

*The simplicity of*  
**INFECTION Math**



MATHeCADEMY.net

*The simplicity of*  
**INFECTION Math**



Part I. The 2 Infection Formulas, exemplified with data from Denmark in 2020

Part II. The Danish lockdown

# INFECTION

follows 2 simple  
formulas

Allan.Tarp@MATHeCADEMY.net, June 2020

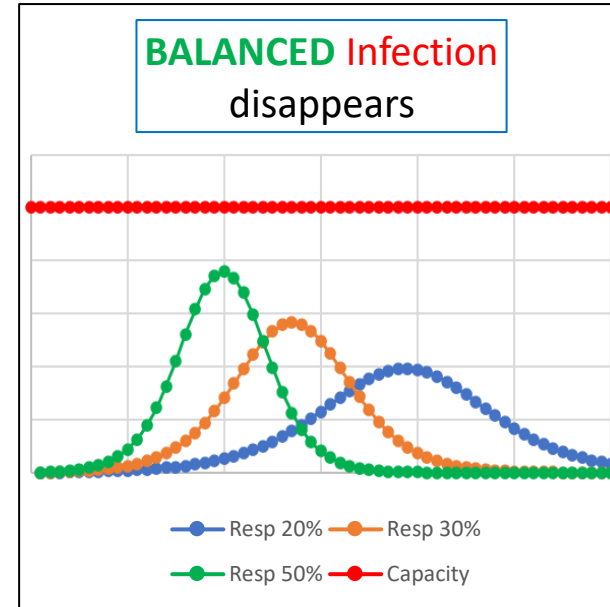
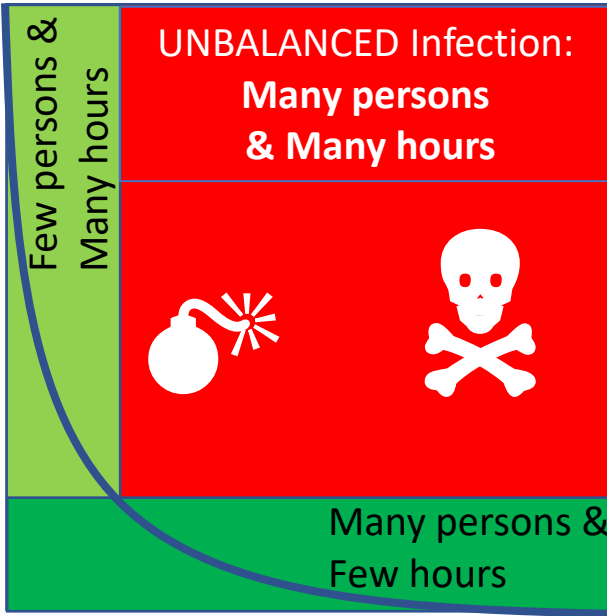
$$R = d * c * t$$

# The 2

# INFECTION

# Formulas

$$R * P1 = P2$$



Calculate how **INFECTION** spreads

- and how, if **BALANCED**, it **DISAPPEARS** by itself

So, do not **EXCEDE** or **LOCKDOWN**.

Simply **BALANCE**



# Infection reproduces

The basic Reproduction Number is called **R**.  
It tells us how many persons, 1 will infect.

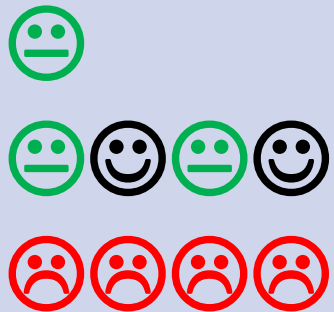
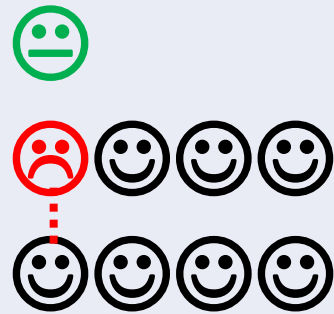
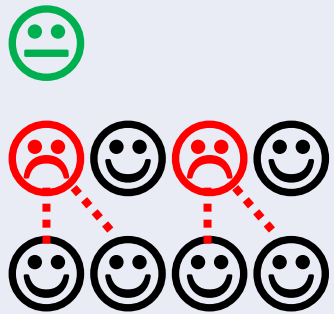
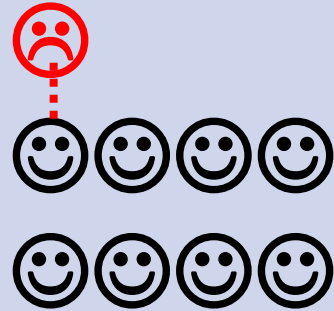
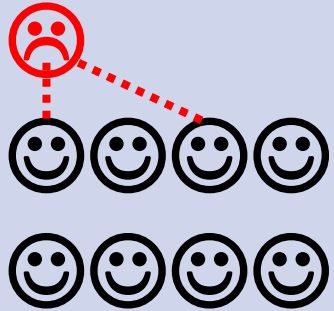
*Typical Reproduction-numbers:*

- Ebola            2            ☹️        ➡️        ☹️☹️
- Sars             4            ☹️        ➡️        ☹️☹️☹️☹️
- Corona         2.5        ☹️        ➡️        ☹️☹️☹️
- Flu              1.5        ☹️        ➡️        ☹️☹️



















R = 2

R = 1

R = 1/2



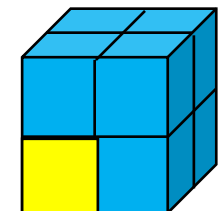
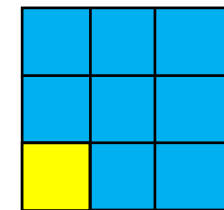
InfectionFormula I: Reproduction  $R=d*c*t$   
doubles up with **d**irt & **c**rowd & **t**ime

dirt	crowd	time
  	  	  
  	  	  

# Doubling-formulas are all over

Nature is full of doubling-formulas describing proportionality in the **STEM**-subjects **S**cience, **T**echnology, **E**ngineering, and **M**athematics

formula	proportionality	a 10-doubling needs
1-factor	Distance = length*unit Distance = speed*time	10-doubling
2-factor	Area = length*length Stopping distance = speed*speed	3-doubling ( $3*3 \approx 10$ )
3-factor	Volume = length*length*length Pressure = crowd*temp.*molecules Reproduction = dirt*crowd*time	2-doubling ( $2*2*2 \approx 10$ )







