COVID-19, the quarantine-virus disease

Abstract:
Since December 2019, the world faced an outbreak of a new Coronavirus, SARS-CoV-2, causing COVID-19. The virus spreads through close contact and droplets when we sneeze, cough or speak. Luckily, when children get infected, they likely seem to only have mild symptoms, like fever and cough. Mainly elderly people (over 65 years old) and people with other health conditions can heavily suffer from COVID-19. The disease causes infections of the lungs, blood and digestive system. Increased hygiene, keeping a ‘social’ distance of minimum 1.5m from those that don’t live in your house and staying at home is our best protection against the spreading of the virus. Through thorough testing for infections, tracing and quarantining infected patients and those who got in contact with the patient just before he/she got sick is our best way to contain the virus at this moment. Currently, a COVID-19 vaccine is being developed!

Body text:
The new Coronavirus, what we know so far

SARS-CoV-2 is the youngest member of the Coronaviridae family known to infect people (Fig. 1). Its full name is Severe Acute Respiratory Syndrome-Coronavirus-2. The virus causes severe infections of the lungs, blood and digestive system. The disease is called COVID-19 (COronaVirus Disease 2019). SARS-CoV-1 (Severe Acute Respiratory Syndrome-Coronavirus-1) and MERS-CoV (Middle-East Respiratory Syndrome-Coronavirus), two other famous family members, also caused considerable human’s suffering and dying, SARS in 2002 and MERS in 2012 respectively. Four other successful family members (Human Coronaviruses - HCoV) cause about a third of common colds (Fig. 1).

SARS-CoV-2 is a zoonotic virus, meaning that it jumped from an animal to a human. The virus’ genetic similarity to bat coronaviruses explains why scientists believe that the virus jumped from its original host, a bat, to a human (patient 0) in Wuhan, China. Coronavirus looks like a little ball (diameter: 50-200 nm, so tiny it’s only detectable with a super-
microscope) with crown-like spikes (Corona, as in ‘crown’). The ball’s outer layer consists of fatty particles (lipids) that are easily destroyed when the virus comes into contact with soap.

The COVID-19 virus, successful in causing a pandemic

For decades, zoonotic viruses have caused more and more outbreaks. A disease spreading over the whole world is called a pandemic. But why did this virus cause a pandemic like we haven’t seen in more than a century?

Worldwide almost 8,5 million people got infected, and nearly 450,000 people died from COVID-19 (date 17/06/’20). For a disease to become a pandemic, spreading around the world in just months, causing that much harm to people, it has to be very contagious but not too deadly.

Viruses need to hijack other cells to reproduce. That’s there only goal: to survive and multiply themselves (Fig. 2). The virus spreads through close contact and droplets we spread when we sneeze, cough or speak. It can enter us directly through our eyes, nose or mouth. The virus can survive on various surfaces for hours so people can get it on their hands and infect themselves by touching their face, something we do on average 20 times per hour.

Once inside the body, the crown-like spikes attach on the ACE2 receptors found on many human cells like blood vessel cells (Fig. 2). Through these receptors, it enters human cells and gives instructions to produce numerous copies of itself, that potentially invade more and more cells. As more cells get infected, it can lead to flu-like symptoms, such as cough, fever and fatigue. Other symptoms are a shortness of breath, sore throat, loss of appetite or sense of smell, lack of taste, or diarrhea.

However, you can also be infected and spread it without having symptoms. Initially, the Coronavirus is silent for some time: the incubation period that can last up to 2 weeks. About 3 days before the first symptoms appear (if symptoms appear), infected persons are likely to
transmit the virus. When no measures are taken, they are likely to infect several people, between 1 to 4, without knowing it. Those people in turn also infect more people and so on. That’s why the virus is so successful in causing a pandemic. The number of infected people doubles quite rapidly (shown as exponential curves in the graph in Fig. 3 where the red line mounts very quickly).

Currently, the best measures to prevent infection is good hygiene through washing our hands regularly with soap, sneezing in a paper tissue (and throw it away afterwards), and sneezing in our elbow. ‘Social distancing’ or ‘physical distancing’ which means keeping a distance of minimum 1.5m from others, is important as it prevents the virus from jumping from one person to another. When we cannot keep that distance, wearing a mouth mask protects the spreading of the virus (Fig. 3).

Am I at risk? Am I a risk to others?

Research is ongoing, but we know already that children are at lower risk of severe infection and they are not the main actors spreading the virus (Fig. 1). Only a small portion of confirmed COVID-19 cases are children. However, since children show no or only mild symptoms, they don’t get tested as much as adults.

The older you get, the more you are at risk of suffering from COVID-19 such as developing a severe lung infection. People aged 65 and older (probably your grandparents), but also people already suffering from another condition, such as lung or heart disease, or having a weak immune system or diabetes are more at risk (Fig. 1). Research showed that men are more likely to get sick than women. This could be due to biological differences, because they tend to smoke more often, or maybe even because they wash their hands less frequently?

