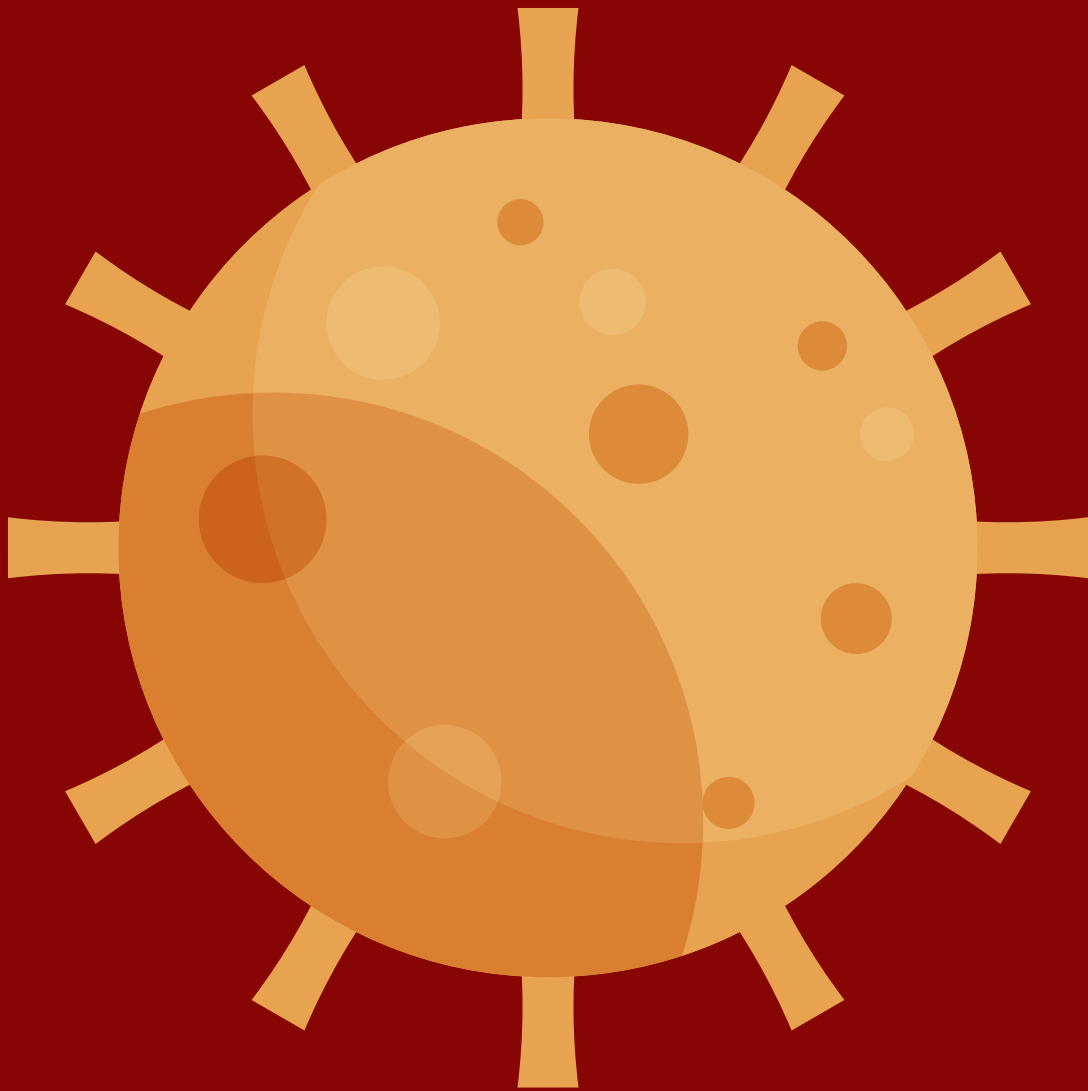




# The Pandemic Notebook

A handy guide from **The Hindu** on understanding the coronavirus pandemic and staying protected against COVID-19



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# Introduction

On December 31, 2019, China informed the World Health Organization of a cluster of cases of pneumonia of an unknown cause in Wuhan City in Hubei province. On January 9, 2020, the WHO issued a statement saying Chinese researchers have made “preliminary determination” of the virus as a novel coronavirus.