# Alpine afterski: HotHotHotSpots with extreme **d**irt & **c**rowd & **t**ime

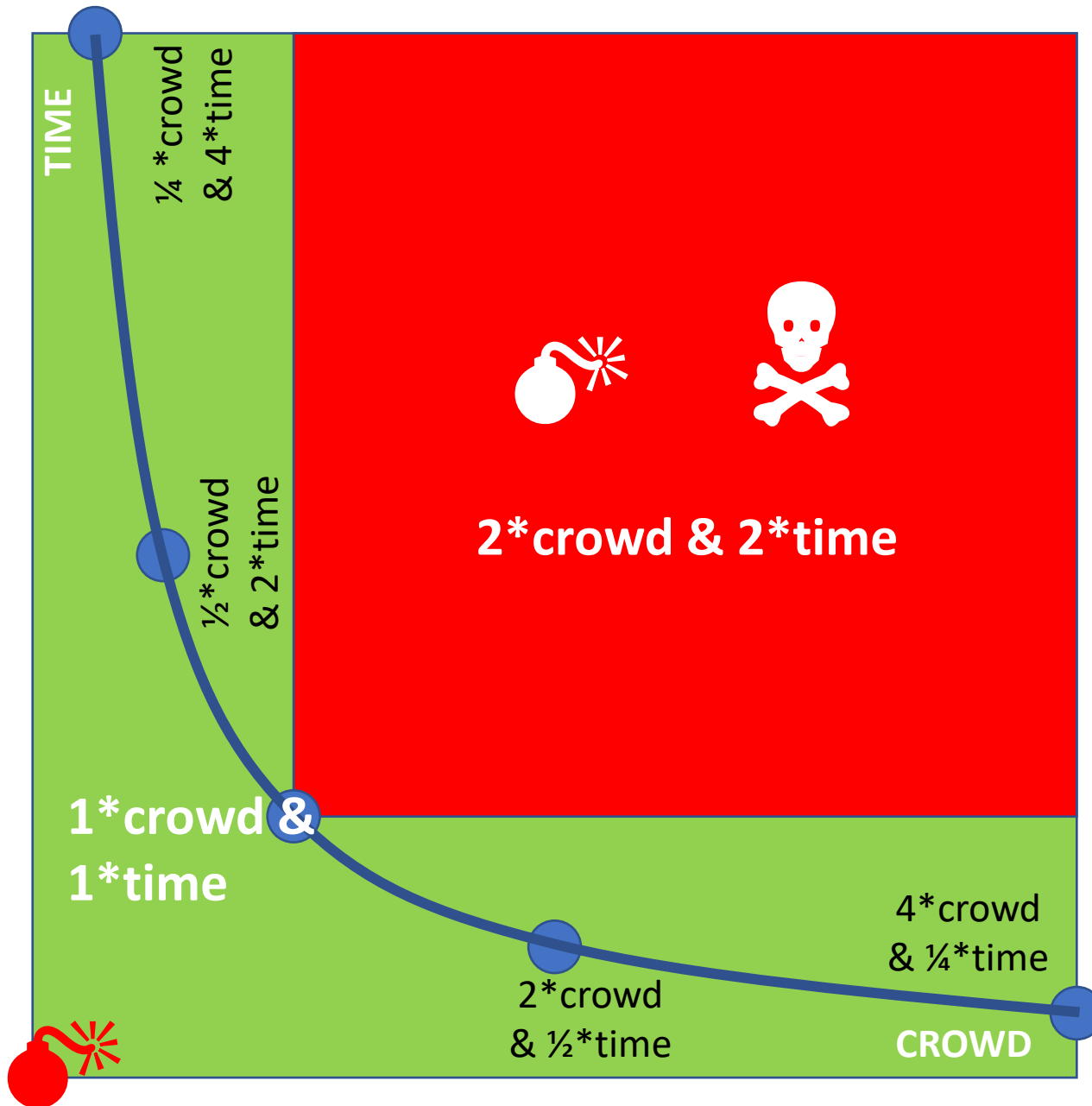


5-doubling all 3 factors  
**d**irt & **c**rowd & **t**ime  
creates a 125-doubling



so 1 infects more than  
300 persons





$R=d*c*t$  stays constant  
by **Balancing Factors**

With standard hygiene, soap, NO alcohol  
fix the **Person\*Hours Area**:

- 1\*time & 1\*crowd , or
- 1/2\*time & 2\*crowd , or
- 1/4\*time & 4\*crowd , or
- 2\*time & 1/2\*crowd , or
- 4\*time & 1/4\*crowd

But not **2\*time & 2\*crowd**  
and not **0\*time & 0\*crowd**

***Do not exceed or lockdown***

# A lockdown will prevent infection from terminating at herd immunity (60%)

Meeting by chance, 1 infected may infect 1,



so  $R = 1$  and counting down

$$R = 5/5 = 100\% = 1$$



$$R = 4/5 = 80\% = 0.8$$



$$R = 3/5 = 60\% = 0.6$$



$$R = 2/5 = 40\% = 0.4$$
 Herd immunity

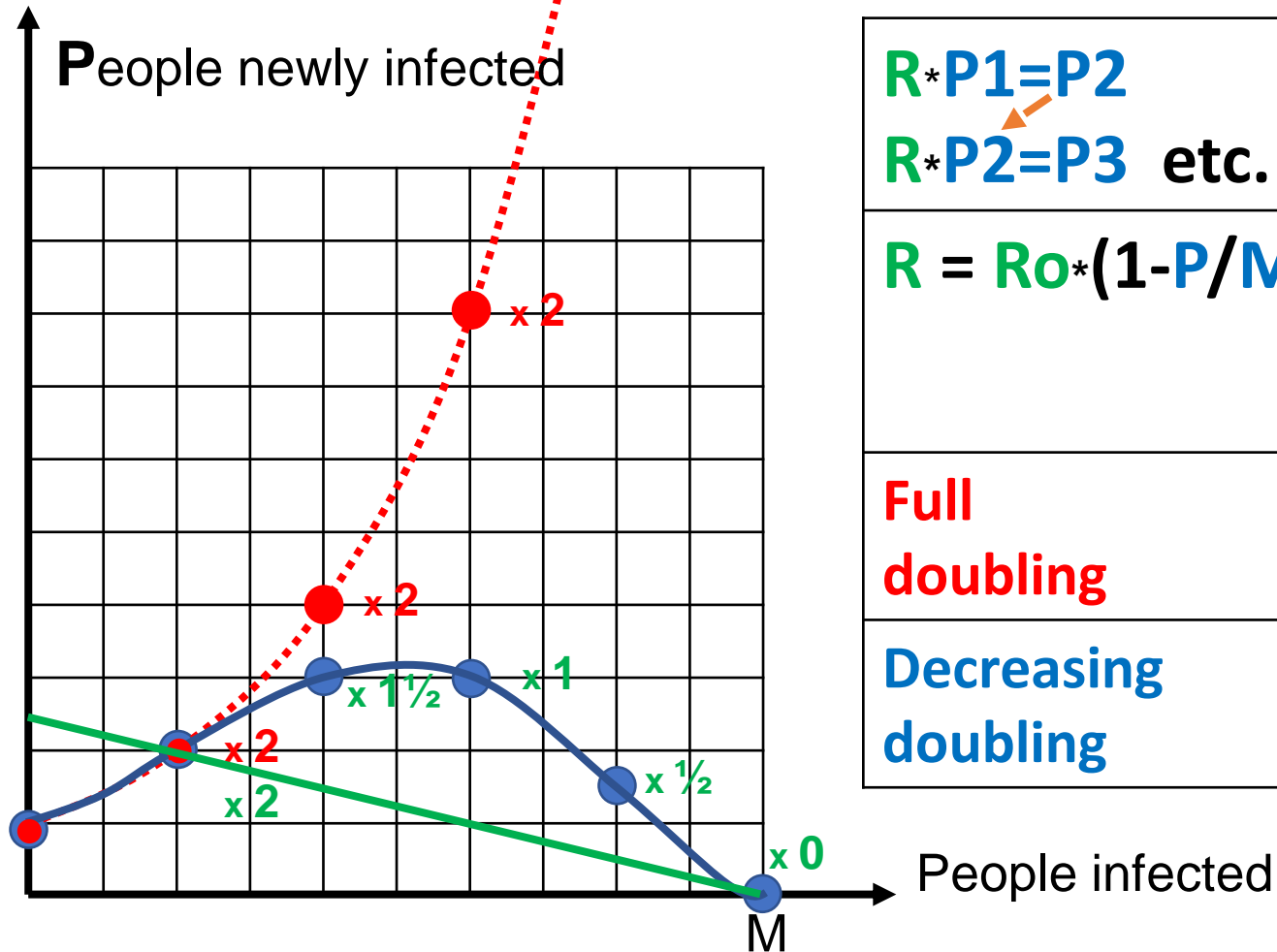


$$R = 1/5 = 20\% = 0.2$$



$$R = 0/5 = 0\% = 0$$

Infection Formula II  $R \cdot P_1 = P_2$  says that infection terminates when reaching herd immunity



