

Family project on Understanding COVID-19



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The Rise

"11 million inhabitants in the Chinese city of Wuhan are placed under lockdown to control the outbreak of a new deadly virus."

The announcement of this measure on the Chinese New Year's eve initially sounded draconian to the rest of the world.



January 2020

The outbreak of a novel coronavirus

We are different. In 2019, patients were admitted to hospitals with an alarming severe acute respiratory syndrome from a novel coronavirus. Many of them had been to wet-markets in Wuhan.

China first thought it was Wuhan's problem. The rest of the world thought it was China's.



The first major outbreak outside China was in Italy. Other European countries thought they were different and better equipped.

They were not! Infections and deaths skyrocketed.

Hope against hope. In this initial phase, there was still a big hope: COVID-19 would soon go out of circulation, like SARS did in 2003. That did not happen.

The only way was to lockdown entire countries.

Viruses are unpredictable in general, and so is this novel virus.

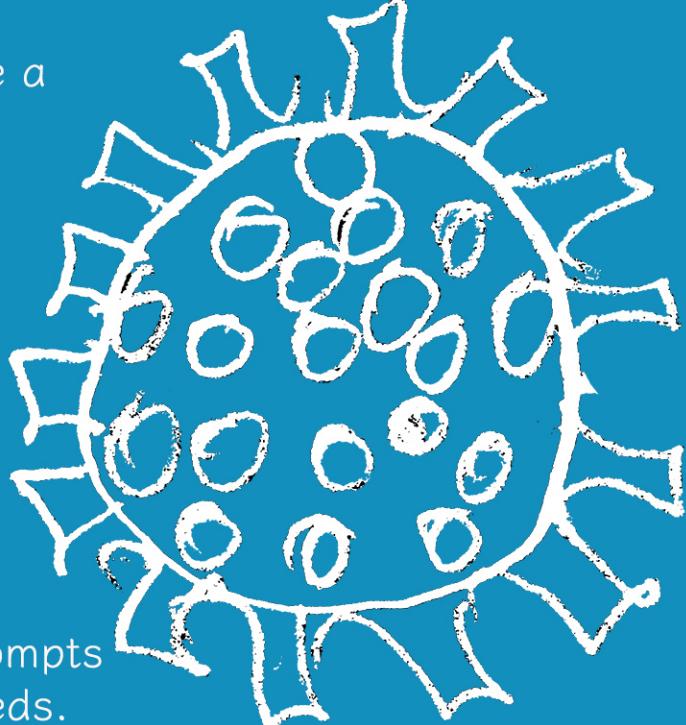
Are viruses different from bacteria?

We cannot see bacteria, but they have a life-cycle by themselves. They swim to the nutrients, “eat” them, grow bigger and divide into daughter cells.

A virus does not show these usual signs of life. It does not eat, grow, or multiply by itself. It needs a person’s cells to survive and make copies of itself.

Coronavirus also enters a cell and prompts it to make the proteins and RNA it needs.

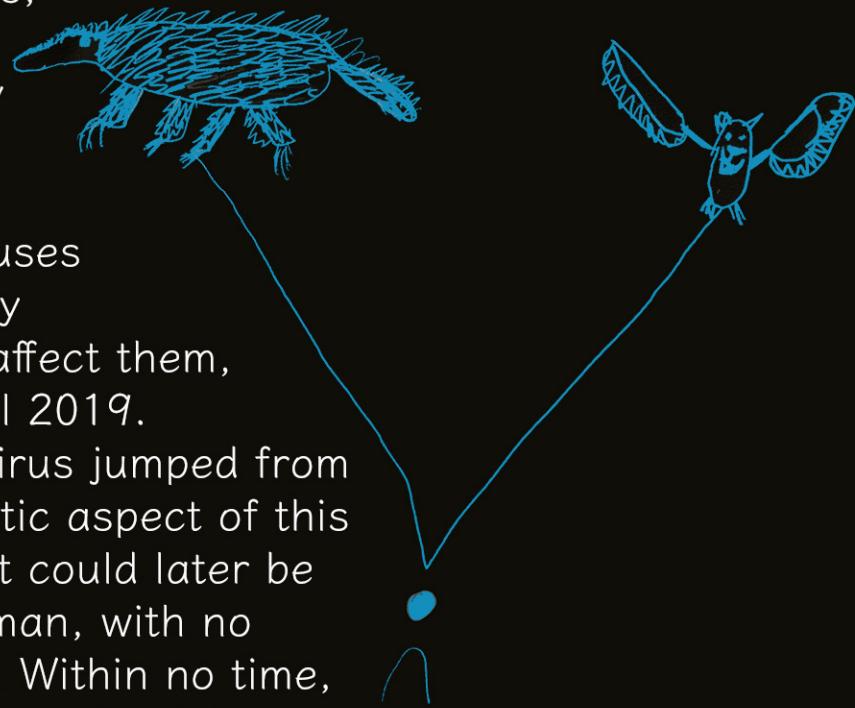
They all “assemble” like pieces of a magnet puzzle sticking together. Each virus particle makes many viruses, which are released and continue this cycle. But where was coronavirus “living” before?



Why did we not hear of COVID before '19?

Some viruses survive in humans,
some others only in animals.

Not all living things are equally
hospitable for every virus.



The SARS-CoV-2 virus that causes
COVID-19 was mainly hosted by
pangolins and bats. It did not affect them,
neither did it infect people until 2019.

But one day, a mutant of the virus jumped from
animals to humans. The dramatic aspect of this
Zoonotic transformation was that it could later be
transmitted from human to human, with no
direct exposure to the animals. Within no time,
the infections developed into a pandemic!