Since then, more than 6,000 deaths have been reported due to COVID-19 across the world till March 20, 2020. Cases have been reported from more than 180 countries, including India. Lockdowns, curfews, massive airport screenings, quarantines, and social distancing have become the norm across the globe.

In these critical times, access to authentic information is of paramount importance. The Hindu has been covering the pandemic since the early days with the highest journalistic standards, ensuring that science and safety are the primary focus. For the benefit of our readers, we are now compiling the most relevant parts of our coverage in the form of an eBook, that we hope will be a handy guide to good health practices as well as in fighting misinformation.

# What are coronaviruses?

Coronaviruses are a large family of viruses with some causing less severe common cold to more severe diseases such as severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS). The SARS-CoV-2<sup>1</sup> is a coronavirus very similar to the one that caused SARS.

Many coronaviruses are zoonotic, meaning they are transmitted from animals to humans.

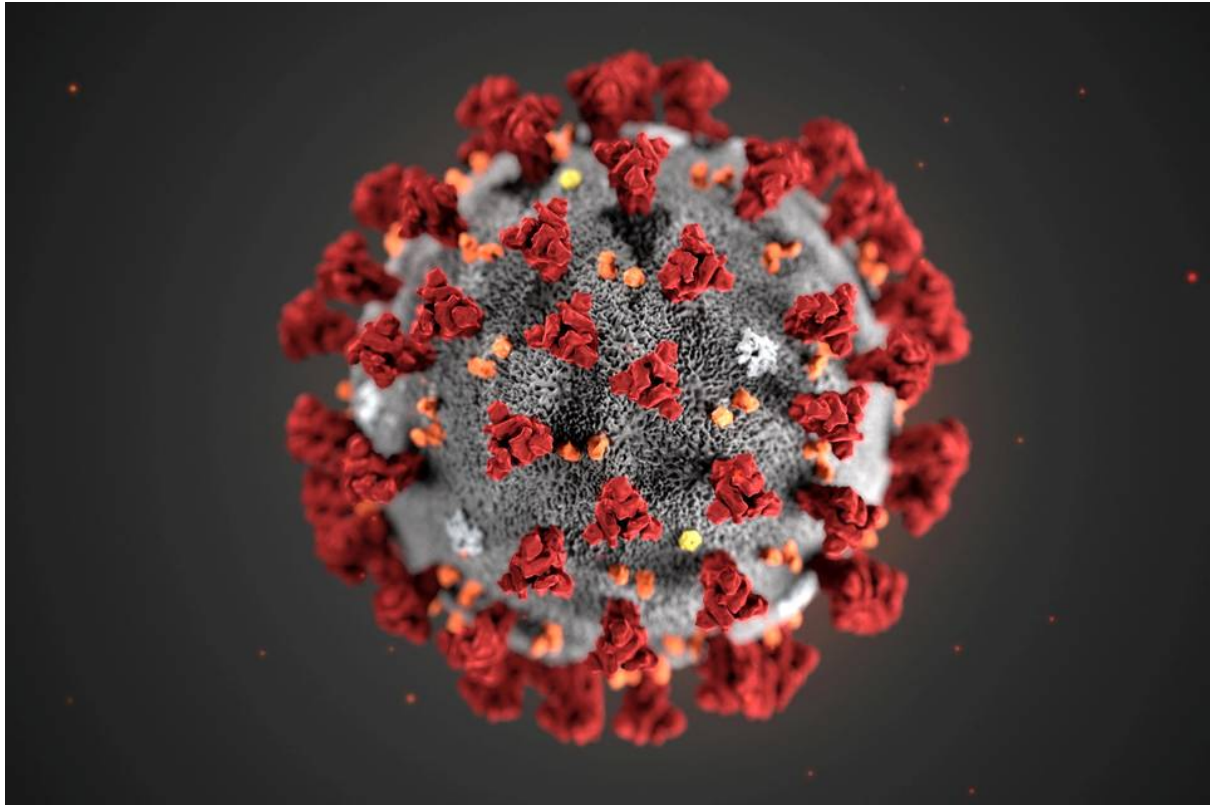
While the SARS coronavirus is thought to be an animal virus from an as-yet-uncertain animal reservoir, perhaps bats, that spread to other animals (civet cats) and first infected humans in the Guangdong province of southern China in 2002, the MERS coronavirus was passed on from dromedary camels to humans in Saudi Arabia in 2012.

