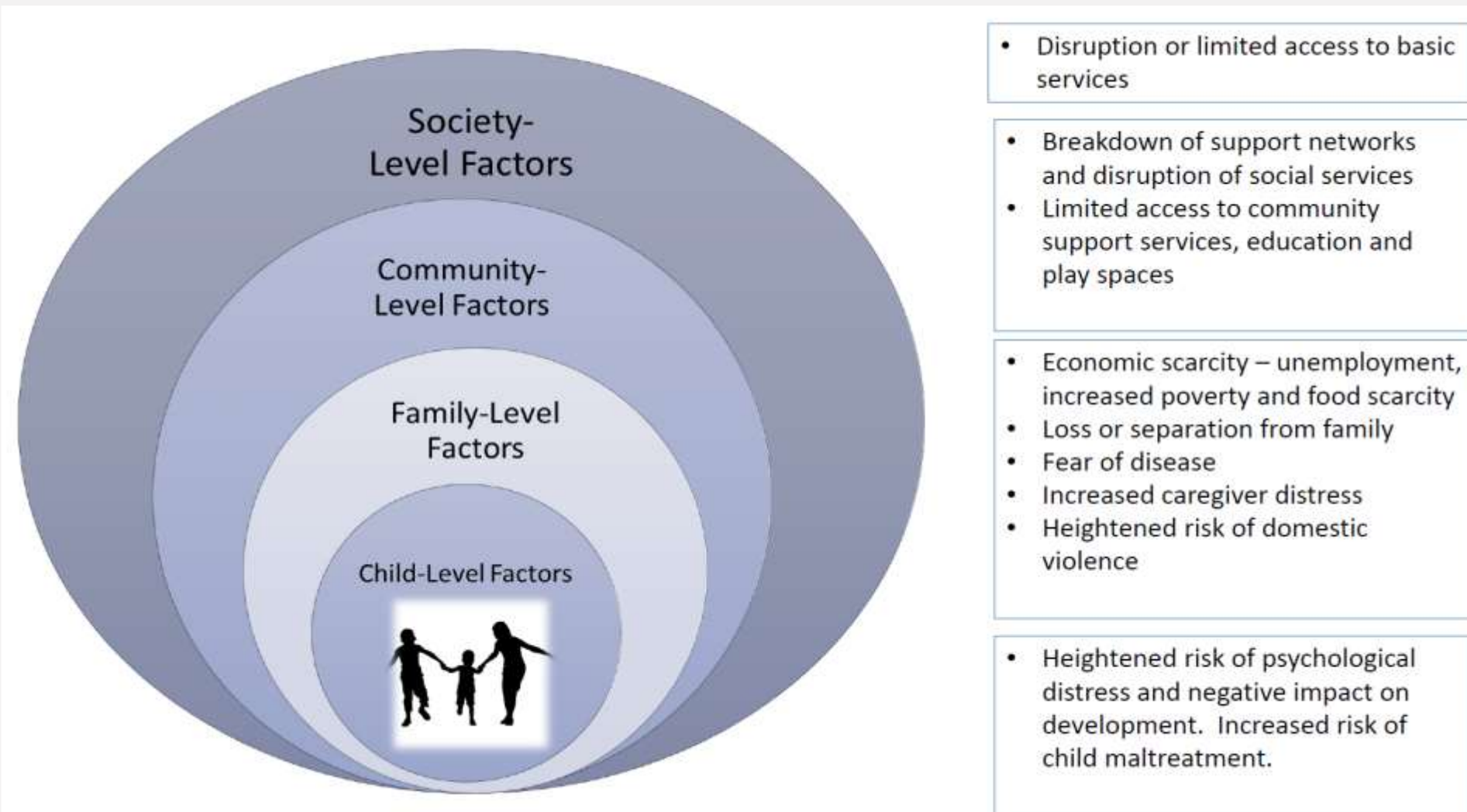
What do we know from other contexts?



A rapid review of the impact of public health measures on children and families indicated that school closures and stay-at-home orders negatively effects access to nutrition and vaccination programs through schools, and increases risk of financial stressors, mental health problems, decreased movement behaviour and increased risk of factors related to child maltreatment (Public Health Ontario, 2020).



A second rapid review of the psychological impact of quarantine identified 24 eligible studies and found numerous psychological effects including PTSD, confusion and anger. Stressors included longer quarantine duration, infection fears, boredom, frustration, inadequate supplies, inadequate information, financial loss and stigma (Brooks et al., 2020)





COVID-19 negatively impacted caregiver's mental health





- 45.6% of caregivers reported no change in alcohol consumption since the start of the pandemic; 37.5% reported an increase in alcohol intake
- Most parents reported no cannabis use within the last six months (80.7%). However, among those reporting using cannabis, over a third of parents reported changes in amount of cannabis consumption since the start of pandemic; with 87.9% reporting increased usage.