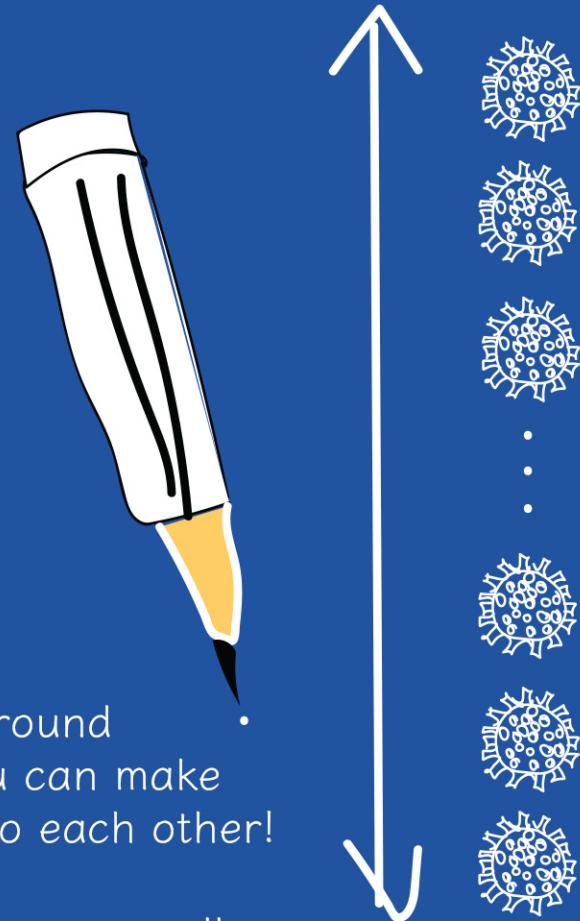
But how large is this virus sometimes dubbed as a monster?

How big is the coronavirus?

Viruses are extremely small in size. Among all the germs like bacteria, fungii, that cause diseases, viruses are the smallest. They are also the only ones you can not see even under a microscope.

A coronavirus is called so because it has a core which is a sphere, and a “crown” of proteins around it. Even counting this crown, the diameter is only around 100 nanometers. The smallest pencil dot you can make hosts a million coronaviruses, sitting next to each other!

The viruses are without a life, and they are very small. It actually makes you think we can destroy them easily.

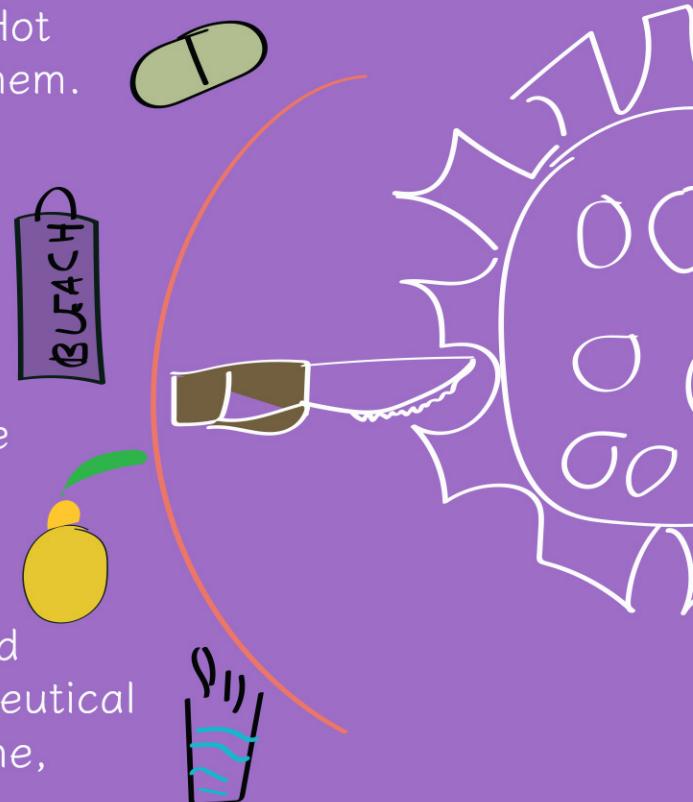


If virus is so small, can we not kill it?

It is not too complicated to kill a virus. Hot water, lemon, bleach, or soap destroy them.

Well, killing the virus outside the body is easy. But drinking bleach or soap is not an option, because they kill the virus, together with the person who has it. Even lemon and hot water are not tolerated by nose or lungs at the intensity that kills the virus.

That is why it is important to have a medicine that destroys only the virus and does not harm the person. The pharmaceutical research is in progress. In the meantime, non-pharmaceutical interventions like lockdowns were implemented.



Why were there lockdowns?

When someone spends 15 minutes closer than 2 meters from an infected person, he or she is likely to develop and transmit COVID-19. Suspects are traced and isolated before they can spread it to others.

If 50 infected people spent 15 minutes each with 10 persons, 500 people should be isolated.



When there are 1,000 infections, the problem of knowing by name, calling by phone, and isolating 10,000 suspects before they infect others is enormous. The plan B, when contact tracing becomes difficult, is to “isolate” everyone in the city from each other with a lockdown. Thankfully, that early lockdown phase finished.