There is evidence that the SARS-CoV-2 has also been transmitted from bats

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<sup>1</sup> The Coronavirus Study Group of the International Committee on Taxonomy of Viruses, which had assessed the novelty of the human pathogen, has named the virus as “Severe acute respiratory syndrome coronavirus 2”, or “SARS-CoV-2”. The Coronavirus Study Group is responsible for developing the official classification of viruses and taxa naming of the Coronaviridae family.

## A closer look at SARS-CoV-2



*The ultrastructural morphology exhibited by the SARS-CoV-2 seen in an illustration released by the Centers for Disease Control and Prevention on January 29, 2020. Image Credit: [Reuters](#)*

Like other coronaviruses, SARS-CoV-2 virus particles are spherical and have mushroom-shaped proteins called spikes protruding from their surface, giving the particles a crown-like appearance. The spike binds and fuses to human cells, allowing the virus to gain entry.

Researchers at the University of Texas at Austin and the National Institutes of Health, U.S., have produced a 3D atomic scale map of the protein of the SARS-CoV-2 that binds to and infects human cells.

Mapping the 3D structure of the protein — spike (S) glycoprotein — will allow better understanding of how the virus binds to the human cells. Knowing the structure of the spike protein will, in turn, allow

scientists to develop vaccines and antivirals against the virus and even better diagnostics.

### Closely related to SARS

The new coronavirus first identified in the Chinese city of Wuhan appears to be similar to the one that caused severe acute respiratory syndrome (SARS), and there is evidence it originated in bats

**HORSESHOE BAT**  
Many coronaviruses are zoonotic diseases, meaning they are transmitted between people and animals

- 1. Animal disease reservoir** Bats thought to be original host of SARS – which caused 2002-03 epidemic – and new virus, named 2019-nCoV
- 2. Intermediate host** Other animals infected by blood, saliva, urine or faeces of bats
- 3. Transmission to humans** Virus “jumps” species barrier, possibly via close contact with infected animals, and may then be spread person-to-person
- 4. Adaptation:** Changes in surface proteins can allow virus to attach to new host cell, either by mutation or recombination (mixing of different viruses)
- 5. Infection:** Both SARS and 2019-nCoV can bind to cells using same receptor, known as ACE2, allowing virus to get deep into human lungs. This may explain pneumonia-like symptoms of patients  
Glycoproteins play a part in important cellular functions such as cell adhesion.

**SARS host believed to be civet cats.** Existence and identity of 2019-nCoV host yet to be determined

**Coronavirus**  
Ribonucleic acid (RNA) carries genetic code of virus. Analysis shows 2019-nCoV infections to be 80% identical to SARS and 96% identical to bat version of virus

**Spike glycoprotein**  
**HOST CELL Infection**  
**ACE2 receptor**

Source: Graphic News – Business Insider, Nature, NCBI, Picture: Getty Images

The spike protein of the novel coronavirus shares 98% sequence identity with the spike protein of the bat coronavirus, the researchers say. The results were published in the journal Science.

similar yet different

The researchers also found that like in the case of the SARS coronavirus, the spike protein of the SARS-CoV-2 that causes Coronavirus Disease 19 (COVID-19)<sup>2</sup> binds to the cellular receptor called angiotensin-converting enzyme 2 (ACE2), which serves as the entry point into human cells. But unlike in the case of SARS, the spike protein of the novel coronavirus binds to the cell receptor with much higher affinity — 10- to 20-fold higher.

<sup>2</sup> Concerned about the stigma that names of new diseases can cause to certain people and religion, the WHO came up with the new guidelines in May 2015. According to the guidelines, name of a new disease should consist of a combination of terms. These terms consist of a generic descriptive term based on clinical symptoms (respiratory), physiological processes (diarrhoea), and anatomical or pathological references (cardic). It can refer to specific descriptive terms such as those who are afflicted (infant, juvenile, and maternal), seasonality (summer, winter) and severity (mild, severe). The name can also include other factual elements such as the environment (ocean, river), causal pathogen (coronavirus) and the year the new disease is first detected with or without mentioning the month.

## **High transmissibility**

The much greater binding affinity to the cell receptor explains the apparent high human-to-human transmissibility of the virus compared with the SARS coronavirus.

