Manuscript to the video 'The simplicity of infection Math'

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Part one, https://youtu.be/nUsnQa6gi0U

The MATHeCADEMY.net welcomes you to the simplicity of infection math.

Part one will be about the two infection formulas, exemplified with data from Denmark in 2020. Part two will be about the Danish lockdown.

Infection follows 2 simple formulas that predicts its behavior.

The first infection formula is a 3-factor formula. It tells us, how infection spreads.

For example, infection may explode in unbalanced meetings, where many persons are together, for many hours. Therefore, balance meetings in space, and in time. Few persons in many hours, or many persons in few hours.

The second infection formula is a hill-formula. It tells us, that if balanced, the infection will disappear by itself. In a shorter period, with higher infection intensity. And in a longer period, with a lower infection intensity.

Therefore, the message of the 2 infection formulas is: do not exceed. Do not lockdown. Simply balance.

Infection reproduces, and the basic reproduction number is called R. It tells us, how many persons, that 1 will infect. Typical reproduction numbers are 2 and 4 for ebola and sars. And 2.5 and 1.5 for corona and flu.

If the reproduction number is 2, 1 will infect 2, that will infect 4; and the infection will increase. If the reproduction number is 1, 1 will infect 1, that will infect 1; and the infection will stay constant. If the reproduction number is a half, 4 will infect 2, that will infect 1; and the infection will decrease.

The first infection formula is a 3-factor doubling-formula, that is quickly found on Google. The formula finds the reproduction number, R, by multiplying the three infection factors, the dirt-factor, the crowd-factor, and the time-factor. Therefore, my infection risk doubles, if I double my lack of hygiene. Or, if I double my crowding. Or, if I double my meeting time.

Doubling-formulas are all over. Nature is full of doubling-formulas. They describe proportionality, in the STEM-subjects Science, Technology, Engineering, and Mathematics. Here are some examples. We should notice the extreme power of 3-factor formulas: In a 2-factor formula, 10-doubling needs 3-doubling, since 3 times 3 is close to 10. In a 3-factor formula, 10-doubling needs only 2-doubling, since 2 times 2 times 2 is close to 10. The pressure formula is used to generate steam pressure difference in power plants. The reproduction formula is used to generate virus greenhouses.

The 3-factor infection formula shows, that after-skiing will create hot-hot-hot spots, where extreme doublings of all three infection factors, dirt, and crowd, and time, will create effective virus greenhouses. We see, that a 5-doubling all 3 infection factors will create a 125-doubling, so that 1 will infect more than 300 persons at an after-ski party.

But, the 3-factor formula also shows, that the reproduction stays constant, by balancing the three infection factors. So, with standard hygiene, that is using soap but no alcohol, the combined effect of crowd and time is an area, that is kept constant by balancing the changes. Therefore, halving the time, will balance doubling the crowd. And doubling the time, must be balanced with halving the crowd. Therefore, the message of the 3-factor formula is simple. Do not exceed. Do not lockdown. Simply balance.

A lockdown will prevent infection from terminating, at herd immunity, where 60% of the population has been infected. A simple game will show why. In a group of 6 persons, in turn, the players choose 1 person to infect. The chance of success decreases, and soon the chance is down to 40%, where herd immunity occurs.

The second formula shows the infection termination as a hill-curve. It shows that the infection increases, when the reproduction doubling-factor is over 1. And decreases, when the doubling-factor is below 1. And because of a limited population, the reproduction factor will decrease steadily from its, initial level to zero, when herd immunity has been reached. Therefore, a decreasing doubling-factor will make the number of newly infected, first go up, and later go down. The only question is, if the top is below or over the capacity of the hospitals.

Solving its change equation will give the details of the hill-curve. The equation occurs in two versions. The first version uses a spreadsheet to calculate, and add, the periodic changes, step by step. The second version uses calculus, to transform the change-formula into a level-formula, for the hill curve.

To have reliable data we use the number of hospitalized, since we are not able to measure the total number of infected persons in a population. The number of hospitalized then allows finding the number of respirators needed. Here we see the Danish data for persons being hospitalized daily. We focus on the period until March 26, when the effect begins to show of the Danish lockdown, proclaimed on March 11.

The period up to March 11 showed an average daily growth close to 50%. This corresponds to a daily doubling-factor 1.5, coming from people infected during Italian after-skiing.

