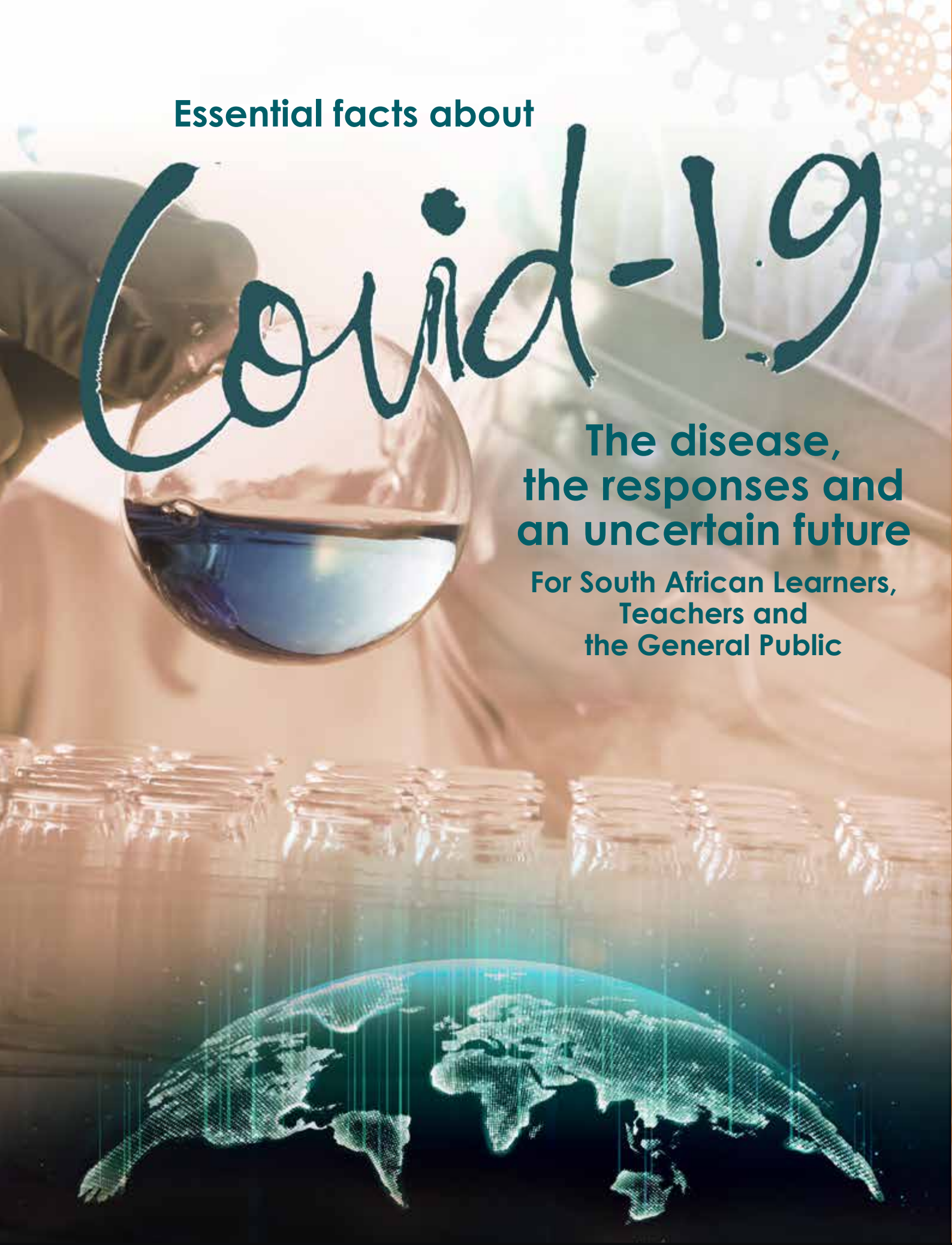
Essential facts about

Covid-19

The disease, the responses and an uncertain future

For South African Learners, Teachers and the General Public



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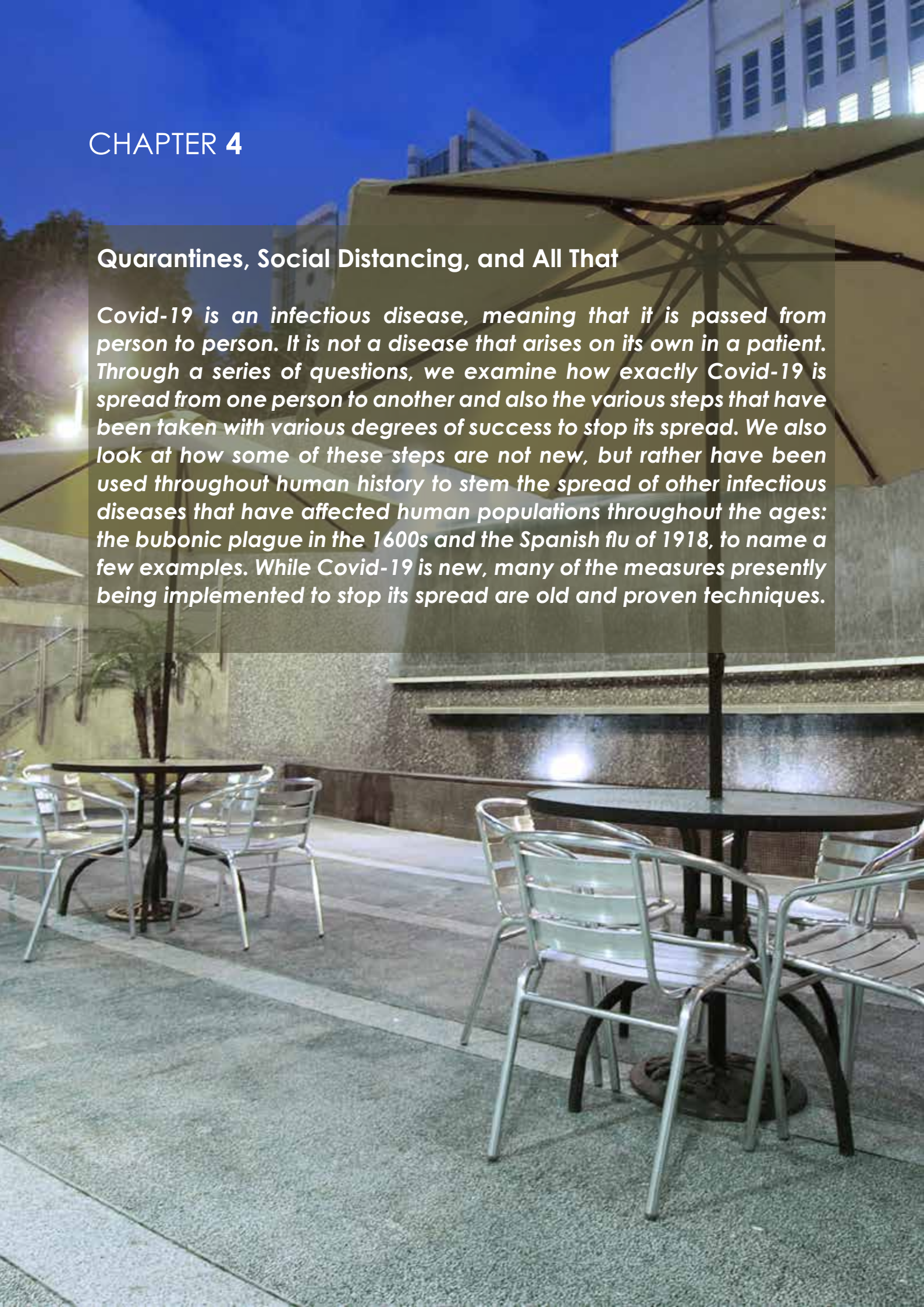

CHAPTER **4**

Quarantines, Social Distancing, and All That

Covid-19 is an infectious disease, meaning that it is passed from person to person. It is not a disease that arises on its own in a patient. Through a series of questions, we examine how exactly Covid-19 is spread from one person to another and also the various steps that have been taken with various degrees of success to stop its spread. We also look at how some of these steps are not new, but rather have been used throughout human history to stem the spread of other infectious diseases that have affected human populations throughout the ages: the bubonic plague in the 1600s and the Spanish flu of 1918, to name a few examples. While Covid-19 is new, many of the measures presently being implemented to stop its spread are old and proven techniques.