$R \cdot P_1 = P_2$ $R \cdot P_2 = P_3$ etc.	The infected $P$ grows by a doubling-factor $R$ (exponentially)
$R = R_0 \cdot (1 - P/M)$	$R$ decreases from 2.5 to 0 at herd immunity $M$ when 60% is infected
<b>Full doubling</b>	With constant reproduction $R$
<b>Decreasing doubling</b>	With constantly decreasing reproduction $R$

Solving the change equation give the details

Periodic:  $\Delta P = r * P$  ( $r = R-1$ )      Instant:  $P' = r * P$

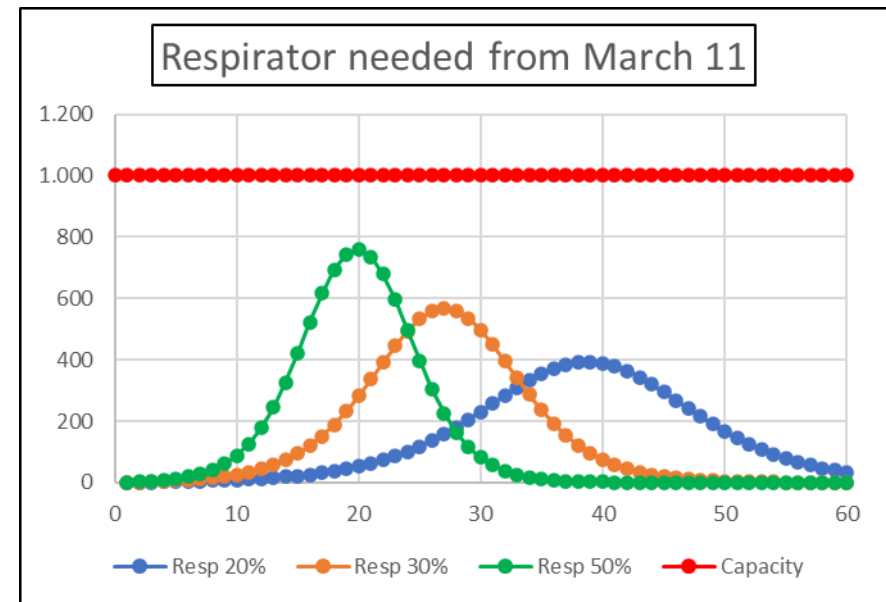
SPREADSHEET

Day	Change	Total
26	10,6%	* 2.989 =
<i>New</i>		<i>+316</i>
27	9,6%	* 3.305 =
<i>New</i>		<i>+317</i>
28	8,6%	* 3.622 =
<i>New</i>		<i>+311</i>
29	7,6%	* 3.933 =
<i>New</i>		<i>+300</i>

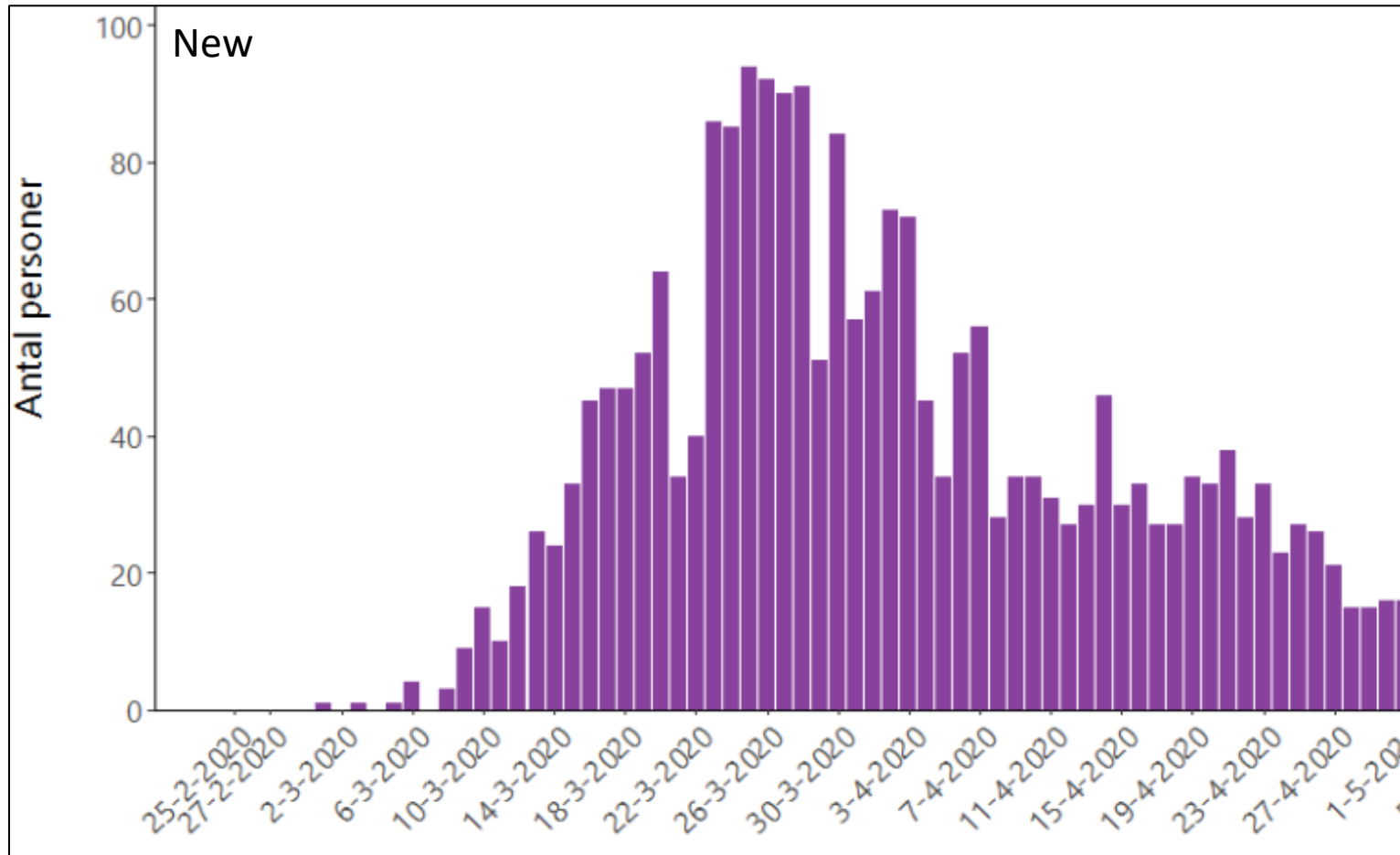
Respirators needed: Sum of News / 5 ≈ 420

CALCULUS

$P' = r * P$	$P' = r * (1 - P/M) * P$
$P = P_0 * e^{r * t}$	$\frac{1}{P} = \frac{1}{P_0 * e^{r * t}} + \frac{1}{M}$