Relaxations



**"Europe allows reopening of activities.
Social distancing should still be practised.
Masks are required during some activities."**



May 2020

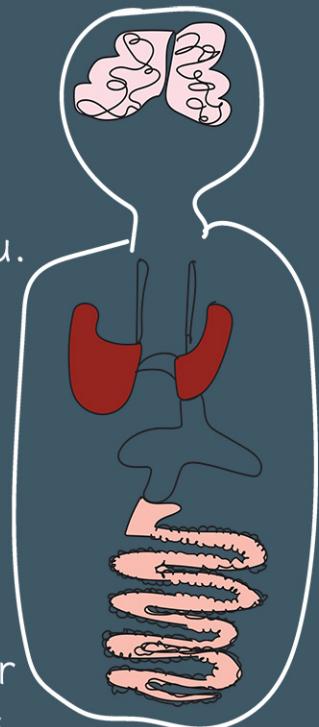
This announcement came in late spring as the number of daily infections began to reduce. At the same time, it was realized that there is more to fear of COVID-19 than the risk of death.

Is COVID-19 just another flu?

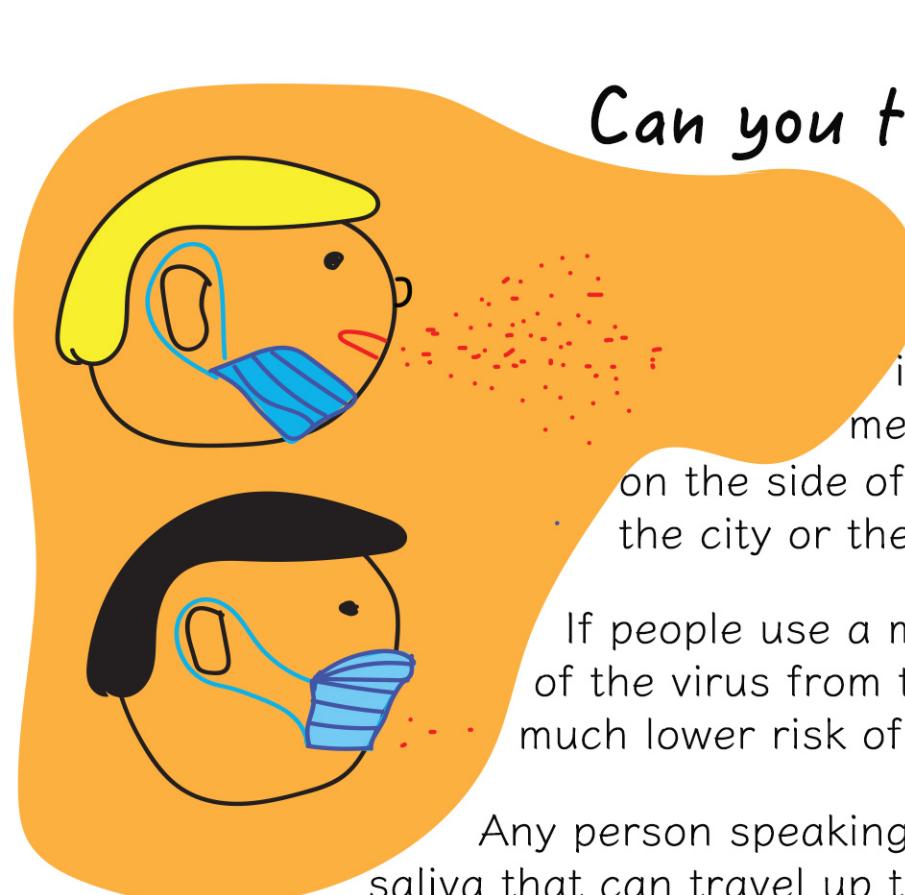
Many did not realize they had a COVID-19 infection because they did not have any symptoms. Most others have been having flu-like symptoms: cough, sneezing, fever. A large number of the infected need intensive care, and the risk of dying is much higher than with flu.

Over the months, COVID-19 case studies showed that the patients had complications not just in the lungs, but even in the brain and intestines. Longterm damages to organs were also seen.

Loss of smell, foggy head and fatigue, which cannot even be clinically diagnosed, remained for months after people tested negative. These long-COVID repercussions also among the young highlight the importance of COVID-19 prevention. But how do you reduce the risk of contracting it?



Can you take off the mask when you speak?



Proving that mask is effective is not easy. It has been recommended with a hunch of erring on the side of caution, and the benefits at the city or the state level were analysed later.