But if children are less likely to get infected and develop severe symptoms nor to spread the disease, then why did almost all schools close? Well, children playing together don’t keep the physical distance. And children usually love visiting their grandparents. At the start of the pandemic, little was known about this virus. Scientists and governments did not want to take any risk to let the virus spread further. Schools, shops and airports closed, every non-essential contact between humans was avoided and the majority of people worked from home. Almost the whole world went in a so-called ‘lockdown’. Everybody stayed at home as much as possible. Only public services such as hospitals – of course! – but also public transport and services like garbage collectors and food shops continued working. Thanks to these strong governmental
measures, the rate of infections slowed down and the health emergency services were able to help the people that got really ill and needed to be hospitalized. This is what is meant by ‘flattening the curve’ (Fig. 3).

SARS-CoV-2 caused suffering in many different ways. Many people got sick, or worse, lost someone they loved. Being quarantined for a long time also lead to many people feeling sad and lonely. People could not travel nor go shopping during the lockdown, so the economy also seemed to stop. Consequently, many people will lose their jobs. Even when the pandemic is over, it will take some time for the world to recover from the damage this virus caused; for example, people who lost their jobs need to find another way to support their families. So the better we follow the hygiene measures (washing our hands regularly and social distancing), the less the virus will spread and the sooner the pandemic will be over.

### Diagnosing and tracing to contain the virus

Never before have scientists worldwide collaborated so closely – at a safe distance! – to find answers to their questions about the virus’ origin and its rapid pace and route of transmission, a treatment to relieve the patients’ symptoms, and particularly, a cure to stop this devious virus from spreading further.

Physicians are currently exploring ways to relieve patients’ symptoms. One way might be drug repurposing. Compare it with old toys used to play a new game. Drugs normally given to patients to fight other infections, such as Remdesivir to fight ebola, are tested. Dexamethasone, a cheap and widely available drug used to reduce inflammation, shows promising results in reducing deaths among patients seriously ill with COVID-19.

By means of quick testing with a nose swab, we can detect infected people and quarantine them (for 2 weeks) so they stop infecting others. Further, by tracing down the persons who were in contact with the SARS-CoV-2-positive patient, and also quarantining them, the risk of further spreading is contained. A more profound blood test can help determine whether people were infected before and built immunity against the virus.

The blood of people who recovered from COVID-19 is a potential cure that is explored. Because when fighting the virus, you develop antibodies against it, so your body recognizes the virus quickly when you have another encounter with it. Well, those antibodies in your blood can be isolated (called convalescent serum) and could be used to develop antibody products to fight COVID-19.

High quality population studies including antibody tests for previous infections will provide information about the ‘herd immunity’ built up by infected humans. When enough people (about 60-70%) developed antibodies against the virus, it becomes really hard for the virus to spread and cause new waves of infections. However, we see that, despite the high number of infected people worldwide, building herd immunity will take a long time.

### And what about the future?

A vaccine will be our best chance to be protected against COVID-19. Worldwide the scientific community has shared data, such as the genetic code of the virus, to unravel its secrets, and develop a weapon against it. Unfortunately, its development will take at least one year. The good news is that there are currently over 135 potential vaccines candidates that are being developed.
As it turns out that children are less affected by COVID-19, and when they do get infected, suffer from milder symptoms than adults, scientists are also looking at what particularly protects them from getting infected by or suffering from COVID-19. Who knows that children, next to all the nurses and public health workers, could also become heroes in this quarantine virus story (Fig. 3)?

Glossary

**Digestive or gastro-intestinal system**: the organs that swallow (throat and esophagus), digest (stomach) and absorb (small and large intestines) food and liquids and evacuate the rest from the body as feces (rectum and anus).

**ACE2 receptor**: the angiotensin-converting enzyme2 receptor, attached to cells in the lungs, arteries, heart, kidneys and intestines, is involved in blood pressure regulation through blood vessel dilation and constriction, unfortunately also an entry point into cells for some Coronavirus.

**Incubation period**: time between the encounter with the pathogen (virus or microorganism causing disease) and appearance of the first symptoms. During that time the pathogen multiplies to a level sufficient to cause symptoms of illness.

**Convalescent serum**: blood serum from patients recently recovered from an infectious disease. It is rich in antibodies against the infectious agent of the disease and may be used to treat patients with the same infection.

**Herd or group immunity**: resistance of a population (or herd, group) to a particular pathogen (virus or microorganism causing disease) due to immunity (through earlier infection or vaccination) of a large (60-70%) part of the population to the pathogen.

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I am an Associate Professor at the Université libre de Bruxelles. My research focuses on how people with various cultures and ways of working (e.g. academics or people in the pharmaceutical industry) could optimally collaborate to bring inventions from the lab to the patient much faster, and how patients in low- and middle-income countries also could get access to innovative therapies. I love telling stories about bad bugs to my children and how to fight them, and then we make paintings about it!

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