Nowadays, everyone wants to learn more about how infectious diseases spread. Thankfully, writer Adam Kucharski became an expert by conducting studies on today's most dangerous infectious diseases, including Zika and Ebola. This book was written and published before the coronavirus pandemic but offers important insights into how viruses spread and why they disappear.

However, an infection cannot be reduced to viruses. Many things also follow the same phase in society. You've probably heard of viruses that infect computers or a lot of "viral" things on the Internet, but it can be seen that contagion phases are also noticeable in gun violence acts and the spread of new ideas.

In this summary, you will learn how infectious outbreaks occur and how they eventually disappear.

## Chapter 1 - Mathematics and models have uniquely changed the way we work on infectious status.

In the past, we had to deal with infectious or pandemic disease outbreaks. The good news is that treatments for many of these diseases, such as malaria, smallpox, and measles, have been largely found. Thanks to advances in vaccines, attention to personal hygiene, and our understanding of how the disease spreads, we are much better at dealing with the spread of the disease than in the past.

The use of scientific models is one of the tools used to learn about diseases. These scientific models helped us analyze the spread of infectious diseases and, in some cases, accurately estimate the risk of getting sick.

One of the first scientists to use mathematics to study epidemics was the nineteenth-century English surgeon Ronald Ross. In 1883, Ross carried out his studies in Bangalore, India. It was the first time he realized that there was a serious mosquito problem in this city. But what was the reason for this problem? Ross was one of the first to realize that mosquito numbers are directly linked to the presence of stagnant water.

Ten years later, on sabbatical in London, Ross learned some important perceptions from fellow doctor Patrick Manson. While studying parasites in China, Manson realized that mosquitoes that feed on parasite-infected blood may be carriers of these parasites. This information was very critical for Ross because it was seen as a possible explanation of how malaria, one of the oldest infectious diseases affecting humanity, spreads. Could the mosquitoes carrying parasites be guilty?

Ross proves his theory by studying mosquitoes that bite a bird infected with malaria. He showed how these mosquitoes carrying the disease could later pass the disease on healthy birds. Ross later developed a new argument by developing her ideas. He suggested ways to control malaria. He made measurements and created models for this argument, and later published them in his 1910 book called The Prevention of Malaria Prevention. For the first

time, Ross proved how infection rates can be reduced and controlled with a reduction in the number of mosquitoes in a region.

For example, Ross's data showed that creating an average new human infection requires about 48,000 mosquitoes. Therefore, drying or purification of stagnant water would have a direct effect on the number of new infections. He then revealed the importance of the two statistics - infection rate and recovery rate and he proved that when the recovery rate exceeded the infection rate, the number of disease cases would eventually be zero.

This demonstrated a new way to study infectious diseases.

## Chapter 2 - Thanks to scientific models, we can adapt the contagion stages to other situations in life.

Researchers have developed models to help combat a wide range of infectious diseases, including Ebola, Zika, and HIV. Researchers, who expanded the work of Ronald Ross, developed the SIR model which is known as Susceptible, Infectious, and Recovered.

In many cases, when someone is treated for a disease, he is no longer susceptible to that disease. So, while the number of people treated increases, the number of people susceptible to the disease decreases.

The SIR model shows that at the time when the outbreak is worst, there is a point where the number of sensitive people is lowest. At this point, most people will either get infected or will have recovered. Then, the epidemic will start to decrease when there are not enough sensitive people to catch the disease. This situation is called herd immunity.

These concepts and models can also be applied outside of health and disease control.

Ronald Ross believed that this study could explain more situations than just the spread of infectious diseases. For example, Ross also defined the idea of "happenings". Happenings are situations that show people may or may not be sensitive to other kinds of trends. Ross described two types: independent happenings and dependent happenings.

In an independent happening, such as falling downstairs and breaking your leg, it is unlikely to increase or decrease the likelihood of this event happening to someone else later. Therefore, with an independent happening, the level of danger risk for the average person will not change every year.

In a dependent happening, situations become different. Dependent happenings tend to spread. These happenings cover ideas or beliefs as well as infectious viruses. For example, when someone is aware of an exciting idea- assume it is a hot new application - the people around him are more likely to be exposed to this idea and have an increased interest in it.

Ross's models show that dependent happenings often follow an S-shaped line on the chart. There is a slow initial propagation that grows more rapidly until it reaches a certain point where it slows down and becomes flat.

In 1962, sociologist Everett Rogers stated that Ross's dependent happenings model explained many aspects of life, including the adoption of new ideas and products. As with an infectious disease, the spread rate of an infectious idea will eventually be balanced when it is unlikely to contact a sensitive person who has not heard the idea before.

## Chapter 3 - Contagion rules can be applied to finances.

What is considered a crisis in your mind? Undoubtedly, a serious threat to our health may be a crisis, but any danger for our financial institutions can also create a crisis.

The phrase "financial contagion" has been in use since the mid-1990s. However, the idea of financial contagion became clear during the financial crisis of 2008.