How does the coronavirus spread?

The coronavirus spreads mainly through droplets or aerosols that an infected person breathes out. We then either breathe these in or acquire them directly through our nose or mouth. Such droplets are deposited on surfaces that we touch and subsequently are transferred to our nose, mouth or eyes. The virus enters our body internally mainly by infecting epithelial cells. These are the type of cells that line the inside of our nose, mouth, throat, airways, lungs, and other passages within our body. The virus attaches itself to such cells by means of its spike protein, and then enters and infects the cell. Once infected, a cell reproduces the virus so that the cell contains many, many new viruses. The infected cell, which has become full of new viral particles, then bursts, and the process repeats itself. In this way, the virus spreads throughout the body, through the blood or lymph stream to many organs. Only when the body's immune system has become trained to fight the virus, by killing it off or preventing its reproduction, does the multiplication of the virus within the body slow down and eventually stop, hopefully before the patient has developed severe symptoms or dies.

How does someone become infected with Covid-19?

Whenever we breathe, the air entering and leaving our nose and mouth creates small droplets of all sizes (Figure 4.1). The air that we breathe out spreads these droplets and aerosols all over the place. The largest droplets do not go very far. They drop, falling to the ground within a metre or two. But smaller aerosols travel farther and can linger, sometimes floating in the air for hours, before possibly being breathed in by others or landing on surfaces, which, in turn, can be touched.

The basic mechanism of how the disease spreads from person to person through droplets and aerosols has been established.

Although the basic mechanism of how the disease spreads from person to person through droplets and aerosols has been established, many of the details have not fully been worked out. We do not know, for example, exactly how long the virus remains viable in droplets or aerosols and on surfaces. Nor do we know the precise minimum dose needed to become infected. At first the disease was regarded as less infectious than was later established, so the instruction to wear masks was delayed. Now mask-wearing has become compulsory in many countries and guidance on the effectiveness of masks has improved. Good medicine is characterised by a process of learning while discovering new information and summarising the most accurate conclusions from the evidence available at any moment in time. It is, thus, natural that the guidance given by public health authorities should evolve as we learn more and more about this new disease.

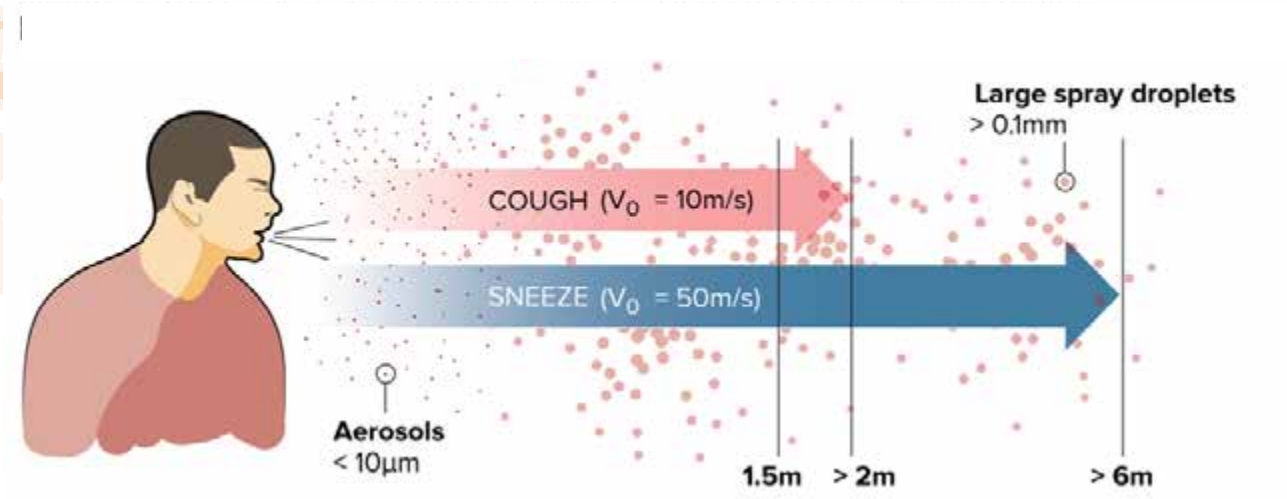

Figure 4.1: Sneezing, coughing, and even speaking gives off droplets of all sizes carrying the virus, thus allowing the virus to pass from one person to another.