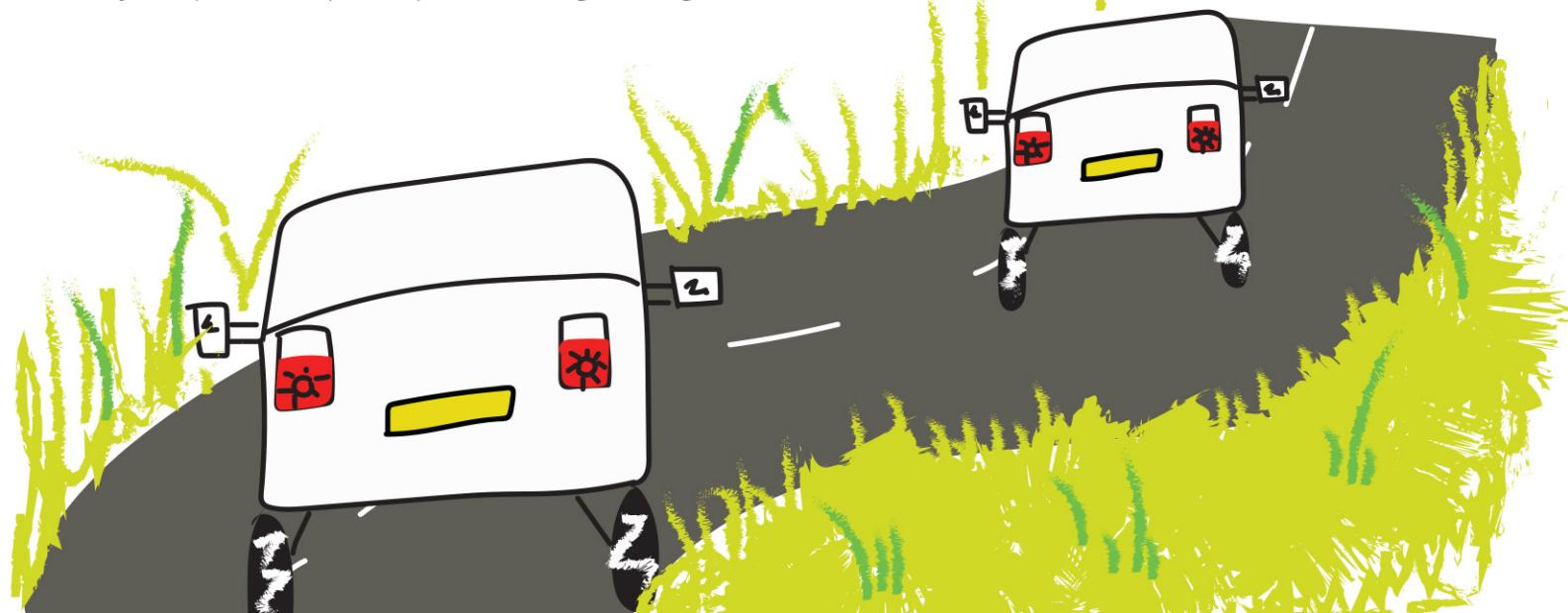
If people use a mask, they receive a lower dose of the virus from the spreader, and they have a much lower risk of developing severe symptoms.

Any person speaking or singing emits droplets of saliva that can travel up to 2 meters, which is the social distance we have to maintain from one another. A mask offers an additional protection, blocking the emission of droplets with virus, and protecting others.

Why should I wear a mask to help others?

In a society, everyone watches out for the others. Look at the lights of a car? A car driver doesn't directly benefit from the rear red-lights of his or her own car. But they definitely need the rear red-lights of the car in front of them.

I agree, but I feel fine today. Why should I wear a mask now?

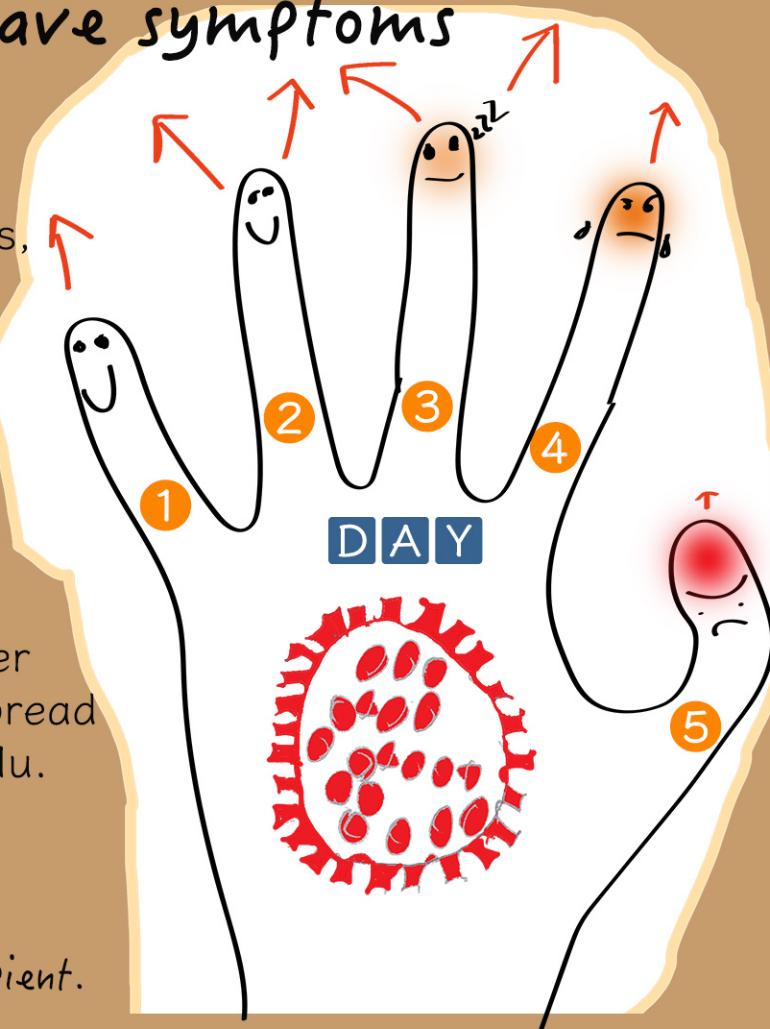


I will be careful if I have symptoms

A person who just got infected with COVID-19 is most contagious to others within the next 2 to 3 days, a period when he or she mostly has no symptoms. It's only around the 4th or 5th day that symptoms like cough, diarrhea and fever appear.

In other words, a seemingly healthy person in front of you could be transmitting COVID-19 without either of you suspecting it. This "silent" spread is a peculiarity of COVID-19 unlike flu.

The virus released by the infected person starts a new cycle when it enters the nose or the mouth of the recipient.



Coronavirus: attack and defense

Multiply. The early development of the virus happens in the backside of the nose. The viruses multiply in number by a 10,000 times in a couple of days. These viruses then spread to lungs and other organs.