The following week showed an average daily growth close to 30%. This corresponds to a daily doubling-factor 1.3, now also coming from people infected in Denmark.

The period from March 11 to March 26 showed an average daily growth close to 20%. This corresponds to a daily doubling-factor 1.2, now primarily coming from people infected in Denmark.

When meeting an infected person, some are infected, some are not. If infected, some are sick, some are not. If sick, some are hospitalized, some are not. If hospitalized, some need a respirator, some do not. A 5day Horse Show in the Danish town Herning from March 4-8 helps estimating the different percentages. Here fifty thousand persons were together for 5 days. This means that all 3 infection-factors were doubled up several times. This would indicate, that all were infected. But only 30 were hospitalized. Therefore, the ratio between the infected, and the hospitalized may be estimated to 50 thousand to 30, or 1650 to 1. Danish Authority data shows, that in average, 5 beds need 1 respirator. In total this means, that 5 million infected need 3 thousand beds with 6 hundred respirators, which is below the capacity on 1 thousand respirators. Therefore, the message of the horse show is, no crisis. The same message comes from observing, that the problems in Italy first occurred 2 months after the infection arrived from China.

Therefore, on March 11, with reliable hospitalization data, the 2 infection formulas would say: With a doubling-factor 1.5 created in after-skiing, we will reach herd immunity in mid-April, needing a maximum of 800 respirators, in late March. With a doubling-factor 1.2 created in Denmark, we will reach herd immunity in mid-May, needing at maximum of 400 respirators in mid April. Both respirator numbers are below the capacity at 1000 respirators. Consequently, the infection will behave like a flu. Therefore, to avoid Italian after-skiing numbers, we maintain normal hygiene, that is soap but NO alcohol. And we balance meetings in space and time, by keeping the, person-times-hour area, below 100, for the next three months.

Here ends part one concluding that, with reliable Danish data, the message of the two infection formulas is, do not exceed, do not lock down, simply balance meetings in space and time. Part two will be about the Danish lockdown.

Part 2, https://youtu.be/EKPpu7LWbKc

The MATHeCADEMY.net welcomes you to the simplicity of infection math. Part one was about the two infection formulas, exemplified with data from Denmark in 2020. Part two will be about the Danish lockdown.

In part one we saw that, using reliable hospitalization data, the message of the two infection formulas was. With a doubling-factor 1.5 we reach herd immunity in mid-April, needing less than 800 respirators. With a doubling-factor 1.2 we reach herd immunity in mid-May, needing less than 400 respirators. Both respirator numbers are below the capacity at 1000 respirators. Therefore, to avoid Italian after-skiing numbers, we maintain normal hygiene. And we balance meetings in space and time, by keeping the, person-times-hour area, below 100, for the next three months.

But, the government used unreliable data, the infected, instead of reliable data about the hospitalized. Also, the government neglected the 2 infection formulas. The government said: "2 days ago, we had 35 infected. Now we have 514. It is more than a 10 doubling. This must stop." But, in the same period, the reliable numbers of hospitalized had doubled only 2 dot 3 times, from 19 to 44. The government also said: "We must avoid the Italian situation." But, the Italian situation was created by after-skiing, with extreme doublings of dirt and crowding and time, which could never be the case in Denmark, having no skiing season.

And, the government also used unreliable data to compare Denmark with the rest of Europe. The government said: "Our numbers have increased in recent days in such a way, that Denmark now occupies the place in Europe, where we have seen the most dramatic increase, in the number of new people infected. We must avoid, what we have seen in the Italian health service, and that is so serious. We have a health crisis in Denmark."

Then to curves were presented, a green, and a red breaking through the capacity-line. The government said: "Now I want to show these two graphs. The red scenario shows a steep increase in the infection. If this steep increase is to continue, it will break through the normal capacity of the health service. It is absolutely essential that we push the infection, so that we get into the green scenario."

Instead of using the 2 simple infection fact-formulas, the Danish Serum Institute probably has used complicated mathematical fiction-models to find the two curves, which apparently are known and copied world-wide.

Therefore, the government message was clear. Avoid the red curve crossing the capacity line! But, the graph has no numbers on the axes. It does not specify if 'incidents' mean reliable hospitalization or unreliable infection data. And it places the capacity line too low, because, the 2 infection formulas say: the capacity line is above all curves.