The slow spread of some ideas among traders and financial markets is one of the many factors leading to the 2008 crisis. In particular, CDO trading or secured debt obligations became well known during this period. CDOs covered a group of loans, including bundled mortgages.CDO investors made money by taking part in a piece of people's loan repayments.

This is simple. And it is in principle quite low risk. It is seen as the only danger that many people stop giving back their mortgages and loans. This is something that most people don't think will happen.

Potentially low-risk and high-value CDOs increased their value. With an increasing pace, as more and more people invested in them, it spread to the financial system. As the credit expert Janet Tavakoli said, "they spread to the spirit of financial markets like a highly contagious through virus".

Sadly, a problem emerged. There has been a steady increase in housing prices for years. And by 2008, many CDOs had mortgages based on old and outdated prices. Therefore, these mortgages are unlikely to be paid back. In other words, CDOs that looked like low-risk investments were high-risk. And since CDO investments were very popular, this risk spread directly into the system.

It was only a matter of time before things came to the end, and the market realized that CDO investments were worthless. When this finally happened, the whole system crashed. The outbreak damaged banks and financial institutions like Lehman Brothers and Bear Stearns. Many businesses went bankrupt and investors lost their wealth.

It should be noted that developments and events such as the dot-com spread of the late 1990s or the Dutch tulip craze of the 1630s follow the same contagion rules: Financial ideas emerge, spread, and things are inevitably accepted until it reaches a breaking point and collapses.

## Chapter 4 - Statistics on violence and crime are very similar to those of infectious diseases.

You've probably heard the phrase "violence starts violence". If so, it is probably not surprising to you that epidemiologists have discovered that acts of violence can spread just like viruses.

Making an outbreak map of a disease is a relatively new thing. Mapping started in 1848 with a doctor named John Snow. Snow used a London map to detect a recent outbreak of cholera to a particular shared water pump. Since then, maps have proven to be a valuable tool for epidemiologists who want to find the source of the infection outbreak.

Gary Slutkin is one of such epidemiologists. He found that murder maps in US cities were very similar to those of cholera outbreaks in Bangladesh. Maps have shown that outbreaks of violence can accumulate somewhere just like an epidemic and then spread out. Similarly, historical charts on violence in Rwanda were similar to data on cholera outbreaks in Somalia.

Dr. Slutkin is not the only one to discover the correlation between violence and disease. Andrew Papachristos, a sociologist at Yale University, conducted a shooting study in Chicago. He found that "contagion will result in 63 follow-up attacks for every 100 people who were shot".

This level of infection gives gun violence a 0.63 reproduction number (or R) in Chicago. For comparison, the pandemic flu or Ebola outbreak is usually R of 1-2. This means that, for example, every person with Ebola is likely to infect one or two people. The SARS outbreak that occurred in 2003 had an R of 2–3. Smallpox, which is the only human infection that was eradicated, had an R of 4-6.

Therefore, violent attacks should be treated as a disease, although they are not as contagious as some infectious diseases. This is exactly what happens with positive results in some US cities. Dr. Slutkin's research forms the basis of the organization called Cure Violence. This organization identifies high-risk areas and sends the "anti-violence" team to these areas. This anti-violence team tries to prevent the spread of the outbreak by talking to friends and families as well as victims and directing them to options other than violence retaliation.

Incredibly, after a year of work at Chicago's West Garfield Park, gun attacks in the area decreased by about two-thirds.

## Chapter 5 - Ideas and internet memes also have the potential to go viral.

It is difficult to make accurate predictions for epidemiologists. You need solid data to build a good model, but it's often hard to come across. For the flu pandemic, you will need hospitals

and health centers from around the world to record and obtain accurate data and also people are required to collect and organize all this data.

This is no small success. And even if this data is obtained, it is often delayed. Researchers often have to process data that can be days, or even weeks old.

However, there is a place where data is abundant and easily accessible: the internet.

Jonah Peretti is someone who knows a lot about creating "viral" online content. In 2001, Peretti ordered a pair of personalized sneakers with the word "sweatshop" on them, and then exchanged emails with Nike. When Nike did not accept the order, Peretti shared the e-mail correspondence; the email chain has become viral. His story appeared in newspapers and Peretti became a guest on the Today Show.

At that time, Peretti was a graduate student at MIT, but then viral content creation became a full-time job for him. In the beginning, he was at the head of New York City's "infectious media lab" called Eyebeam, a non-profit organization. Eventually, he helped develop the Huffington Post and also create a small website called Buzzfeed. It would be correct to say that Peretti is an expert on how and why things go viral on the internet.

To spread online content like an epidemic, Peretti uses studies on the rules of contagion. For example, when starting a marketing campaign, Peretti benefitted from the equation to determine what types of outbreaks are expected when the number of reproduction is less than one.

Let's be patient to understand while talking about a little math. Suppose the flu pandemic has an R of 0.8. One minus 0.8 equals 0.2. And one divided by 0.2 equals 5. As a result, the flu with a reproductive number of 0.8 means we can expect outbreaks with an average of five cases.