A human sneeze gives off droplets of all sizes. After a fraction of a second, the front cloud will have already reached a distance of approximately 75 cm. Many of the droplets are so small (aerosols) that they have hardly fallen. If the person sneezing is infected by Covid-19, someone breathing in these droplets or aerosols can become infected. While the larger droplets fall within a meter, smaller droplets go even farther,and the smallest droplets can linger in the air for an hour or more if there is no wind to carry them away. Even normal speaking or breathing gives off some droplets and especially aerosols of this sort. This is the main way Covid-19 is passed from person to person.

To repeat: Once someone has been infected with the coronavirus, a so-called 'incubation period' lasting from 2-14 days follows before the onset of symptoms. Symptoms may include the following:

- Fever or chills
- Cough
- Shortness of breath or difficulty breathing
- Fatigue
- Muscle or body aches
- Headache
- New loss of taste or smell
- Sore throat
- Congestion or runny nose
- Nausea or vomiting
- Diarrhea

Each case is slightly different. Each symptomatic person experiences only a few of the above symptoms. This variation in the symptoms exhibited makes it very difficult to diagnose Covid-19 without a test, because many other illnesses present some of the same symptoms listed above.

A patient is said to be infectious when he or she spreads the virus and can, in turn, infect others. A person can be infectious a few days before the onset of symptoms. Consequently, staying away from people who are sick is not enough to stop the spread of the disease. Precautions must be taken to prevent getting infected by apparently healthy people around you, and also to prevent you from spreading the disease to others in case you have been infected but do not yet know it.

We have also learned that some people become infected and consequently are infectious without ever showing any symptoms (asymptomatic cases). They have no way of knowing that they are sick but are able to spread the disease to others.

How to avoid breathing in respiratory droplets or aerosols?

A combination of the following measures is recommended:

Physical distancing. To the maximum extent possible, try to maintain a distance of at least two metres from other people. This allows the larger respiratory droplets and some of the aerosols to drop to the ground or be blown away by the wind rather than being breathed in or coming into contact with one's skin or clothes. The two metres is a rough guide. Keeping a larger distance would reduce the risk even more. The duration of the contact is also a factor. Coming close to someone else for a short time is a lot less risky than spending a longer time (more than 15 minutes) near someone.

Wearing a mask. It is recommended that people wear surgical masks or triple-layered cloth masks when coming near to people not belonging to their immediate family. The protection provided by surgical masks is limited. The virus may still go through the mask layers but the possibility of this happening is very low.

Avoiding places where there are large groups of people, especially indoors.

Whereas outside the smaller respiratory droplets mentioned above are likely to be carried away by the wind, indoors, especially in places that are not well ventilated, the respiratory droplets can linger and be breathed in.

The above measures do not guarantee that a person will not get infected but greatly reduce their chances of getting infected. The recommendations given by public health experts try to ensure a compromise between avoiding contracting the virus and being able to continue, at least partially, with the usual activities of everyday life.

For medical personnel who work directly with either patients suffering from Covid-19 or with patients who may have Covid-19, more stringent protective measures are recommended. Medical personnel likely to come into contact with Covid-19 patients are recommended to use more tightly fitting so-called N-95 masks as well as goggles and face shields (which additionally prevent introduction of the virus through the eyes).

How can we destroy the virus on our hands and other surfaces?

Compared with other bacteria and viruses, the Covid-19 virus is relatively fragile. Hand-washing for at least 20 seconds using soap has been shown to be effective in destroying the virus. Soapy water is effective in disrupting the surface of the virus. An alternative when running water is not available is to use a disinfectant gel or sanitiser that contains at least 60% alcohol. The alcohol attacks the surface of the virus and destroys it. It is also important to disinfect surfaces that are touched often or are likely to contain respiratory droplets. Surfaces can be disinfected in a variety of ways. Using soap and water, alcohol, or water and bleach (diluted with one part bleach to 100 parts water) is known to work.

How long can the virus survive on surfaces?