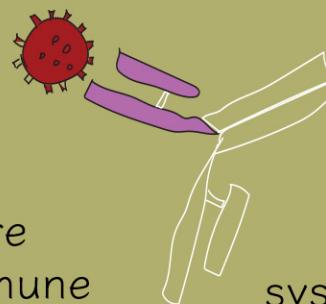


Tissue damage.

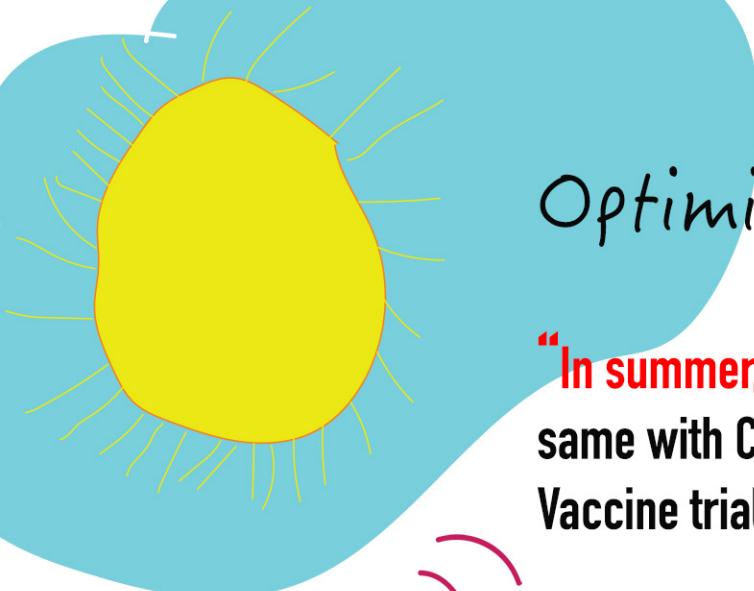
When the virus reaches the organs, it needs a “door opening” receptor to enter tissues.



The infected tissues are killed by your own immune cells, damaging for example lungs, kidneys and blood vessels. Children under 10 years mostly do not develop symptoms because they do not have this receptor, and not because they are immune!



Be blocked. It may take 2 to 3 weeks for the immune system to respond and produce antibodies which block the coronavirus. These 2 weeks may be too long for a person of vulnerable health. A vaccine can prepare the immune system in advance.



Optimism

**"In summer, flu infections decrease. We expect the same with COVID-19...
Vaccine trials are progressing well."**

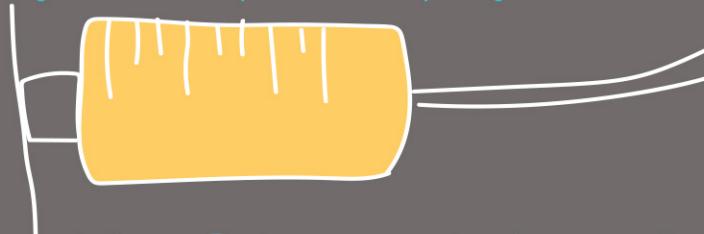


June 2020

Such announcements filled the air with optimism. The contact tracing and testing capabilities gave a feeling that the newer cases were due to widespread testing.

What does a vaccine do?

Immune system detects and attacks small fragments of the virus. But it needs about 3 weeks to prepare the antibodies needed for this attack against a new disease. If there is a vaccine, it's injected to prepare the immune system in advance. A vaccine is made of fragments of the virus, too small to cause infections, but large enough to train the immunity. If the real virus attacks a few weeks after vaccination, the trained immune system responds rapidly before severe symptoms can occur.



The COVID-19 vaccine trials are promising. But we can truly count on a vaccine only if it meets the two usual challenges: it has to be effective in training; millions or billions of doses for everyone who needs it have to be made. This can take many months to years. If a vaccinated person not only remains healthy but also does not transmit, it offers protection to "the herd".

What is herd immunity?

A person who “falls” sick makes other “fall” sick as well.



→ IF a person has immunity from a vaccine or from a previous infection, he or she should not fall sick again.



← IF this immune person does not transmit, it helps the “herd” as well.

IF it is not a vaccine that leads to “herd” immunity, it will be through infections and deaths.



We do not yet know enough to comment on all these IFs for COVID-19 to encourage herd immunity. Until an effective vaccine is developed, the importance of *rapid testing and isolation* will remain high.

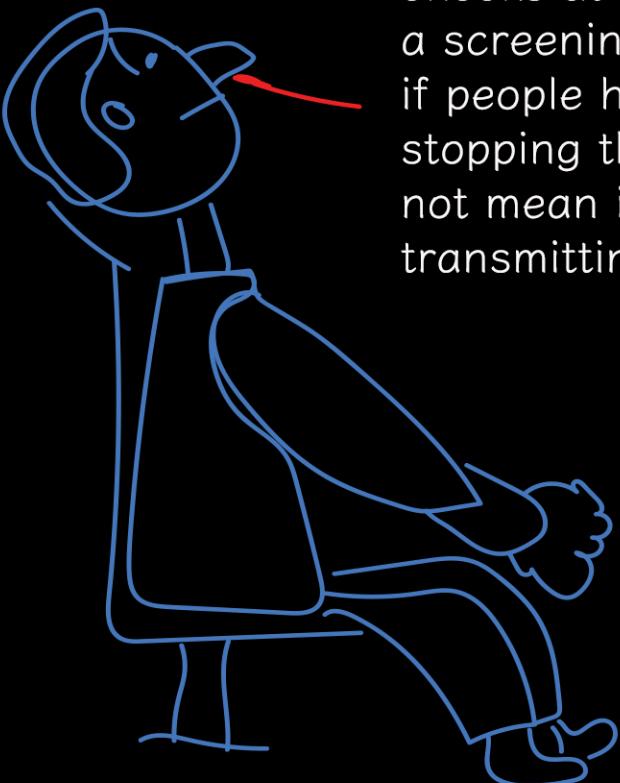
Is the temperature check a COVID-19 test?