“The high affinity of the 2019-nCoV S for human ACE2 may contribute to the apparent ease with which the 2019-nCoV can spread from human-to-human,” the researchers write. “Additional studies are needed to investigate this possibility.”

Since both the SARS coronavirus and the 2019 novel coronavirus share structural similarity and bind to the same receptor, the researchers tested three monoclonal antibodies specific to SARS virus for their ability to bind to the novel coronavirus. But none of the three antibodies tested were found to be effective in inhibiting the novel coronavirus from binding to the human receptor ACE2 and prevent or treat the disease.

## **Spike structure**

However, the 3D map of the S protein will help researchers design new antivirals to stop the virus from binding and infecting human cells.

“Knowing the atomic-level structure of the 2019-nCoV spike will allow for additional protein engineering efforts that could improve antigenicity and protein expression for vaccine development,” the researchers write.

The researchers were able to determine the structure of the spike protein as the Chinese researchers shared the whole genome sequence data in the global database.

## **Genome sequencing**

When the entire genome is sequenced it helps researchers understand the arrangement of the four chemical entities or bases that make up the DNA or RNA. The differences in the arrangement of the bases make organisms different from one another. Sequencing the genome of

SARS-CoV-2 will help us understand where the virus came from and how it spread. For instance, by sequencing the genome of the virus isolated from an Indian patient, it will become possible to know if the virus had come from China or any other country

In India, the Pune-based National Institute of Virology (NIV)<sup>3</sup> has sequenced the SARS-CoV-2 genome collected from two patients in Kerala.

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<sup>3</sup> NIV is the only lab in India which has a bio-safety level-4 (BSL-4) facility to culture pathogenic, novel viruses, study the origin of such viruses and provide a comprehensive characterisation of them by sequencing the entire viral genome.



## Understanding the disease

The World Health Organisation has declared COVID-19 to be a pandemic<sup>4</sup>. The symptoms of COVID-19 appear within two to 14 days after exposure and include fever, cough, a runny nose and difficulty in breathing.

### How does the disease spread?

It primarily spreads through the respiratory droplets of infected people. If a person touches a surface or object that has been infected by the virus and then touches his own mouth, nose, or eyes, he may get infected.

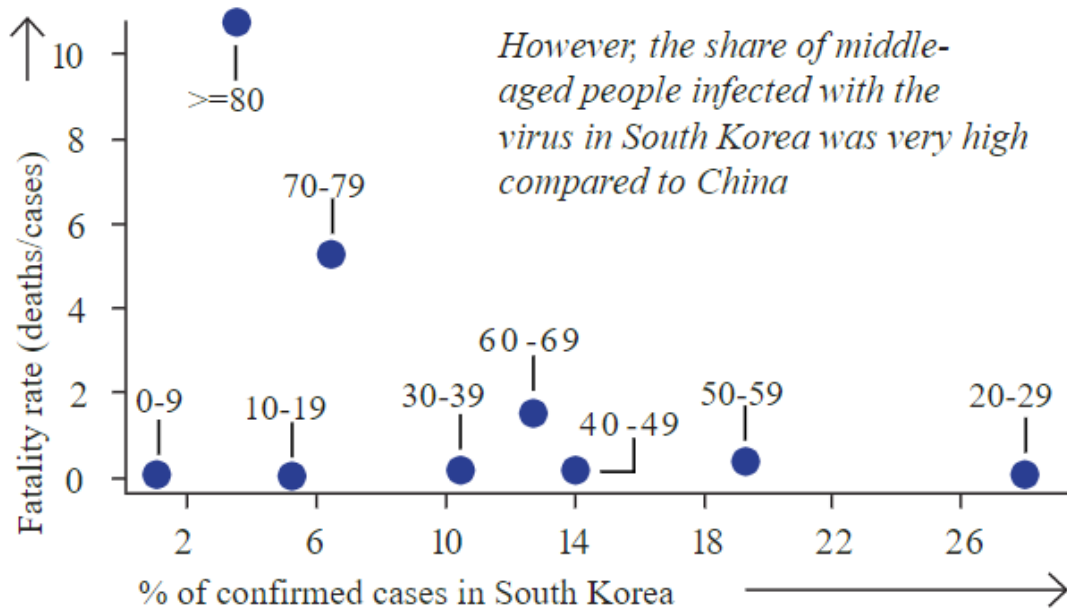
### Who is affected?