Parents/caregivers reported moderate to high levels of concern for:



48%

Managing their children's remote learning.



54%

Managing their children's screen time.



48%

Managing their child's anxiety and stress.



31%

Managing their child's behaviour.



48%

Managing household routines, organization and meals.



"Working from home full time and helping children with online learning is exceptionally stressful for all of us and as a result, patience is quite short resulting in more arguments."



of caregivers reported deterioration in their children's behaviour or mood.

32% reported needing assistance with their children's behaviour and/or mood during the pandemic.



COVID-19 has affected family functioning.



Parents also reported a high level of conflict ("somewhat" to "a lot") with their partner/spouse since the lockdown began – 49 per cent reported feeling angry or annoyed with spouse; 34 per cent indicated moderate to high levels of criticizing or yelling at their partner; 47 per cent reported high levels of feeling distant from their partner, and almost one quarter reported having exploded at their partner in the last month. Similar patterns were observed when participants were asked about their spouse/partner's behaviour towards them. **Almost 10 per cent of parents indicated increased verbal or physical conflict since the pandemic started.**



Summary

- Ontario families are struggling
- These findings also represent a call for help with one third of parents indicating they need assistance with their own mood and stress and a third indicating needing help with their children's behaviour and mood



Women, moms at risk of binge-drinking during pandemic: CAMH study



Parents, women among Canadians struggling most with mental health during pandemic: surveys



Calls to Canadian domestic violence helplines jump during pandemic





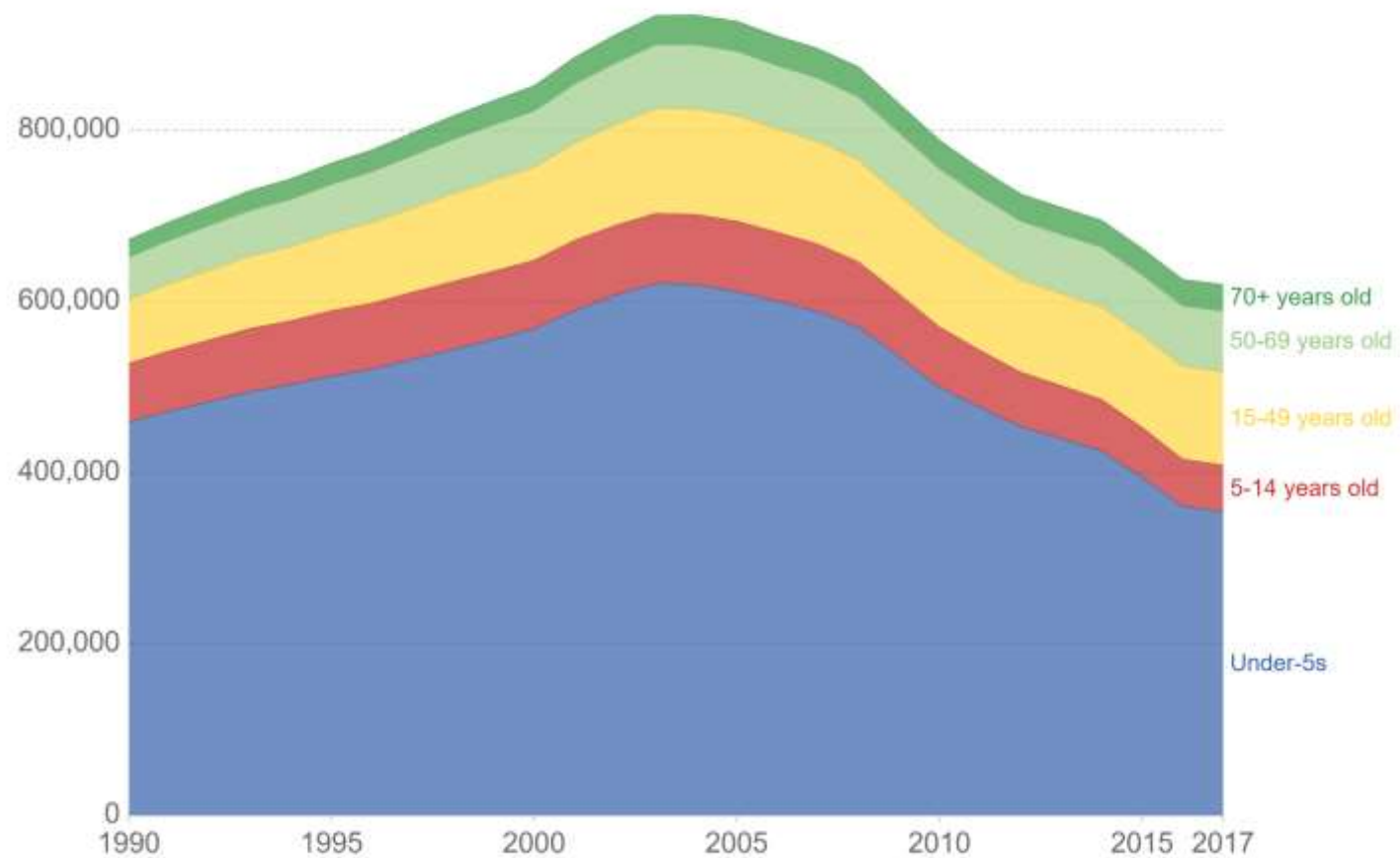
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Deaths from malaria, by age, World, 1990 to 2017

Annual number of deaths from malaria, differentiated by age category.