The Danish Health Authority said: "We are very concerned about the very rapid increase in the number of infected people, we are seeing in Denmark. How the development will be in Denmark, whether it becomes an Italian model, that cannot be predicted in itself." But, why does the Danish Health Authority talk about unreliable infection data, and silence reliable hospitalization data? And why silence the 3-factor formula predicting, that only after-skiing can produce the extreme doubling of the 3 infection factors?

The Danish press said: "It is a very, very explosive increase, we are seeing right now. The numbers are reported every half-day, and they have increased dramatically each time." But why does the press not question the reliability of infection numbers, and instead refer to the hospitalization numbers available at the Danish Health Authority's website?

The opposition leader in parliament said May 14: "What especially motivated locking down so resolutely, and thank you for that, Prime Minister, were the pictures we could see from Italy. And so, it was the right thing to do, because everything else would have been irresponsible. " But why silence the 3-factor formula saying that only after-skiing in Italy can produce the extreme doubling

of the 3 infection factors? And why not question the reliability of the infection numbers used to lockdown?

The authority published 5 advices for minimizing infection. “1. Stay at home, and minimize social activity. 2. Wash your hands often and use alcohol. 3. Keep a distance to other people. 4. Sneeze and cough in your armpit, not in your hands. 5. Points of contacts in your home and at work must be cleaned daily.” But, there is no mention of the 3-factor infection formula, aR is d times c times t. And, the dirt-factor d is mentioned in 2, and 4, and 5. And, the crowd-factor c is mentioned in 1 and 3. But does not 1 imply 3? And, the time-factor t is NOT mentioned at all. Nor is balancing.

Conclusion. The Danish government based its 2020 lockdown on five things. It used unreliable data from infected, not reliable data from hospitalized. It neglected the 2 infection formulas saying: balance, do not lockdown. It scared the population with the Italian after-ski virus-greenhouses, even if they could never occur in Denmark, according to the 3-factor formula. It scared the parliament to pass a state of emergency. It silenced time as an infection factor. As a consequence, there never was a Danish corona crisis. Instead there was a corona scandal, that created a financial crisis, that will cost at least 30 billion euro in 2020.

A fictitious press conference. Welcome, please pose your questions. What is the moral of the 2020 Danish corona scandal? Locking down means preserving the virus. How can we get rid of the virus in the present situation? How to avoid the next infection scandal? Where can we read about, and try out the two infection formulas?

The moral of the 2020 Danish corona scandal. In a globalized world, a nation cannot afford that its politicians, its population, and its education is unenlightened. Democracy only works with politics based on the parties’ own knowledge tanks; and with dosage: 40+30+20+10 percent for liberals, socialists, social-liberals, and independents not voting. Education must have three prime goals: to develop the learner’s word- and number-languages; to enlighten children about their outside world; to enlighten teenagers about their inside talents. When teaching number-language, its grammar, mathematics, must submit to its fact- and fiction-calculations, using flexible bundle-numbers to raise area questions as: 2 threes and 4 fives total what?

Locking down means preserving the virus. How to get rid of the virus in the present situation? Go back to the start. Open up everything until the reproduction number is back to 2.5. Send primary, secondary, and tertiary students to Sweden to be infected. Practice mega-crowds in September in education and in sport. Once the reproduction number is back to 2.5, start balancing meetings in space and time by fixing the person times hours area. Start maintaining standard hygiene by using soap, but NO alcohol. Ask seniors to be careful for 3 months until herd immunity is reached.

How to avoid the next infection scandal. Simply fix the Person times Hours Area. Avoid Many persons & many hours in Hot-Hot-Spots. Avoid Hot-Hot-Hot-Spots in Mega-Crowds. Accept Few persons and many hours in SoftHotSpots. Accept Many persons and few hours in HotSoftSpots. Simply Balance. Do not exceed, do not lockdown. And transfer the ‘Serum Institute’ to a university.

Where to read about the two infection formulas?
Where to try out the two infection formulas? Go to the MATHeCADEMY.net website.

The MATHeCADEMY.net thanks you for watching the two infection formula video. Please remember: To end an infection, observe standard hygiene, do not EXCEDE, do not LOCKDOWN. Simply BALANCE meetings in space and time. Simply fix & squeeze, the Person times Hours Area.

Slides and details on http://mathecademy.net/corona-infection-model/