What makes COVID-19 dangerous?

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Understanding the Spread of Diseases

We are now in the midst of a global crisis brought on by COVID-19, a new disease that emerged at the end of 2019 and has caused major disruptions the world over. One might wonder what makes COVID-19 "more dangerous" than diseases like Malaria. In this article, we share with the reader our understanding of what makes COVID-19 so extraordinarily dangerous.

To understand COVID-19, let us begin by talking about another infamous disease, the Ebola Viral Disease (EVD). This is a disease that is contracted by contact with either infected animals or infected human blood. It causes the infected person to develop sudden symptoms of fever, vomiting, diarrhea and bleeding as the disease progresses. Approximately 50% of all those who are diagnosed with EVD die, though sometimes the rate can be as high as 90% [1]. In comparison, COVID-19 by some estimates has this rate at approximately 3.4% [2]. Why then has the entire world not come to a grinding halt over EVD? The is because other factors besides mortality rates determine how contagious a deadly disease is, and hence how it affects the community. The intuition here is that a disease that is deadly but very difficult to communicate will only kill a few hosts. The factors that determine the ultimate contagiousness of a disease are (a) the mortality rate, which we considered before, (b) how the disease spreads, (c) how long after getting infected does the infected person start showing symptoms and (d) how well it can be isolated and cured. Let us understand each of these separately.

How diseases spread

Communicable diseases spread when a healthy person comes in contact with an infected person directly or indirectly. An example of this is malaria, which is passed by a mosquito bite from one infected person to another. Here the infection can pass from one person to another due to mosquitos being used as part of the life cycle of the disease-causing organisms (Plasmodium). Another example is cholera, which is passed from one person to another by drinking dirty water infested by the bacteria, the water made dirty usually by fecal matter

from an infected person. In these examples, the path towards controlling the disease is to remove the transmission paths. Malarial infections are reduced by making sure that standing water is not available for mosquitos to breed and safe drinking water can reduce the number of cholera cases drastically.

Now to our first example of EVD. The only way to contract EVD is by transfer of bodily fluids from an infected person. This means a healthy person is standing next to an infected person stands no risk of getting infected unless the infected person is bleeding. This has been crucial, alongside community education and contract tracking in minimizing the otherwise enormous death toll EVD could have caused in Africa [3]. Hence the method of transmission of the disease is an important factor in how quickly a disease spreads. In the case of COVID-19, since the virus (SARS-Cov2) can stay in the air suspended in spit that is aerosolized (imagine what happens when you sneeze in front of a mirror…what you see on the mirror is aerosolized spit) and also can land on surfaces and be spread after the infected person leaves the room, COVID-19 is very dangerous to humans by just how easily it spreads.

How long before symptoms show

Another important factor is how long before the symptoms show. If an infected person immediately shows signs of the infection, then it would in principle be simpler to control the spread of the disease by isolating the patients. For instance, cholera poisoning shows symptoms between 1 and 5 days [4]. On the other hand, COVID-19 takes anywhere between 1 and 12 days to show symptoms. This means that a person could be asymptomatic for as much as nearly two weeks, unknowingly spreading the disease for almost the entire time. This makes it possible for more deadly diseases which exhibit symptoms sooner to be *less deadly on the whole* than less deadly diseases that are asymptomatic but infectious for longer. This can be quantified in a number R_0, which we shall briefly consider.

Putting it together: Quantifying Contagiousness

These factors above are usually put together in a number called R_0 ("r naught"), which is called the *basic reproduction number.* It is calculated as the product of the mean infection duration times the mean infection producing contacts per time. If $R_0 < 1$, then the disease will not become an epidemic whereas $R_0 > 1$ represents an epidemic. This is often used to talk about the overall contagiousness of a disease. For instance, measles has an R_0 of about 12-18 [5]

and EVD has an R_0 of about 1.5-2.5. R0 can be brought from above 1 to below 1 by intervention techniques such as quarantining.

Prevention, Testing, Tracking and Cure

The best way to reduce transmission of COVID-19 is to simply wash hands frequently and to wear a mask when in the inevitable company of others for necessary activities. Furthermore, social distancing has been shown to reduce the transmission rates as well. Besides this, one of the best ways to prevent the immense personal and societal costs of such communicable diseases is to test, isolate and cure patients as soon as possible, before the disease turns into a pandemic.

[1] https://www.who.int/news-room/fact-sheets/detail/ebola-virus-disease
[2] https://www.bloomberg.com/opinion/articles/2020-03-05/how-bad-is-the-coronavirus-let-s-compare-with-sars-ebola-flu
[3] https://www.who.int/emergencies/diseases/ebola/frequently-asked-questions
[4] https://www.nhsinform.scot/illnesses-and-conditions/infections-and-poisoning/food-poisoning#causes-of-food-poisoning
[5] https://en.wikipedia.org/wiki/Basic_reproduction_number