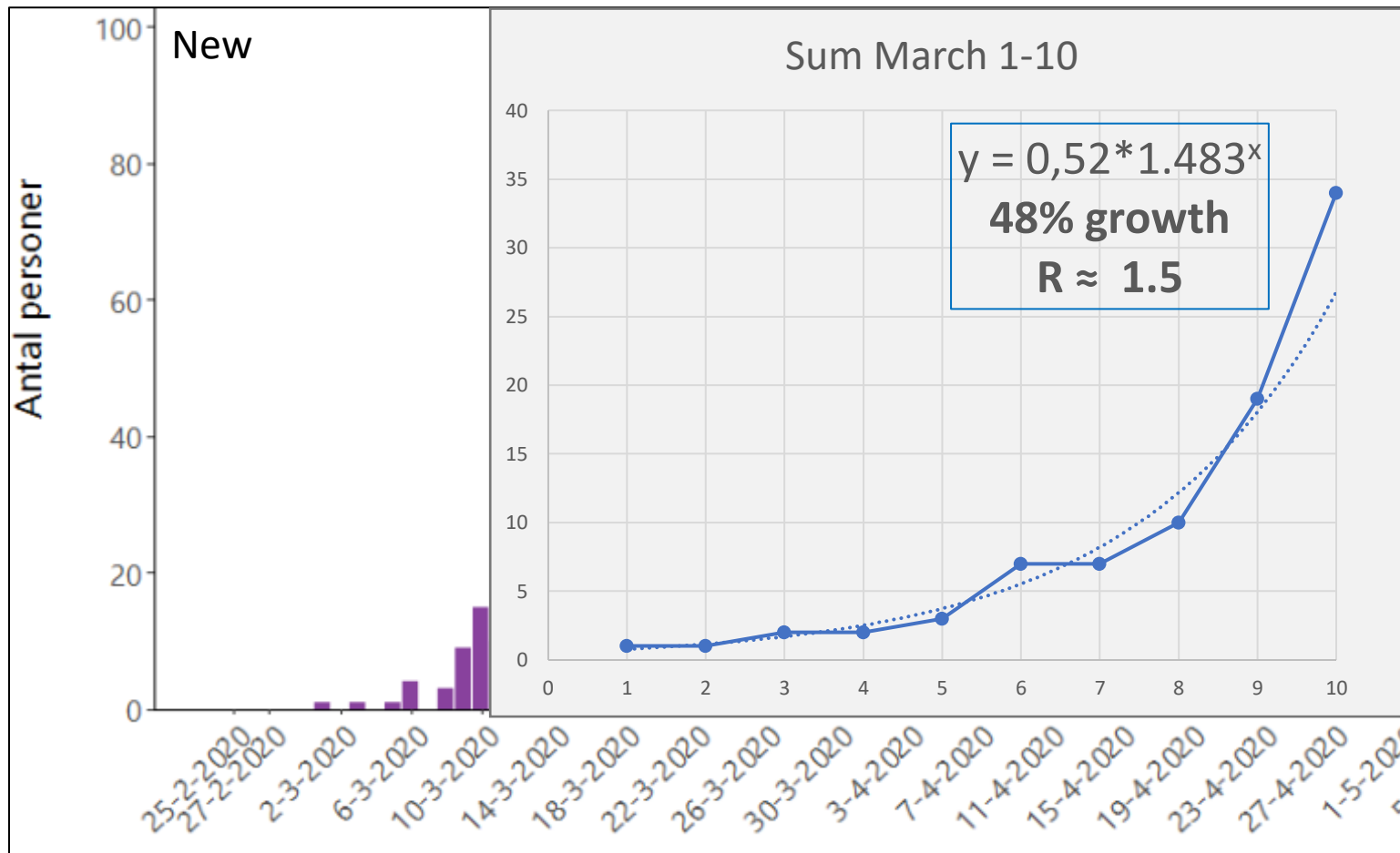
Reliable hospitalized data give valid outputs  
 Unreliable infection data do not



Data from the Danish Health Authority

March	New	Sum
1	1	1
2	0	1
3	1	2
4	0	2
5	1	3
6	4	7
7	0	7
8	3	10
9	9	19
10	15	34
11	10	44
12	18	62
13	25	87
14	23	110
15	32	142
16	44	186
17	46	232
18	45	277
19	50	327
20	62	389
21	32	421
22	39	460
23	80	540
24	74	614
25	89	703
26	81	784