Temperature Screens. The temperature checks at malls, offices, airports are a screening measure, a way to see quickly if people have symptoms without even stopping them. Remember: a fever does not mean it is COVID-19; a person that is transmitting COVID-19 can be without a fever.



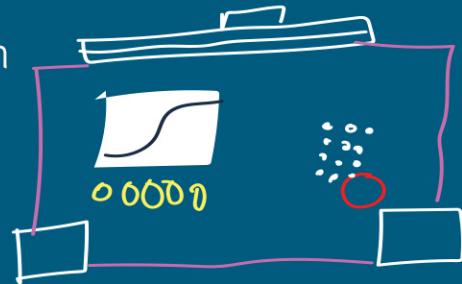
Waste water. The poo of the infected people contains virus. The municipality can check the sewage water to understand the infection levels in the city.

But neither of these is a COVID-19 test. Direct tests on the samples collected from the persons are needed.

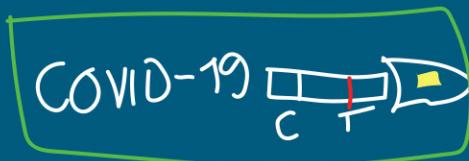


How do they test for COVID-19?

COVID now? Viruses use a trick: a single virus in the body multiplies into millions. PCR test also uses a similar trick. It picks up even a single virus fragment in the nose swab sample, multiplies into millions and detects it easily.

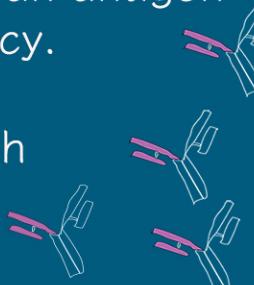


With PCR we know if the person has virus fragments, but not if they are contagious. Sometimes, the test is positive even weeks after cure.



A PCR test needs 4 hours when technicians and machine are fully dedicated to one sample. Practically, since many people need testing, a result report takes 2 to 10 days. The same sample placed on an antigen teststrip can show results in 30 minutes, but with low accuracy.

COVID in the Past? Blood (sero) tests look for antibodies which confirm an infection in the past months.





Déjà vu

"Israel is the first country to implement a second lockdown. The contact tracing system was overwhelmed with too many infections to trace."

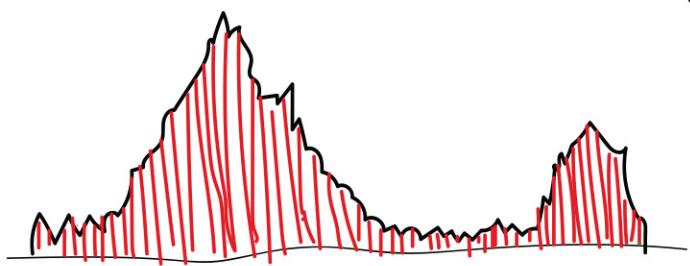


The announcements sparked the second wave of fears about lockdowns in all other countries.

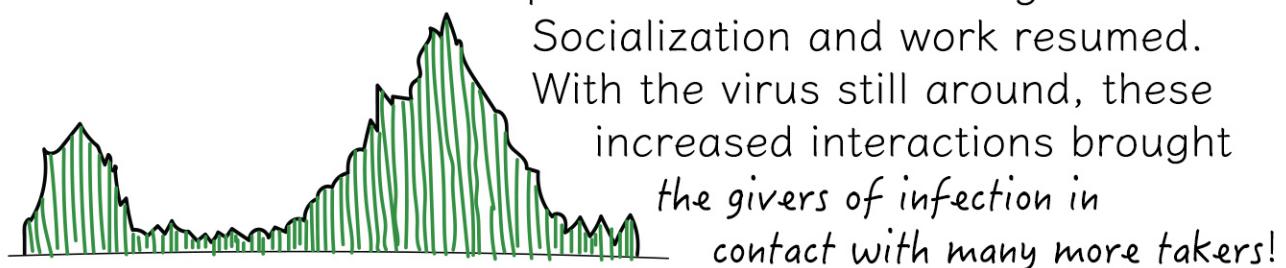
September 2020

The second wave

After a visible drop of the numbers of infections in summer, they began to rise again. Initially, it was thought that rise in infections was due to widespread testing. Soon it was realized that it was the beginning of the second wave.



What caused it? People were exhausted with the restrictions endured during the spring. Fewer infections made them overly optimistic and lower the guard.