We can only provide an approximate answer to this question as the lifespan of the virus depends on the type of surface and how effective any disinfecting agent has been in destroying the viruses. Not all viruses are destroyed at the same time but rather gradually. The virus lasts longer on smooth surfaces such as metal or glass than on porous surfaces such as cloth, paper or tissue. The virus can last on surfaces from a few hours to a few days (and perhaps for up to a week). See Chapter 7 for some estimates.

Communicable diseases date back to the beginnings of human civilization and became increasingly severe as large towns and cities began to develop and people from distant lands started to trade with each other.

Are quarantines a new idea?

Wearing masks and isolating ourselves from others when we show symptoms of Covid-19 is certainly new to us and marks a break with our previous old habits. But the problem of communicable diseases dates back to the beginnings of human civilization and became increasingly severe as large towns and cities began to develop and people from distant lands started to trade with each other. The practice of preventing the spread of communicable disease through isolating those possibly infected is not at all a new idea but dates back to ancient times. In Biblical times, sufferers of leprosy had to live in caves away from people to prevent spread of the disease. The word 'quarantine' derives from the Italian word 'quarantena', meaning a period of 40 days, which was the length of time the crews of ships entering the trading city of Venice had to wait aboard their ships before disembarking and mingling with the Venetians. This simple measure enacted by the Venetians proved

an effective means of keeping the bubonic plague (already described previously) out of Venice. Similar measures have been reported throughout history from all parts of the world.

While many of the old communicable diseases have been eliminated with modern drugs and vaccines, with Covid-19 we find ourselves having to revert to ancient measures that worked in the past and have also proved effective today when applied consistently.

Are the recommendations for particularly vulnerable populations the same?

It is recommended that elderly persons and those suffering from certain medical conditions, which increase their risk, adopt stricter physical distancing and other measures. But this is easier said than done. One of the measures adopted has been to limit access to care homes for the elderly, either partially or completely. The idea is to create a Covid-19-free bubble for those most likely to get infected and suffer serious consequences. Many of the major outbreaks have taken place in nursing homes. In many cases, the disease has been brought in by younger staff, who, without

knowing it, have been infected from the outside and introduced the infection into the nursing home. As a consequence, vaccinating the elderly in nursing homes has been identified as a priority.

How does testing help?

Testing can play a crucial role in reducing, and possibly also reversing, the spread of the epidemic. The idea is to try to identify everyone who is infected and ensure they isolate, thus reducing the spread of the disease. As explained in the next chapter, the number of cases can be made to decrease and even die away, without stopping every transmission event. It suffices to stop the transmission to the extent that, on average, each infected person infects fewer than one other person.

Testing plays a crucial role in a hospital setting, where one infected person can rapidly cause a large number of others to get infected, owing to the large number of contacts and people with weakened immune systems in a hospital setting. For example, in the outbreak at St Augustine's Hospital in Durban during March and April 2020, the infection of one person who was in the emergency department for a short stay led to a chain of infections, which, after passing through many hospital wards, resulted in 119 confirmed infections (39 patients and 80 staff) and 15 deaths. A study done after the incidents highlighted the importance of (1) testing personnel and patients, (2) dividing the hospital into clearly separated zones: a first zone for known Covid-19 patients, a second zone for patients of uncertain Covid-19 status, and a third zone for patients known to be free of Covid-19, and (3) minimising to the maximum extent possible the movement of medical personnel between these zones, and between the various wards within each zone. If these measures had been implemented, the consequences of this outbreak and similar outbreaks in other hospitals throughout the world would have been less catastrophic.

The idea is to try to identify everyone who is infected and ensure they isolate, thus reducing the spread of the disease.

A good case can be made for frequently testing medical personnel, personnel in nursing homes, and other groups of people coming into contact with more people than average and with vulnerable sectors of the population. Identifying and testing such targeted subpopulations can have a large impact in preventing so-called 'super-spreader' events.

Countries that have been successful in keeping out the epidemic and in controlling the number of local cases have great interest in preventing the infection from being reintroduced by persons entering the country. China, for example, has been successful in reducing the number of local infections to almost zero and requires persons entering China first to quarantine for 14 days and to pass two successive

RT-PCR[1] tests. Other countries have implemented similar measures. Of course, if most transmission is local, closing borders has a negligible impact and does little to help.