# March 1-10: a 48% average daily growth

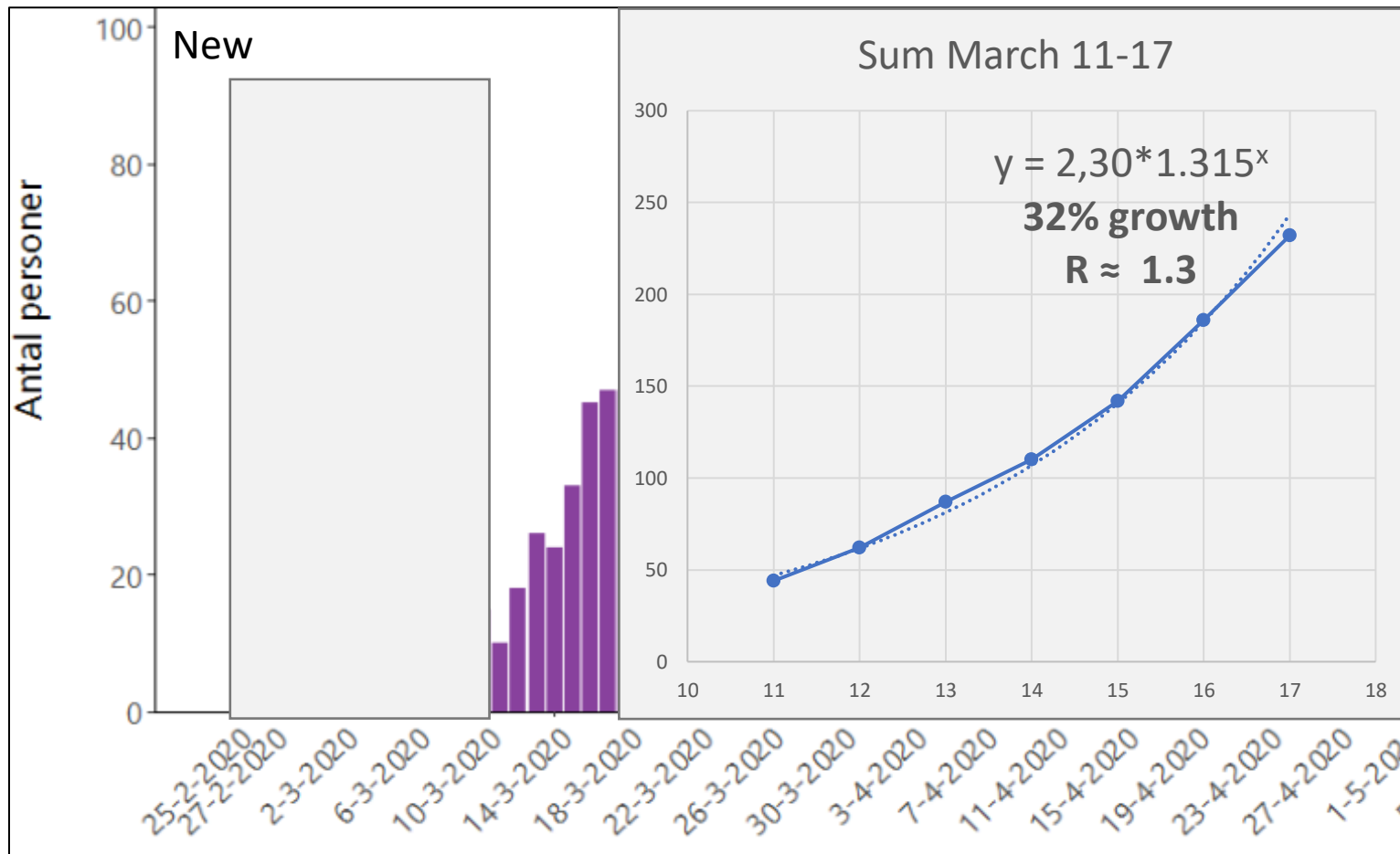


March	New	Sum
1	1	1
2	0	1
3	1	2
4	0	2
5	1	3
6	4	7
7	0	7
8	3	10
9	9	19
10	15	34



March	New	Sum
-------	-----	-----

# March 11-17: a 32% average daily growth

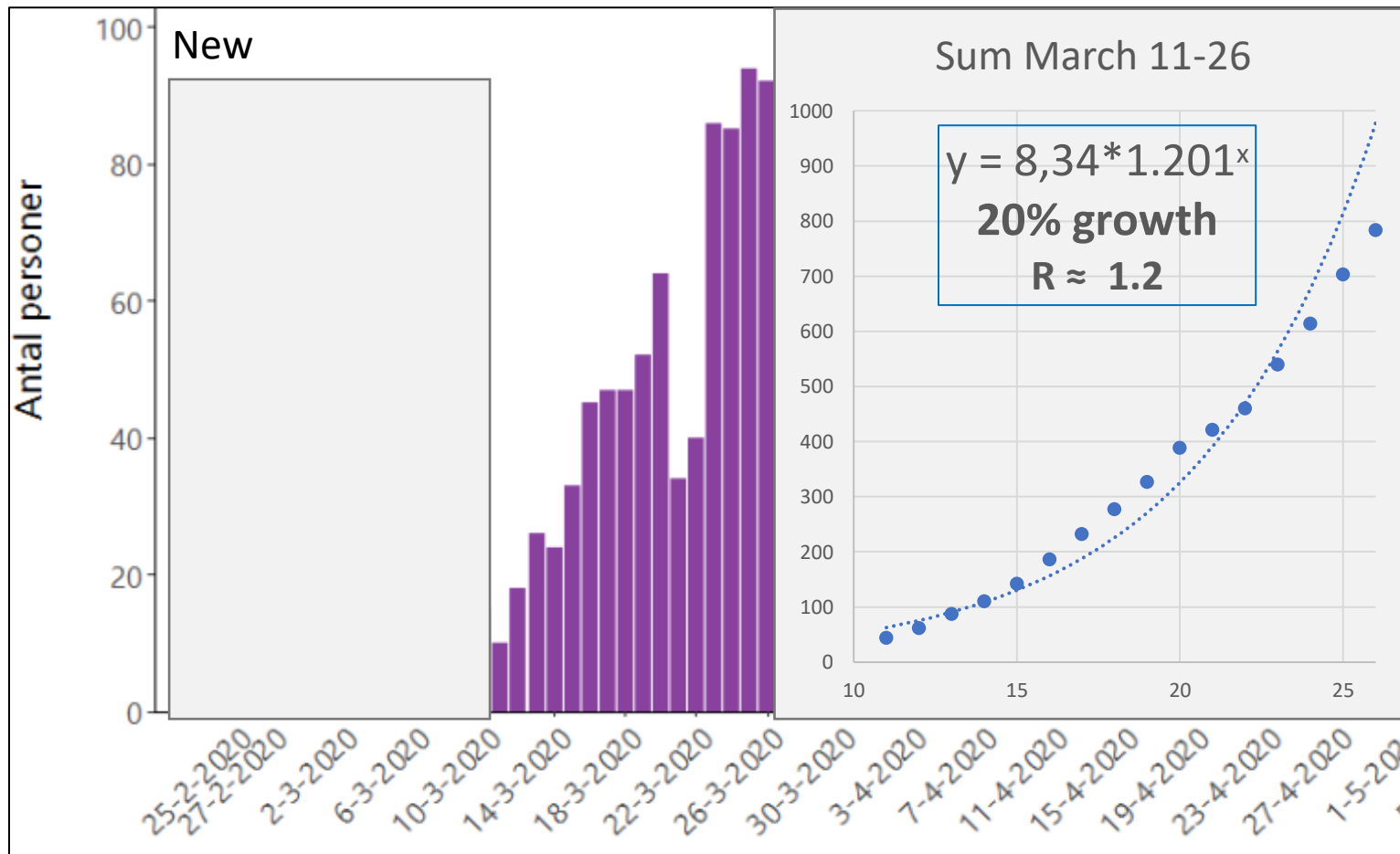


11	10	44
12	18	62
13	25	87
14	23	110
15	32	142
16	44	186
17	46	232



March	New	Sum
-------	-----	-----

# March 11-26: a 20% average daily growth



<b>11</b>	10	<b>44</b>
<b>12</b>	18	<b>62</b>
<b>13</b>	25	<b>87</b>
<b>14</b>	23	<b>110</b>
<b>15</b>	32	<b>142</b>
<b>16</b>	44	<b>186</b>
<b>17</b>	46	<b>232</b>
<b>18</b>	45	<b>277</b>
<b>19</b>	50	<b>327</b>
<b>20</b>	62	<b>389</b>
<b>21</b>	32	<b>421</b>
<b>22</b>	39	<b>460</b>
<b>23</b>	80	<b>540</b>
<b>24</b>	74	<b>614</b>
<b>25</b>	89	<b>703</b>
<b>26</b>	81	<b>784</b>



1 bed per 1650 infect. (*Horse Show March 4-8*)  
 1 resp. per 5 beds (*Danish Health Authorities*)

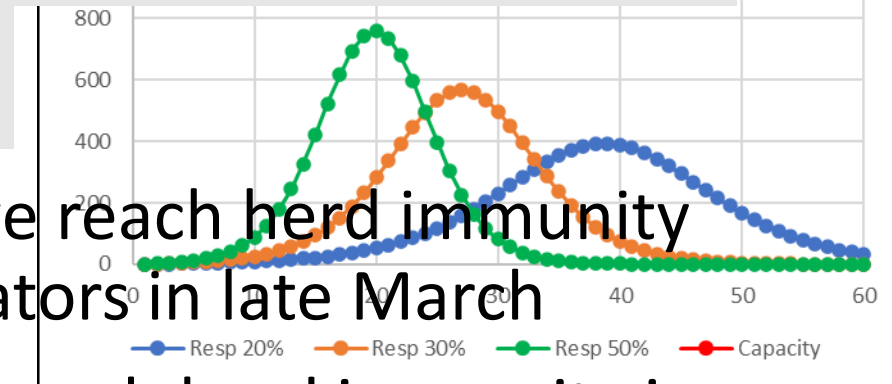
	Infected?	No Yes	Sick?	No Yes	Hospitalized?	No Yes	Respirator?	No Yes
😊	😊							
?	☹️		😊					
50000 persons at the 5 days Herning Horse Show multi- doubled all 3 factors, probably infecting all, but only 30 were hospitalized: $50000/30 \approx 1650$ . Estimate: 5 mio → 3000 beds → 600 respirators < 1000 resp. So no crisis.	?		☹️		😊			
			☹️	?	☹️		😊	
							☹️	
							☹️	

Occurring in Italy 2 moths after arriving from China: few need to be hospitalized

1650/1

5/1

March 11, with reliable hospitalization data, the 2 infection formulas say:



- A doubling-factor 1.5 created in after-skiing: we reach herd immunity in mid April needing a maximum of 800 respirators in late March
- A doubling-factor 1.2 created in Denmark: we reach herd immunity in mid May needing a 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
- To avoid Italian after-skiing numbers, we maintain normal hygiene, soap but NO alcohol, and we balance meetings in space and time by keeping the person\*hour area below 100 for the next three months

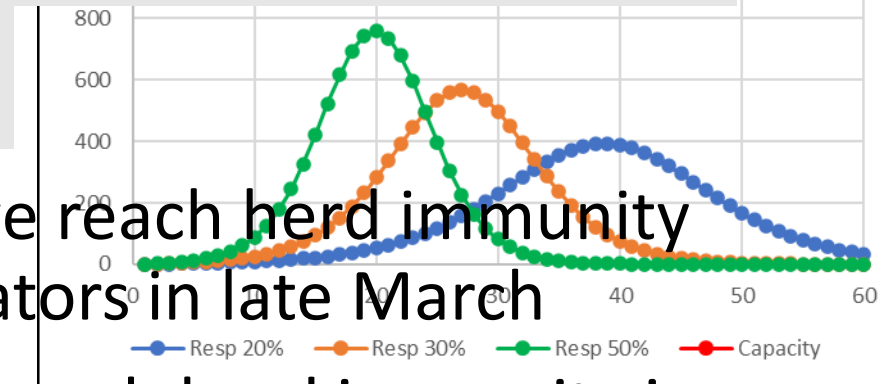
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But, the government used unreliable data: the infected, instead of the hospitalized