Our World
in Data



Source: IHME, Global Burden of Disease (GBD)

OurWorldInData.org/malaria/ • CC BY



Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected mosquitoes.

It is preventable and curable.

In 2019, there were an estimated **229 million cases of malaria worldwide**.
The estimated number of malaria deaths stood at 409 000 in 2019.

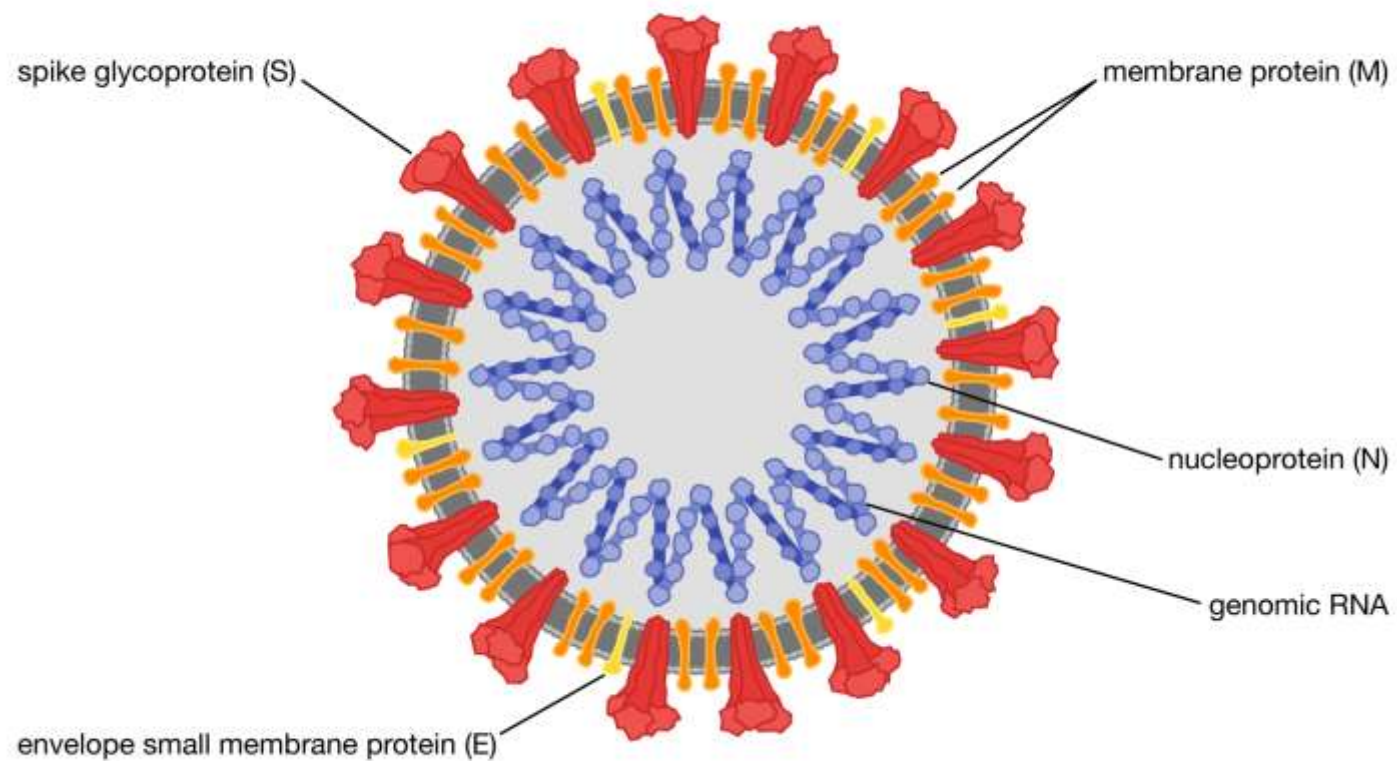
Children aged under 5 years are the most vulnerable group affected by malaria; in 2019, they accounted for 67% (274 000) of all malaria deaths worldwide.

The African Region carries a disproportionately high share of the global malaria burden. In 2019, the region was home to 94% of malaria cases and deaths.

Total funding for malaria control and elimination reached an estimated US\$ 3 billion in 2019. Contributions from governments of endemic countries amounted to US\$ 900 million, representing 31% of total funding.



Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)



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