Likewise, this process can be reversed. Assume that a Twitter post received 130 retweets. When we look at the person's exact history, we can see that most people who see the tweet are not interested in it at all. As can be understood, there were only four sets of activities, and in these sets, the average outbreak was only 1.04 retweets. With this measurement, we can calculate that the tweet had an awful R of the 0.04. This is how Peretti can take advantage of the handy epidemic equation to reveal how effective a marketing campaign has been.

## Chapter 6 - The spread of online content may mimic the outbreaks of contagion, but the effectiveness of the influencers is limited.

You might think that Twitter is occupied entirely with viral content, but 95 percent of the content on Twitter is, in fact, the only tweet that no one has shared. It is extremely rare for online content to become popular and spread around the world.

People like Jonah Peretti and research teams from Microsoft and Facebook are focusing on rare situations where online content is popularly spread. They have been focusing on why and how a particular online content creates a desire to share with everyone.

One way of content reflecting an infectious virus is adaptability. The flu, for example, is known to be bad for its ability to change by mutation every year. Therefore, winter flu is perceived as an annual threat. Although a vaccine can be produced for a new type of flu, it takes about six months, which is usually when an epidemic has complete its course.

Popular memes are also popular with their mutation, change, and more shareability while being transferred from person to person. The words written under a funny picture of a cat can be changed or a new sentence can be added to a donation poster. These minor changes can make a big difference.

For example, there was a Facebook post saying " "No one should die because they cannot afford health care and no one should go broke because they get sick." This post was shared about half a million times in its original form. However, while the message was reposted, one person in every ten posts changed the statement. When the phrase "post if you agree" was added, researchers on Facebook realized that thanks to this, the probability of sharing was doubled.

What about the influencers? Can influencers affect the spread of online content? Not always. Studies on the efficiency of "superspreaders" or individual people who can cause something to spread excessively have found their effects to be limited. Therefore, even if something is shared by an online "influencer" like a celebrity with millions of followers, there is no guarantee that the content will spread around the world. As Jonah Peretti said, "super spreader" is the person who can infect eleven people on the Internet instead of two.Very few people, right?

In fact, after reviewing popular posts on Twitter, there was little common judgment about determining certain features that could make a tweet viral. In other words, we haven't yet found a way to accurately predict what's gaining online prevalence and popularity.

## Chapter 7 - Technological advances can be helpful to understand outbreaks, but they have some disadvantages.

As it turns out, technology can show us a lot about the stages of contagion. But there are also negative sides.

Of course, social media has facilitated communication, but it also allowed false information to spread at the same speed and became a constant concern for anxiety.

Similarly, by analyzing crimes in cities like Chicago, organizations such as Cure Violence can correct the cycle of violence and increase life-saving efforts. However, by using past data, other possible methods of combating crime have been found to strengthen racial prejudices that were part of community policing in the past.

Advanced health technology can be used to combat pandemic flu, but there is still much we can not do.

Surprisingly, during the 2014 Ebola outbreak, researchers were provided with a steady stream of blood samples for DNA analysis. In light of the advances in DNA sequencing technology, researchers were able to follow and study every disease case through an infected human chain. Such developments offer an impressive idea of how the outbreaks started and spread, however, most of this understanding comes after the worst situation is over.

However, today some resources can provide a lot of real-time data about human behavior. Few people can surpass Google and Facebook in terms of data stocks ready for analysis. Providing users with the ability to track via GPS signal, this data can help control potential future contagion outbreaks.

But should this monitoring feature, which is the more important question, be used? Many people are unaware of how much of their data is collected and opened for use by companies such as Cambridge Analytica. For example, the realization that personal information of Facebook users was used information for political campaign research caused huge scandals.

On the other hand, since 2017, the author has been part of a study with a special program called Contagion in collaboration with the BBC channel. The subject of the study was people who downloaded an app for the benefit of researchers to track people's movements and gather information about their social interactions. Tens of thousands of people decided to participate freely in the study, the study had no other benefit than contributing to a large data set, so we can better understand how outbreaks started and spread.

As can be seen, these technologies can be used for a useful purpose. However, in order to understand the benefits of technologies, it is necessary to be more transparent about how this data is used. When people are informed that their personal information has been collected and they know exactly what this data will be used for, good developments can happen.

## The Rules of Contagion: Why Things Spread- and Why They Stop by Adam Kucharski Book Review

Contagion stages may be useful for explaining more things than infectious diseases. Since the early 1900s, researchers have begun to notice similarities between how viruses spread and how ideas spread among humans. Since then, similarities have started to emerge in our financial structures and how violence spreads across communities. However, epidemic studies and research require data analysis. These analyzes cannot prevent the epidemic because they cannot always be done correctly and on time. There is a possibility that new technologies can provide more understanding of human behavior to deal with future contagious outbreaks. However, in the light of technological developments, this data should be obtained in an ethical and transparent manner.

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