< **TV AVISEN Ekstra: Pressemøde i Statsministeriet om corona-situationen**



**G: 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 2.3 doubled from 19 to 44.*

**G: We must avoid the Italian situation.**

*But the Italian situation was created by after-skiing with extreme doubling of dirt, crowding and time, which could never be the case in Denmark, having no skiing season.*



[https://www.dr.dk/drtv/se/tv-avisen-ekstra-pressemuede-i-statsministeriet-om-corona situationen](https://www.dr.dk/drtv/se/tv-avisen-ekstra-pressemuede-i-statsministeriet-om-corona-situationen) 175613

20:33

35:58 MINDST 442 DANSKE ER SMITTEDE, MEN TALLET STIGER LØBENDE. TIRSDAG VAR 262 SMITTEDE 03:03:56

▶ **PRESSEMØDE OM CORONAVIRUS**

[=] ✖

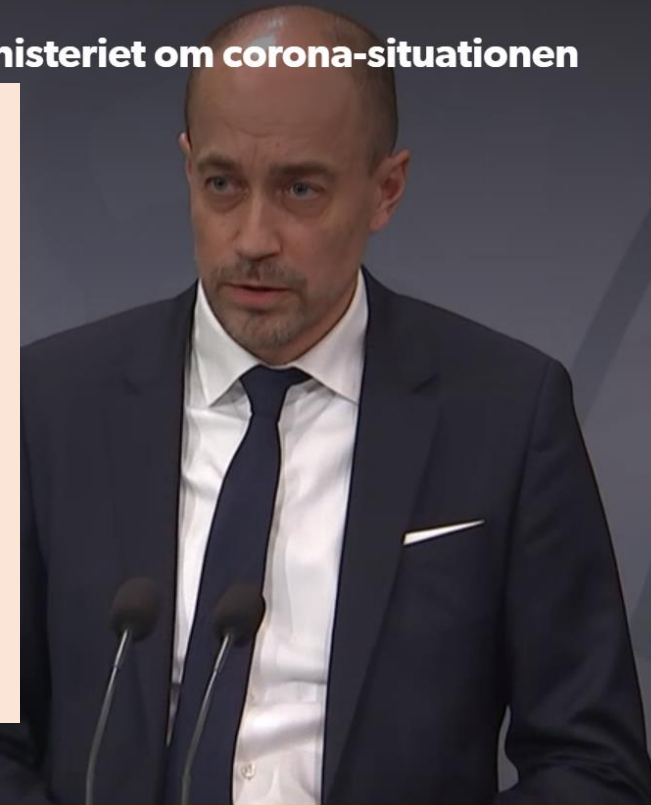
And also used unreliable data to compare Denmark with the rest of Europe

< **TV AVISEN Ekstra: Pressemøde i Statsministeriet om corona-situationen**

**G: 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.**



**BREAKING**

20:49

51:43 **ALLE OFFENTLIGE UDDANNELSESINSTITUTIONER LUKKER FORELØBIGT**

03:03:56

**DANMARK LUKKER NED**

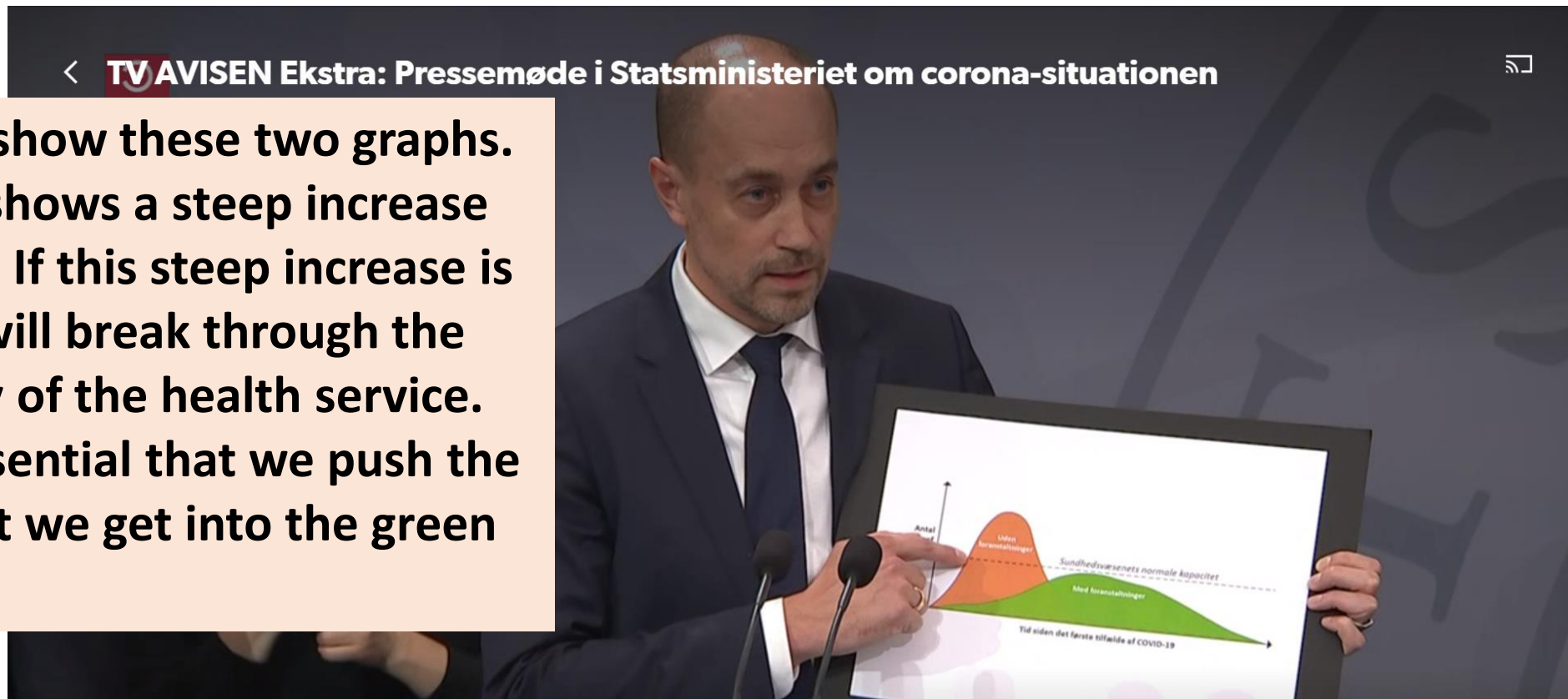
[=] ✖



Then two curves were presented, a green, and a red breaking through the capacity-line