While people of all ages can be affected by the disease, people aged 80 and above are at the highest risk of dying due to COVID-19, according to case records analysed by the Disease Control and Prevention Centers in China and South Korea. Victims of the virus with pre-existing medical conditions such as cardiovascular disease and diabetes have a higher fatality rate than others. Also the rate of fatalities was relatively higher for retirees.

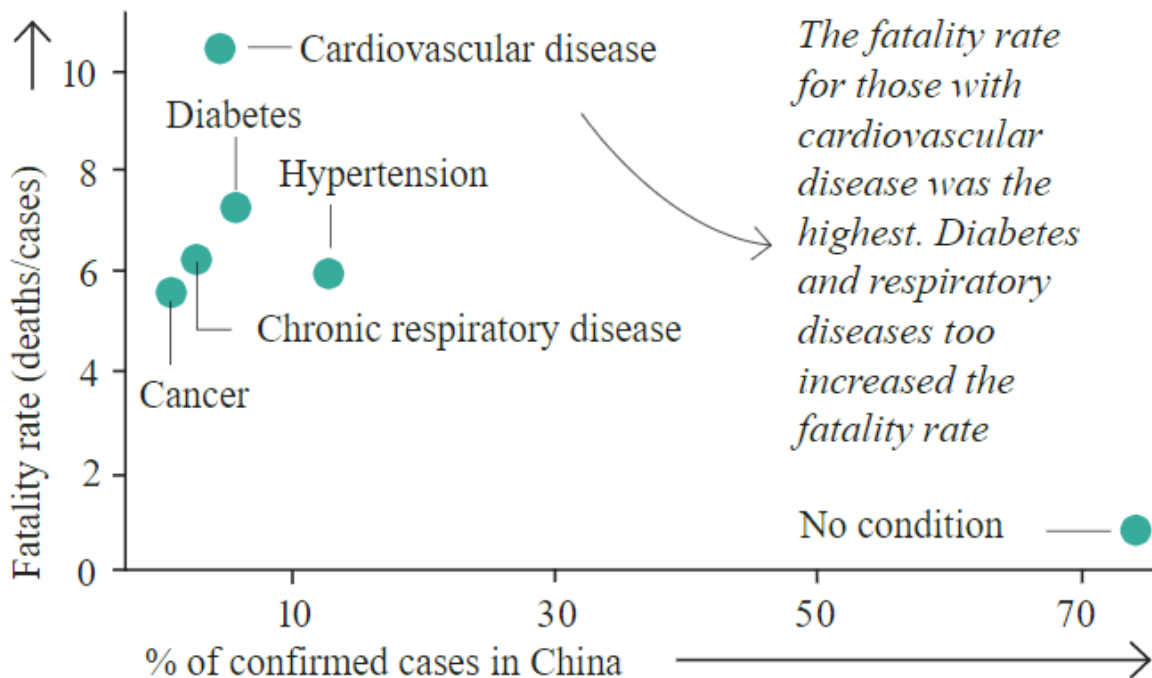
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<sup>4</sup> A 'Pandemic' generally refers to an epidemic that has spread on a more global scale, affecting large numbers of people. Exactly when enough places have enough infections to declare one isn't a black-and-white decision. But generally, the WHO is looking for sustained outbreaks on different continents. An 'Epidemic' is a large outbreak, one that spreads among a population or region. An 'Outbreak' is a sudden rise in cases of a disease in a particular place.

**Which age-groups were at most risk in South Korea?**



**Which pre-existing medical conditions in a patient are more harmful?**



Data visualisations by Vignesh Radhakrishnan and Sumant Sen

## What are the symptoms?

The guidelines<sup>5</sup> from the Union Health Ministry for early recognition of COVID-19 patients are those who come in with Severe Acute Respiratory Infection (SARI) who also have a history of foreign travel or close contact with another COVID-19 patient.

As per the guidelines, “COVID–19 may present with mild, moderate, or severe illness; the latter includes severe pneumonia, ARDS [Acute Respiratory Distress Syndrome], sepsis and septic shock.”

## How can it be detected?

The virus can be detected using a PCR test<sup>6</sup>. A PCR or polymerase chain reaction test is DNA-based and can quickly tell if someone harbours the virus. In India, the government facilities to test for the virus include 52 labs belonging to the Viral Research and Diagnostic Laboratories network of the Indian Council of Medical Research (ICMR), 10 labs under the National Centre for Disease Control (NCDC), and the NIV.

