

- Covid-19 reached peak in NY
- Actions and data we need to decide on when and how to reopen
 - Reopening in stages

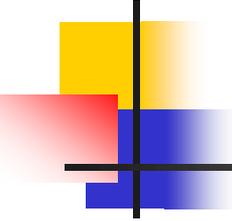
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(DRAFT, NOT FOR QUOTATION)

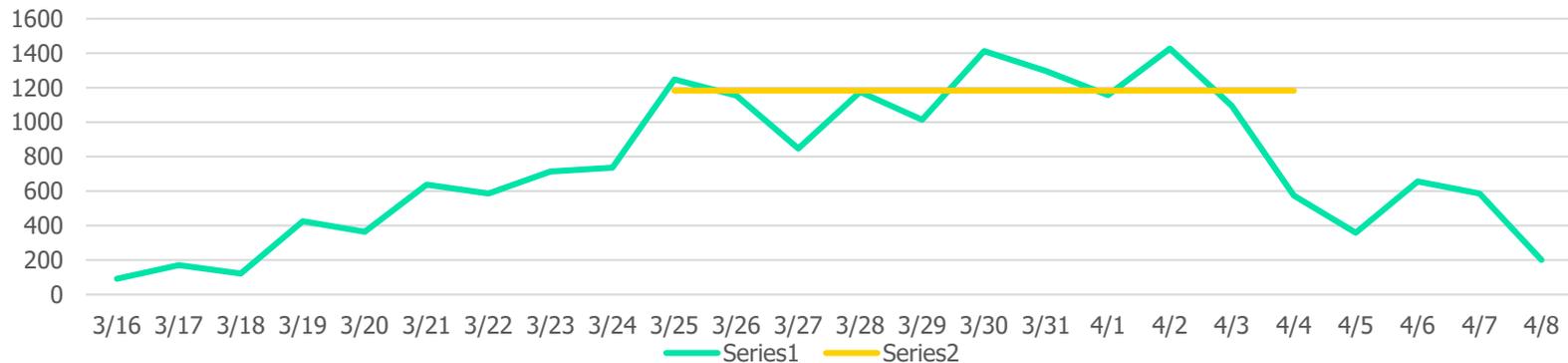


New York State imposed “stay home” rules on 3/22

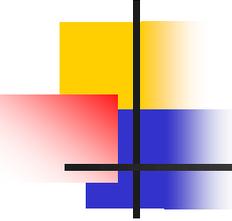
- Impact on infections of “stay home” and social distancing rules occurs with a time lag
- Crucial variable to focus on is “new hospitalizations”
 - ICU entries and deaths are a fixed percentage of “new hospitalizations” and occur with some delay

New York has reached a peak of new hospitalizations on 4/2!

New hospitalized cases in NY up to 4/8/2020
and average of 3/25 to 4/3

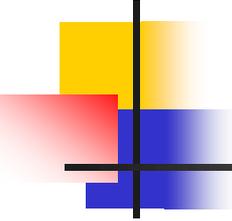


- Fast increase in cases from 3/16 to 3/25 is followed by a plateau (yellow line) to 4/2, and significant decrease from 4/3 onwards
- Strong evidence that the “stay home” and social distancing policy is working!



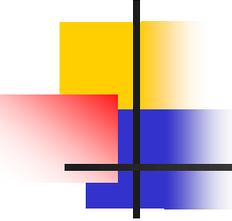
How about deaths and ICU admissions?

- Deaths and ICU admissions are lagging by a week or more to new hospitalizations
- Since deaths are more or less a constant percentage of hospitalizations
 - deaths in NY will decline in a week at the latest



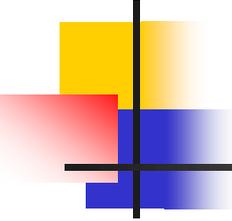
When should the US reopen?

- Lockdown and social distancing has reduced the number of infections, hospitalizations, and deaths
- But closing almost all businesses has huge economic cost
 - Some estimate cost of a two month closure to be 10% of GDP or more
- On the other hand, reopening can increase infections
- The crucial question is to what extent will reopening increase infections?
 - We do not yet have the data to answer this question, but there is a straightforward way to gather the necessary data



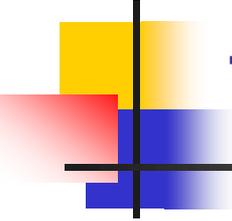
What data do we need to decide when to reopen?