< **TV AVISEN Ekstra: Pressemøde i Statsministeriet om corona-situationen**

**G: 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.**



53:41 **MINDST 514 DANSKERE ER SMITTEDE. MEN TALLET STIGER LØBENDE. TIRSDAG VAR 262 SMITTEDE**

20:51

03:03:56

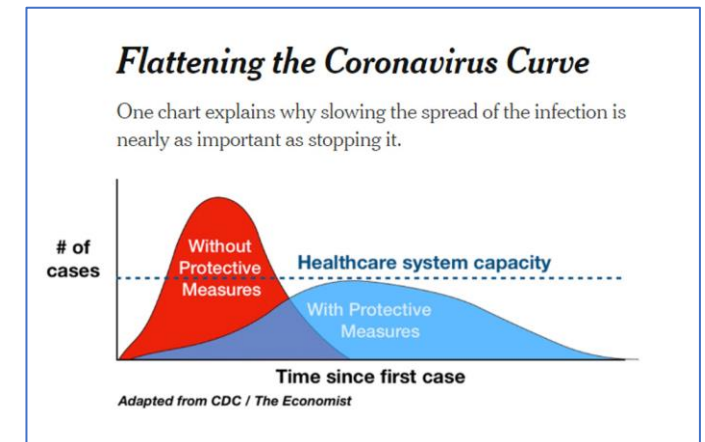
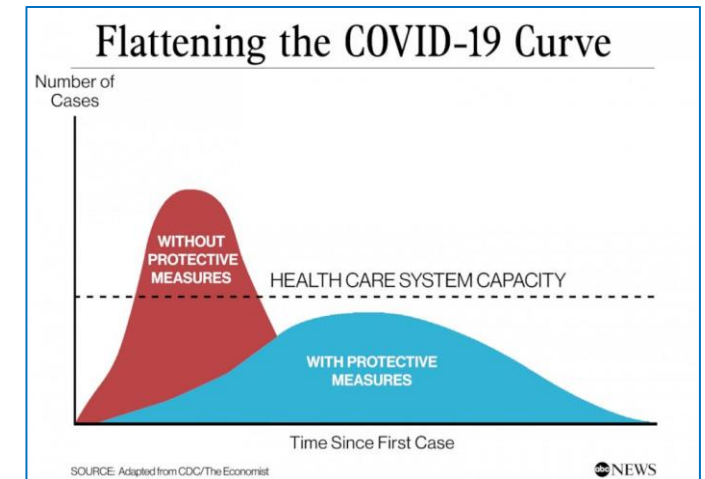
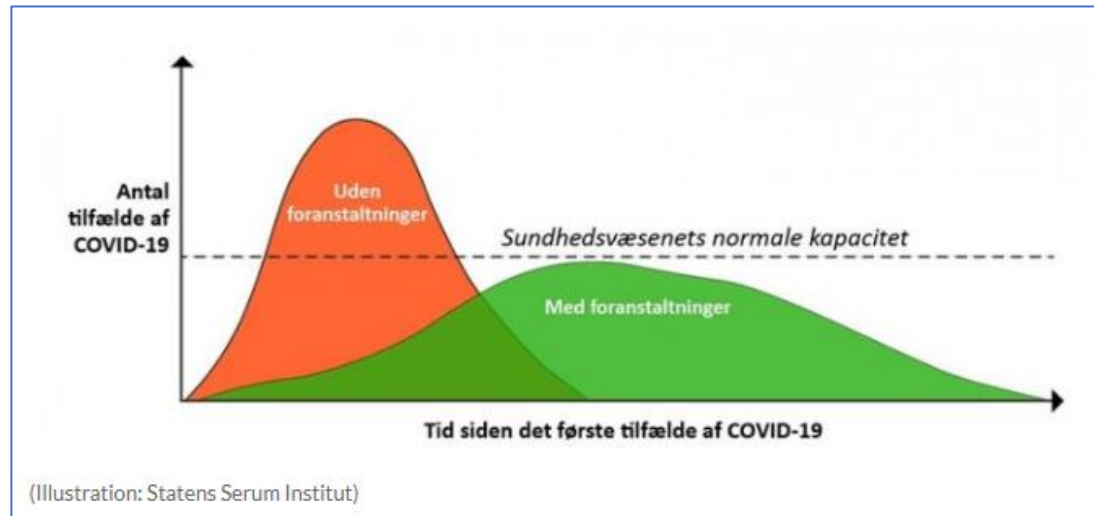
▶ **DANMARK LUKKER NED**

[=] ✖

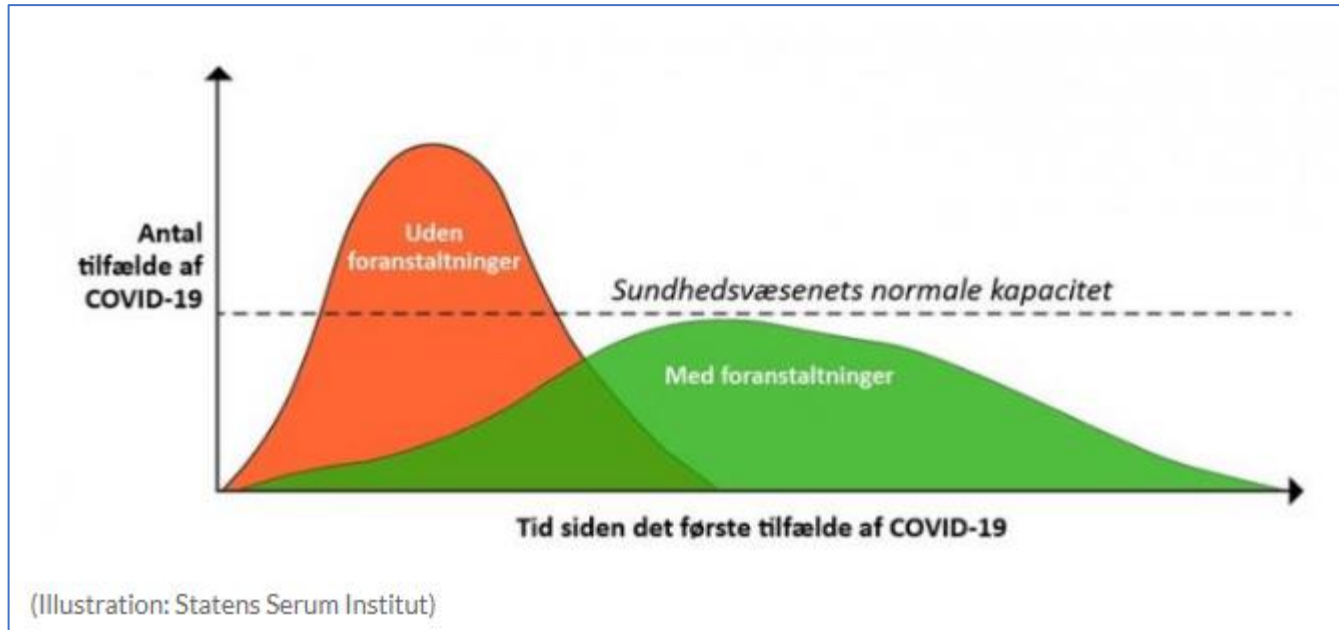


# The Danish curves are apparently known world-wide

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

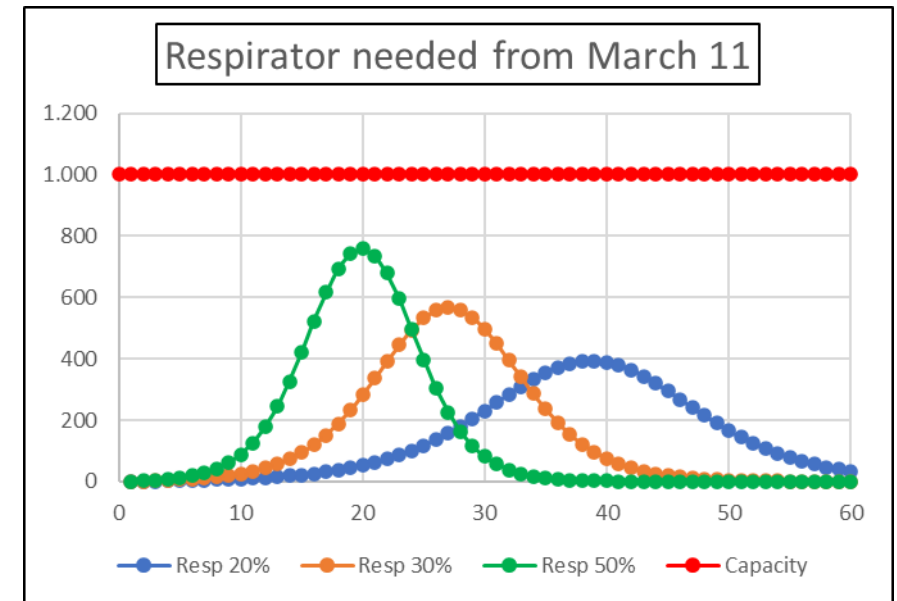


# Government: Avoid the red curve crossing the capacity line!



*But, the graph has no numbers on the axes.  
It does not specify if 'incidents' mean reliable hospitalization  
or unreliable infection data.*

*It places the capacity line too low - because, the 2 infection formulas say: the capacity line is above all curves*



# The Danish Health Authority

< TV AVISEN Ekstra: Pressemøde i Statsministeriet om corona-situationen

**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 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

**It's a very, very explosive increase we're 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?*



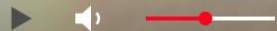
# The opposition leader in parliament, May 14

< Partilederdebat: Hvordan får vi Danmark tilbage?