## What is the treatment?

There is no current evidence from randomised controlled trial to recommend any specific treatment for suspected or confirmed COVID-19 patients. No specific anti-virals are recommended for treatment of those suffering from respiratory ailment due to lack of adequate evidence from medical literature.

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<sup>5</sup> [Guidelines on Clinical Management of COVID – 19](#)

<sup>6</sup> The National Human Genome Research Institute on PCR:

*“Sometimes called “molecular photocopying,” the polymerase chain reaction (PCR) is a fast and inexpensive technique used to “amplify” - copy - small segments of DNA. Because significant amounts of a sample of DNA are necessary for molecular and genetic analyses, studies of isolated pieces of DNA are nearly impossible without PCR amplification.*

*Often heralded as one of the most important scientific advances in molecular biology, PCR revolutionized the study of DNA to such an extent that its creator, Kary B. Mullis, was awarded the Nobel Prize for Chemistry in 1993.”*

In India, the Union Health Ministry guidelines has recommended use of anti-HIV drug combinations Lopinavir and Ritonavir on a case-to-case basis depending upon the severity of the condition of a person having coronavirus infection.

The Ministry recommended Lopinavir-Ritonavir for high-risk groups: patients aged above 60, suffering from diabetes mellitus, renal failure, chronic lung disease and are immuno-compromised.

However, the use of Lopinavir-Ritonavir in PEP regimens for HIV is also associated with significant adverse events which many times leads to discontinuation of therapy.

The guidelines advise the treating doctors to closely monitor patients with severe acute respiratory infection for signs of clinical deterioration, such as rapidly progressive respiratory failure and sepsis, and apply supportive care interventions immediately.

“Application of timely, effective, and safe supportive therapies is the cornerstone of therapy for patients that develop severe manifestations of COVID-19,” it said.

## **Can a vaccine be developed for COVID-19?**

According to Raman. R. Gangakhedkar, head of the Epidemiology and Communicable Diseases-I (ECD-I), Division of ICMR, there are two ways of going for vaccine preparation — either you look at the sequences of the gene which then may lead to development of antibodies, or you actually have the strain and then you try to develop a vaccine which is always an easier option. He said Indian scientists have managed to successfully isolate the COVID-19 virus and about 11 isolates are available which is a prime requisite for doing any kind of research related to viruses and developing the vaccine.

Internationally, several institutes and pharmaceutical companies are in various stages of developing the vaccine with some set to go on clinical trials soon<sup>7</sup>.

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<sup>7</sup> From a report in The Guardian dated March 19, 2020: “The Oxford [University] vaccine, known as ChAdOx1, is one of five frontrunner vaccines in development around the world. The US biotech Moderna gave its first vaccine shot to a person in Seattle earlier this week. Another US firm, Inovio, will soon start trials on its own coronavirus vaccine, which requires a special device to administer through the skin. In Germany, CureVac is working on a vaccine, while others are in development in China.”

## Protecting yourself against COVID-19

Guidelines by the World Health Organization specify that one of the ways to reduce the risk of infection is by regularly and thoroughly cleaning one's hands with an alcohol-based hand rub or washing them with soap and water. Regular washing becomes important as the virus tends to be viable from hours to more than a day on different surfaces that are regularly touched with hands.

### Washing with soap

The grime on our hands contains innumerable viruses and bacteria. Washing with water without using soap helps reduce the amount of microbes but does not remove most of the virus and bacteria completely. Using soap, therefore, becomes far more effective in removing microbes.

Viruses such as coronavirus, influenza-causing viruses, Ebola, Zika have their genetic material encased in a layer of fat called the lipid envelope<sup>8</sup>. Soap molecules are pin-shaped with a head that is water-loving (hydrophilic) and a tail that is oil-loving (oleophilic). Being oleophilic, the tail portion of the molecule tends to have an affinity for and 'competes' with the lipids in the virus envelope. Since the chemical bonds holding the virus together are not very strong, the long oleophilic tail gets inserted into the envelope and tends to have a 'crowbar' effect that breaks the lipid envelope of the virus. The tail also competes with

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<sup>8</sup> Do all viruses have the lipid layer? No, certain viruses do not have the lipid envelope and are called the non-enveloped viruses. Rotavirus which causes severe diarrhoea, poliovirus, adenovirus that cause pneumonia and even human papillomavirus (HPV) do not contain the lipid envelope.

the bond that binds the RNA and the lipid envelop thus dissolving the virus into its components which are then removed by water.