Most countries routinely test people showing Covid-19 symptoms in order to identify who should self-isolate or be quarantined. One of the problems with Covid-19 is that the symptoms, especially during the initial stage, are non-specific and are easily confused for other common conditions such as the flu.

Ideally, if it were possible to test almost everyone, and also frequently, it would be possible to drive the number of infections to zero. Efforts are underway to massively increase testing capacity, ensure a quick turnaround time, and to develop new tests that can be carried out either at home or locally without having to rely on sophisticated centralised laboratories.

What is the rationale behind stay-at-home, or lockdown, orders?

At the beginning of the epidemic, many of the countries hardest hit were faced with rapidly increasing numbers and hospitals rapidly filling up to more than they could handle, both in terms of number of beds and intensive care space. To some extent, hospital capacity could be increased, but the situation threatened to overwhelm the health system and cause a large number of deaths. In Italy, for example, it was reported on the news that since hospitals could no longer cope, a decision was taken that no one over 80 years should be brought to the hospital. This meant that such older citizens could not get extra care and would, in most cases, pass away at home. This, of course, placed a heavy emotional burden on medical personnel, who had to sometimes make decisions on whom to admit to hospital and whom to turn away. With the numbers doubling every few days, in many European countries, a decision was made to order everyone to stay at home except for essential workers. These measures largely shut down the economies, interfering with people's livelihood despite governmental measures to soften the impact. However, stay-at-home orders proved effective in slowing the spread, and in many countries in bringing the numbers down to manageable levels. In the meantime, testing capacity was increased, and personal protective equipment, initially extremely scarce, became more widely available. In many cases, countries were able to open up again and resume normal economic activity to a large extent. Countries such as South Africa, where medical experts advised the government to put in place an early lockdown, managed to lower

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1 You can find out more about what an RT-PCR test is in Chapter 7

the death rate and to ensure access to hospitals for all citizens. As expected, the rise in infections was not out of control and extra facilities that were set up were not actually required.

What is contact tracing?

An effective means of stopping the spread of a communicable disease is contact tracing. The idea is to trace, to the extent possible, every contact of each person who turns out to be infected and to encourage–or, in some cases, order those contacts to quarantine or get tested. For Covid-19, the incubation period is believed to be up to 10 to 14 days. This is the length of time a person must self-isolate without having shown symptoms in order to avoid spreading the disease to others. This was how the previous SARS epidemic was successfully stopped.

Contact tracing requires a lot of resources and is extremely challenging when there is a large number of cases. In China, where the number of people infected was first brought down to a manageable level by a long and strict quarantine, aggressive contact tracing has allowed the country to open up and return to nearly normal. In their effort, China has been aided by precise tracking of all its citizens using mobile phone data, so that all contacts could be identified. Other countries have experimented with various mobile phone tracking schemes allowing for contacts to be notified when someone has been infected.

Testing is also an important part of contact tracing, allowing contacts to avoid the disruption of a full 14-day quarantine. Testing with rapid turnaround of results is crucial for avoiding such disruption and securing the cooperation of the potentially infected contacts.

How effective are masks?

Masks do not provide perfect protection. For a surgical mask, the mask does not seal perfectly around someone's face, allowing some air and–possibly also viral particles–to leak in or out. Nevertheless, videos of persons coughing with and without a mask highlight that substantial protection is provided.

A good reference: WHO, "Transmission of SARS-CoV-2: implications for infection prevention precautions," https://www.who.int/news-room/commentaries/detail/transmission-of-sars-cov-2-implications-for-infection-prevention-precautions.

For medical personnel, tighter fitting and better filtering masks called respirators are used. These so-called N-95 masks are certified to filter out at least 95% of particles 0.3 microns in diameter. (One micron is a tiny unit of length, equal to one thousandth of a millimetre. A human hair is about 20-150 microns thick. A number of viruses are smaller than 0.3 micron such as HIV and SARS-CoV-2 which are about 0.1 micron.) Medical personnel also wear face shields, goggles, and disposable gowns for extra protection.

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The Parliament of South Africa passed the Academy of Science of South Africa Act (No 67 of 2001), which came into force on 15 May 2002. This made ASSAf the only academy of science in South Africa officially recognised by government and representing the country in the international community of science academies and elsewhere.

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