- To make the decision of when to reopen, we need three numbers:
- **(1) The percentage of people currently infected in the population**
- **(2) The percentage of people in the population that have passed the disease (possibly in mild form) and are immune from infection**
- **(3) the rate of infection under lockdown vs when open**
- Currently, in most places in the US, tests are done only on those who come to the hospital with symptoms or had direct contact with an infected person
 - About 10%-25% tested are positive
 - But this information is not useful for the decision on when to reopen because it does not reflect the percentage of infected in the whole population
 - Some estimate that there are 9 infected people with mild or no symptoms for each one that is tested positive at a hospital



How do we find the percentage infected and percentage of immune in the population?

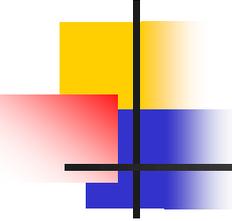
- (1) We do a randomized test on the population to find out what percentage are currently infected
- This type of test exists and only about one thousand are needed for good statistics
 - If we think there are significant geographical differences, we can deploy them locally
 - For example, we can test 1,000 in each borough of NYC, similarly in LI, Westchester and further upstate, total 8,000 tests
- (2) We also do a randomized test on the population to find out what percentage have antibodies and therefore have passed the disease possibly with minimal symptoms
 - This test is almost ready with various versions in different stages of regulatory approval
 - The same numbers of tests will be needed.



What we do once we have the two percentages?

- The number of new infections in an uncontrolled epidemic is proportional to the percentage of infected multiplied with the percentage of uninfected who are not immune
- Calling x = percentage of infected, y = percentage of immune, we have:
- New infections: $\Delta x = ax(1 - x - y)$
 - where a is the infection rate
- The higher the recovered percentage y , the fewer infections we will have
 - Some people call this “herd immunity”

What happens when we lift the lockdown?



- In a lockdown, the number of contacts is lower:

$$kx(1 - x - y), k < 1$$

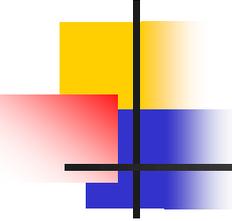
- and the number of new infections under lockdown is also lower:

$$\Delta x = akx(1 - x - y), k < 1$$

- When we lift the lockdown, cases will increase by:

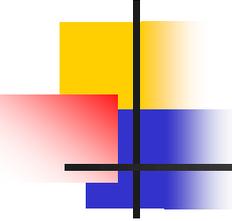
$$Z = a(1 - k)(1 - x - y)$$

- To estimate Z , we need the rate of infection when open "a" and when in lockdown "ka"



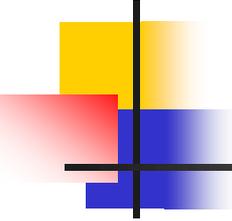
How do we find the rate of infection when open "a" and when in lockdown "ka"?

- We look at the number of cases in NY before it reached a plateau, when NY was open
 - This analysis gives us the rate of infection when open "a"
- We then look at the number of cases in NY after the plateau, when NY was in lockdown
 - This analysis gives us the rate of infection when in lockdown "ka"



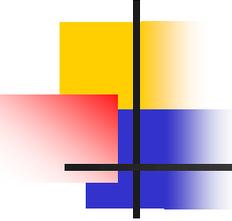
Is there a smarter strategy than lifting the lockdown for all? Yes!

- Do widespread antibodies testing, find out whether each person has antibodies
- Give them a certificate on their phone
- Immediately let all who have antibodies go to work, travel, etc.
 - If anecdotal evidence is correct, 25% of people in NY already had the disease, so this would immediately allow 25% of the population to work



As time passes, continue testing, bring more people with antibodies out to work

- keep the lockdown for seniors and those with medical conditions



Conclusions

- NY cases have peaked, deaths to peak very soon
- Outlined what information we need to make the decision of when to reopen and how to collect this info
- Need widespread antibodies testing and allowing those with antibodies to go out and work
- Reopening will be in stages