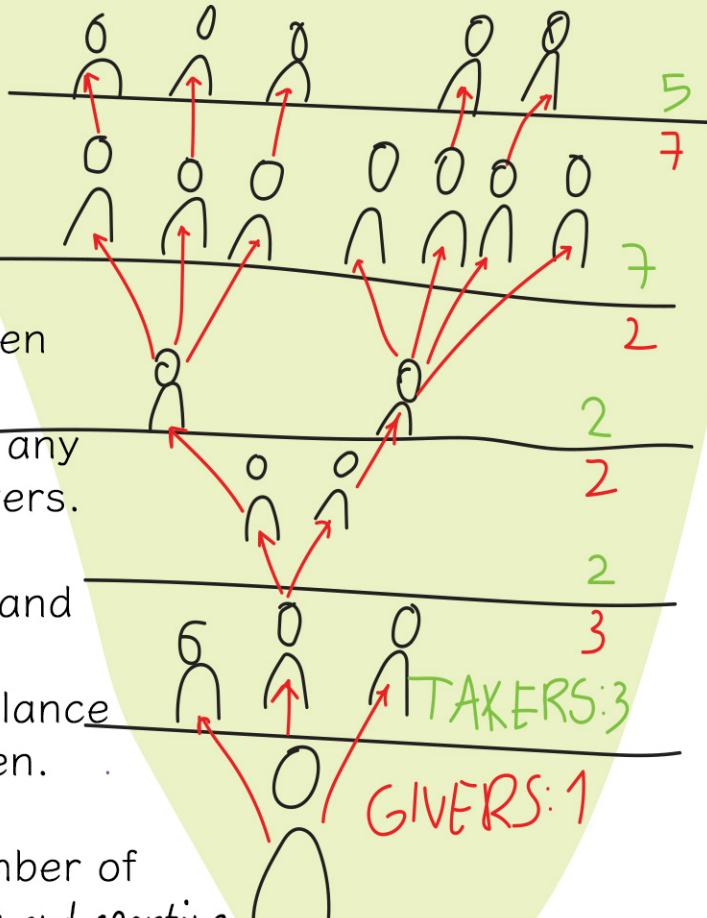
Reproduction numbers

Most things in a society continue with a give-and-take. Unfortunately, it is so even for COVID-19: a person who gets it passes it on to others, when they come in close physical contact.

The pandemic remains in control if at any time the takers are fewer than the givers.

If we count how many give infections and how many take infections at each transmission level, we see that the balance between givers and takers swings often.

Lockdowns and masks reduce the number of takers. Increased social interactions, parties and sporting events bring more takers in contact with the givers.



Are Superspreaders cool?

Movies and comics are full of superheroes who save the world. Unknowingly, a *superspreader* does the opposite.

On average an infected person infects 2 or 3 others. A superspreader infects many more than 3. Perhaps the virus grows easily in these people or they release more droplets when they speak.

In reality, any normal spreader can become a superspreader by closely meeting many people in a short time: a large party, hopping between many parties in the same evening, or attending sporting events and gatherings. Remember the 5 fingers? They may be still without symptoms.



But the COVID-19 situation seems to be in control, why should I be paranoid?

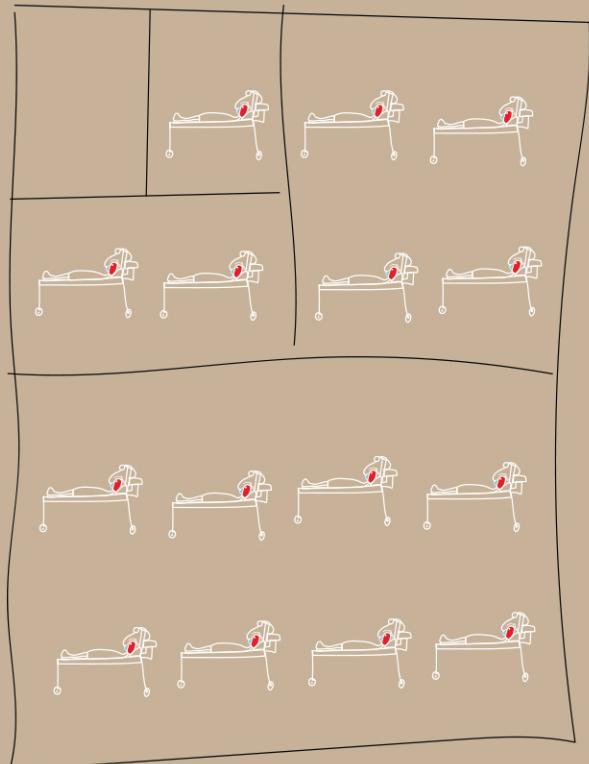
How quickly do hospitals fill up?

Most of us make a mistake in guessing how rapidly the hospital beds fill up with COVID-19 infections. If 1000 patients were hospitalized yesterday, and 2000 today, it is very likely that the number of hospital beds occupied in the coming days are:

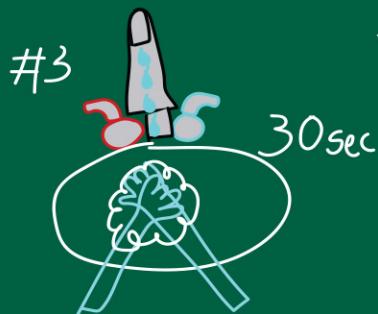
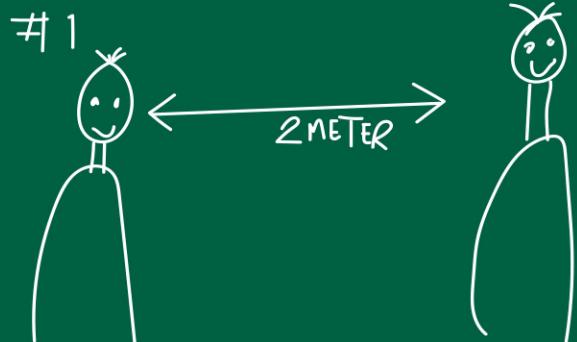
1000, 2000, **4000**, 8000, 16000
and not

1000, 2000, **3000**, 4000, 5000

So, without any measures, going from 50% to 100% bed occupancy takes only 3 to 5 days. To have the healthcare accessible for everyone and avoid situations where one has to choose who receives the treatment, we have to *keep the infections in control*.