## **Alcohol-based hand sanitisers**

Like soap, the alcohol present in hand sanitisers dissolve the lipid envelope, thus inactivating the virus. In addition, the alcohol also tends to change the shape or denature the mushroom-shaped protein structures that stick out of the lipid envelope. The mushroom-shaped protein structures help the virus to bind to special structures found on human cells and enter the cells. To be effective, the sanitisers should contain at least 60% alcohol.

Unlike soap lather, the alcohol does not come in contact with all parts of the hand. So care needs to be taken to use sufficient sanitiser to increase the coverage. Unlike water, alcohol run does not remove the dead viruses from the hand. While a sanitiser can quickly reduce the number of microbes, it does not get rid of all types of germs, and is “not as effective when hands are visibly dirty or greasy”.

## **Using a mask**

Medical masks help prevent the spread of coronavirus infection. If worn properly, masks may be effective in preventing transmission of coronavirus. An article published in the Journal of the American Medical Association (JAMA) says there is no evidence to suggest that masks worn by healthy individuals can help prevent infection.

But a 2010 study says: “Mask wearing was associated with reduced secondary transmission and should be encouraged during outbreak situations.”

Even the World Health Organization says wearing a medical mask is “one of the prevention measures to limit spread of certain respiratory diseases, including novel coronavirus (SARS-CoV-2), in affected areas”.

Transmission through droplets from coughing and sneezing is one of the major routes of virus spread. When worn correctly, a mask can reduce the risk of inhaling droplets containing the virus.

With many studies showing that people infected with novel coronavirus transmit the virus even before symptoms show up, it may be prudent to wear a mask especially when the virus is spreading in the community. In a country like India, maintaining at least one metre distance can be a challenge, especially when there is no way of knowing who is infected till such time the person starts showing visible symptoms.

## **Social distancing**

The WHO says that you should maintain at least 1 metre (3 feet) distance between yourself and anyone who is coughing or sneezing.

This is because when someone coughs or sneezes they spray small liquid droplets from their nose or mouth which may contain virus. “If you are too close, you can breathe in the droplets, including the COVID-19 virus if the person coughing has the disease,” says the WHO.

## **Avoid touching eyes, nose and mouth**

Hands can pick up viruses as they come in contact with many surfaces. It can then transfer the virus to your eyes, nose or mouth. From there, the virus can enter your body and can make you sick.

## **Practise respiratory hygiene**

Cover your mouth and nose with your bent elbow or tissue when you cough or sneeze. Then dispose of the used tissue immediately.



## Some common queries answered<sup>9</sup>

### Are there differences between symptoms caused by the flu and COVID-19?

Cough and cold could mean an allergy. A fever with cough and cold is a symptom of the flu. When you have fever with a cough which is complicated by breathlessness, it is a symptom of Coronavirus infection and you must call your doctor to rule it out.

### How effective are thermal scanners in detecting people infected with the new coronavirus?

Thermal scanners are effective in detecting people who have developed a fever (i.e. have a higher than normal body temperature) because of infection with the new coronavirus. However, they cannot detect people who are infected but are not yet sick with fever. This is because it takes between 2 and 10 days before people who are infected become sick and develop a fever.

### Can a person exposed to Coronavirus transmit it to others if he/she uses a swimming pool?

Highly unlikely. The Coronavirus is a droplet infection. It has to be inhaled to cause the disease. Chlorination of swimming pools to recommended levels can certainly inactivate any virus, including COVID-19.

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<sup>9</sup> These answers were compiled from responses by eminent doctors as well as from material provided by the World Health Organisation. The doctors who provided the answers are **Dr KK Aggarwal**, president, Confederation of Medical Associations of Asia and Oceania and former president of Indian Medical Association; **Dr Ravi Santosham**, Pulmonologist; **Dr V Ramasubramanian**, Consultant, Infectious Diseases, Apollo Hospitals; **Dr J Euphrasia Latha**, Head, Institute of Microbiology, Madras Medical College; **Dr P Kuganantham**, Founder-chairman, Indian Public Health Foundation and former Chennai City Health Officer.