**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?*

30:32



01:29:43



# The authority advice 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, no mention of the 3-factor infection formula  $R = d \cdot c \cdot t$ , and*

- *The dirt-factor  $d$  is mentioned in 2, 4, and 5*
- *The crowd-factor  $c$  is mentioned in 1 and 3 (but 1 implies 3?)*
- *The time-factor  $t$  is NOT mentioned at all, nor is balancing*



# Conclusion

The Danish government based its 2020 lockdown on

- unreliable data from infected, not on reliable data from hospitalized
- neglecting the 2 infection formulas saying: balance, do not lockdown
- scaring the population with the Italian after-ski virus-greenhouses
- scaring the parliament to pass a state of emergency
- silencing time as an infection factor

There never was a Danish corona crisis, but a corona scandal creating a financial crisis costing at least 30.000.000.000 euro in 2020.

# A fictitious press conference



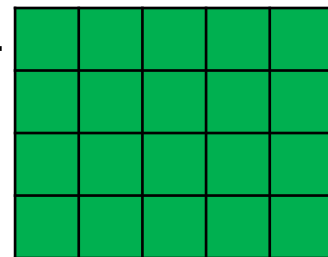
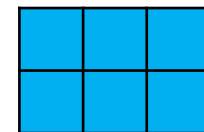
Welcome, please pose your questions

- 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

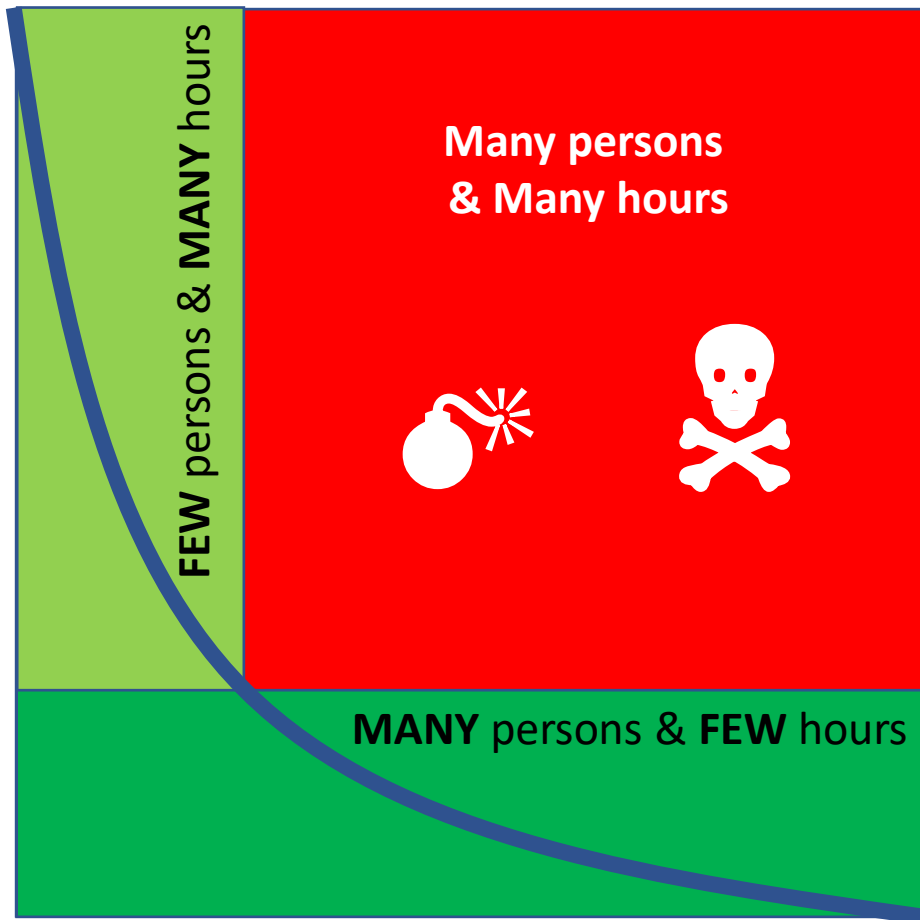
- In a globalized world, a nation cannot afford that its politicians, its population, and its education is unenlightened
- Democracy only works with politics based on the parties' own knowledge tanks; and with dosage: 40+30+20+10 % for liberals, socialists, socioliberals, and independents not voting
- 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
- Teaching number-language, its grammar, mathematics, must submit to its fact- and fiction-calculations using flexible bundle-numbers to raise area questions as:  $T = 2 \mathbf{3s} + 4 \mathbf{5s} = ?$



# 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\*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\*Hours Area



## Avoid

- 💣 Many persons & hours (HotHotSpots)
- 💣 HotHotHotSpots in MegaCrowds

## Accept

- Few persons & many hours (SoftHotSpots)
- Many persons & few hours (HotSoftSpots)

**Simply Balance**

*do not exceed, do not lockdown*

Transfer the 'Serum Institute' to a university

# Where to read about the two infection formulas? Where to try out the two infection formulas?

## MATHeCADEMY.net

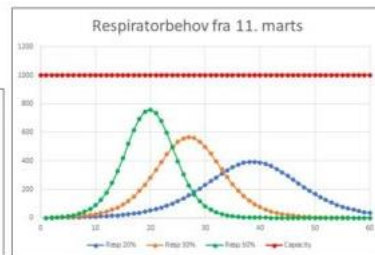
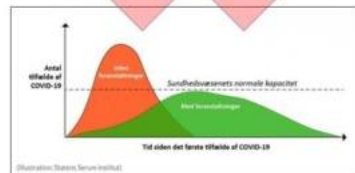
Let Kids teach teachers teach MatheMatics as ManyMath, a natural science about MANY using flexible bundle-numbers to count, recount and double-count before adding on-top and next-to; the CATS approach: Count & Add in Time & Space

HOME INTRO COUNT & ADD TIME & SPACE EARLY CHILDHOOD MATH DISLIKE VARIOUS DK VIDEOS

### DATA

SMITTEDE (utroværdige)

INDLAGTE (troværdige)



Corona Infection Model

### RECENT POSTS

- [Geometry from Below](#)
- [Corona Infection Model](#)
- [Learn Math through Kid's Tile-Math](#)
- [Calculus in grade 1- what else](#)
- [Invitation to co-authorship](#)
- [Math Ed and Research 2019](#)
- [Math with Playing Cards](#)
- [MADIF12 2020](#)
- [Math Modeling & Models](#)
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- [New Curricula for Prim, Middle & High](#)
- [Educate Educators 2019](#)
- [Math Textbooks Conf 2019](#)
- [Finger Counting Math](#)
- [Fresh start precalculus](#)
- [What is Math - and Why Learn it](#)

Go to the website:  
[mathecademy.net/  
corona-infection-  
model/](https://mathecademy.net/corona-infection-model/)

$$R = d * c * t$$

Few persons  
\* Many hours

Many persons  
\* Few hours



# The 2 INFECTION Formulas

## How to **END**

Don't  
**EXCEDE** or **LOCKDOWN**  
Simply  
**BALANCE** meetings in space and time  
fix & squeeze  
the Person\*Hours Area

$$R * P1 = P2$$