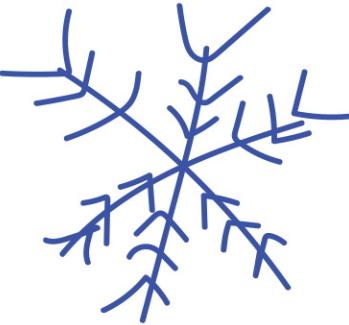
What's the best we can do now?



There are hopes and plans, but the reality is that at the end of October 2020, coronavirus is still around, and the vaccine and medicine are not.

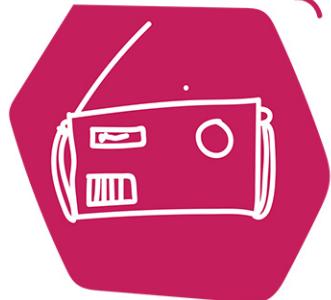
Non-essential activities like parties have to be reduced, and while doing the essential activities like work, one has to follow the rules that we know.

- #1 Maintaining distance
- #2 Using masks
- #3 Washing hands



Winter

"The United States adopts herd immunity as a strategy."

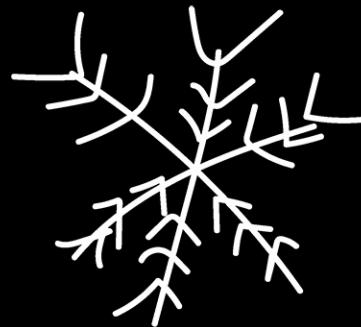


October 2020

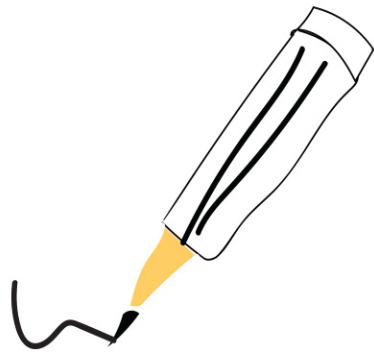


This announcement brought a divide even among scientists. The general sentiments got vibrant and heated as some protested against the measures, some turned optimistic about the drop in mortality rate, and others rode the roller coaster of the good and bad news about vaccines.



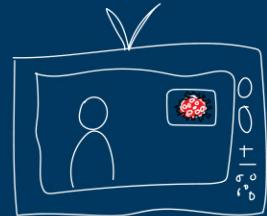


This winter, write your own future,
with hope, responsibility and erring on
the side of caution.



Cast credits: Who is on the TV?

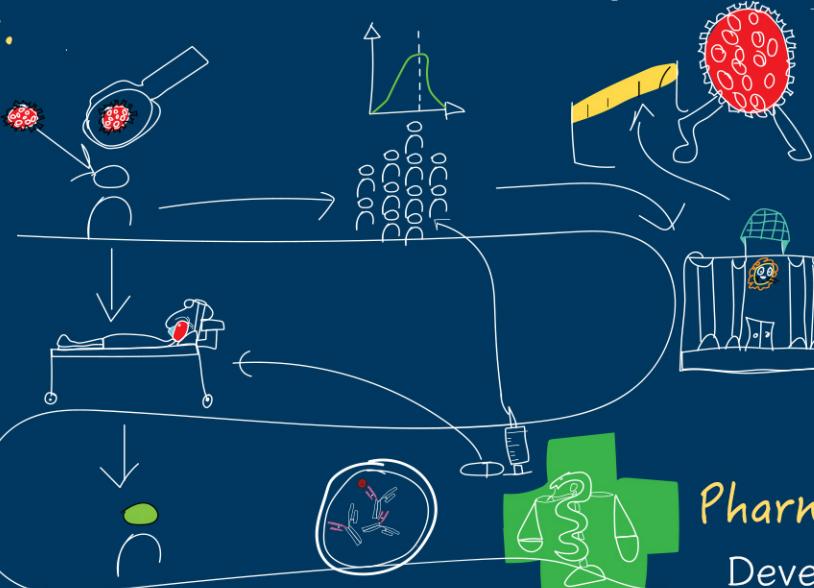
The TV programming is filled with many new faces. What do they do for saving people from COVID-19 when they are not on the TV?



Epidemiologists. Strategies for slowing infections and for distributing vaccines.

Virologists.

Researches on viruses.



Emergency physicians.

Medical doctors who treat the patients.

Immunologists. Researches on the how immunity is built and lost.

Government.

Policies to slow-down virus, distribute vaccines and save jobs.

Pharma Industry.

Developing vaccines and medicines.

Can we not talk about something nicer?

COVID-19 is an undeniable reality of 2020 for all ages. For some because of the risks, for others because of the loss of jobs, for the younger ones because of the seemingly simple concerns that they can not play with friends or not meet their grandparents.

There were fewer sporting events and most movie releases got postponed. Everyone met with fewer or no people. This vacuum of new things to talk about was created by COVID-19, and was filled up by itself.

One thing we understood is that it is a difficult subject, which is the reason why so many experts on TV debate about strategies. Regardless, like everyone, our family also tried to understand about COVID-19. Father developed the concept, son illustrated it, and mother refined them both.

We attempted to tell what we know about COVID-19 so far and how denial, partial acceptance of reality, early optimism, and the onset of a new daily life unfolded.