## **Should people avoid eating meat-based food to prevent transmission?**

It is a respiratory virus and not a food-borne one. Coronavirus has nothing to do with food or pet animals or eating chicken and mutton. People can eat whatever they want and how much ever they want.

## **Is there a link between a person's immunity and COVID-19 transmission?**

Coronavirus is one of the weakest family of viruses. The deaths caused so far or people affected could have been ones with less immunity like children or the elderly. Sometimes, the virus enters a person's lungs and causes pneumonia. People with vulnerable immunity like the elderly succumb to this. For young people with good immunity, the effects of the virus may not be too strong but if you are someone with comorbid conditions like diabetes or cardiac disease, or if you are on immunosuppressive drugs, then the risk of infection is severe.

## **Are there any home remedies to treat COVID-19?**

Home remedies and treatment other than allopathy is not proven science. The best thing is precaution only. You must keep away from a patient who coughs and sneezes. If you are coughing, you need to cover your face with a mask and not spread the droplets around. COVID-19 spreads through droplets.

## **Are antibiotics effective in preventing and treating the new coronavirus?**

No, antibiotics do not work against viruses, only bacteria. The new coronavirus (2019-nCoV) is a virus and, therefore, antibiotics should not be used as a means of prevention or treatment.

However, if you are hospitalized for the 2019-nCoV, you may receive antibiotics because bacterial co-infection is possible.

## **Do vaccines against pneumonia protect you against the new coronavirus?**

No. Vaccines against pneumonia, such as pneumococcal vaccine and Haemophilus influenza type B (Hib) vaccine, do not provide protection against the new coronavirus. The virus is so new and different that it needs its own vaccine.

Although these vaccines are not effective against 2019-nCoV, vaccination against respiratory illnesses is highly recommended to protect your health.

## **Myths around COVID-19**

There have been several myths around the disease, like consuming more garlic, curry leaves or cow's urine would treat or protect one from the disease.

The World Health Organisation has busted such misleading claims. On garlic, WHO said it is a healthy food that may have some antimicrobial properties but there is no evidence that it has prevented people from contracting the 2019 nCoV.

## Here are some other myths and the WHO's response to them:

**Myth:** “COVID-19 virus can be transmitted in areas with hot and humid climates”

From the evidence so far, the COVID-19 virus can be transmitted in ALL AREAS, including areas with hot and humid weather. Regardless of climate, adopt protective measures if you live in, or travel to an area reporting COVID-19. The best way to protect yourself against COVID-19 is by frequently cleaning your hands. By doing this you eliminate viruses that may be on your hands and avoid infection that could occur by then touching your eyes, mouth, and nose.

**Myth:** The new coronavirus can be transmitted through mosquito bites.

To date there has been no information nor evidence to suggest that the new coronavirus could be transmitted by mosquitoes. The new coronavirus is a respiratory virus which spreads primarily through droplets generated when an infected person coughs or sneezes, or through droplets of saliva or discharge from the nose. To protect yourself, clean your hands frequently with an alcohol-based hand rub or wash them with soap and water. Also, avoid close contact with anyone who is coughing and sneezing.

# National and State helplines

(Please note that these numbers are subject to change.)

The new national helpline numbers are  
1075 / 1800-112-545 / 011-23978046

State / UT	State Helpline No.
Andhra Pradesh	0866-2410978
Arunachal Pradesh	9436055743
Assam	6913347770
Bihar	104
Chhattisgarh	077122-35091
Goa	104
Gujarat	104
Haryana	8558893911
Himachal Pradesh	104
Jharkhand	104
Karnataka	104
Kerala	0471-2552056
Madhya Pradesh	0755-2527177
Maharashtra	020-26127394
Manipur	3852411668
Meghalaya	108
Mizoram	102
Nagaland	7005539653
Odisha	9439994859
Punjab	104
Rajasthan	0141-2225624
Sikkim	104
Tamil Nadu	044-29510500
Telangana	104
Tripura	0381-2315879

Uttarakhand	104
Uttar Pradesh	18001805145
West Bengal	3323412600
Andaman and Nicobar Islands	03192-232102
Chandigarh	9779558282
Dadra and Nagar Haveli and Daman & Diu	104
Delhi	011-22307145
Jammu	01912520982
Kashmir	01942440283
Ladakh	01982256462
Lakshadweep	104
Puducherry	104