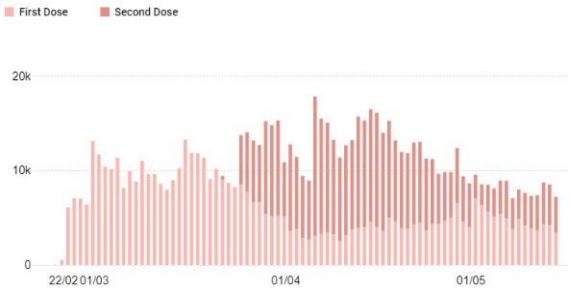
Monitoring vaccination enthusiasm

Dah Ming Chiu, 19 May 2021

It is almost three months since Hong Kong started its Covid-19 vaccination program (22 February 2021), and we have all seen the plots of vaccination numbers published by the government [1]. In this blog, I discuss how to look at these plots, better present data, and make some observations. I will then reflect on the vaccination hesitancy situation and make some comments.

Number of first, second and total shots

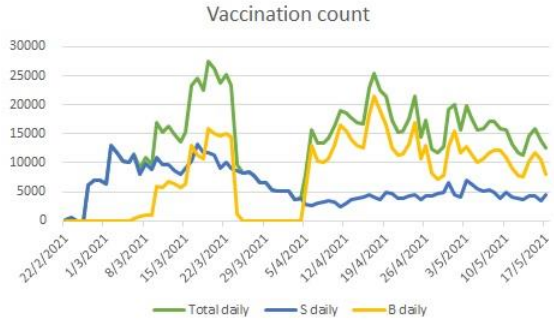
The government publishes the daily number of people getting their first and second shots for each type of vaccine. In Hong Kong, we have two vaccines available: Sinovac and Biontech, denoted S and B respectively. The number of first and second shots given are often plotted together, to get a full picture, e.g. as in the shown in the right plot for Sinovac. However, the public are more interested to learn the progress of the vaccination program (how many people are going for it) rather than the number of shots (number of first plus second) made each day. If we instead plot only the daily number of people getting the first shots, together with a plot for the number of second shots shifted by 28 days (suggested delay between the two shots for Sinovac) as shown, it is easy to make two observations: (i) almost all people take their first shot (of S) also take the second shot on time, and (ii) how the daily number of people (taking S) varies over time. Actually, a noticeable number of people did delay taking their second shot beyond 28 days during the first two weeks of March, perhaps affected by reports of isolated cases of deaths, or other work-related reasons; but these delayers caught up in the following weeks. The total number of people taking their second shot by 16 May amounts to 97.9% of the number of people who have taken their first shot 28 days earlier. The case for Biontech is similar, so I am not showing it here to avoid repetition.



Sinovac versus Biontech

If we plot the daily count of (first shot of) Sinovac versus Biontech, it is clear that Biontech is chosen by more people. As of 16 May, the totals for S and B are 509,868 and 670,611 respectively, though S was available for roughly 30% more days (B started 2 week later and had a 2-week interruption due to packaging defects). But from the plot, we can make more observations. First, the preference for S was

stronger initially; the choice for B overtook S around mid-March, when the group of people eligible for vaccination was expanded to include those between 30-60 years old. Although it can be argued that the preference for S versus B may be affected by news (and misinformation) on side-effects, a more deciding reason may be due to B being more preferred by the younger age group. Another observation is that the daily number for B fluctuates more compared to S. A closer examination shows that the higher numbers tend to occur on weekends. A plausible explanation is that more of the B takers are working (rather than retired), and they are likely to choose weekend days due to work related reasons.

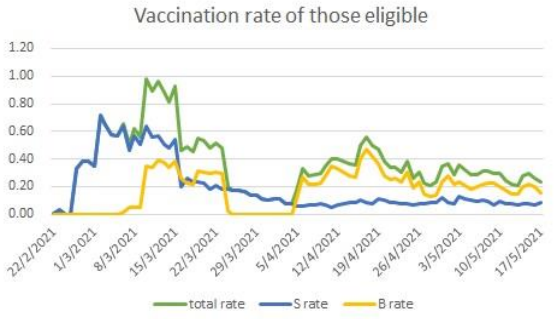


Gauging enthusiasm towards vaccination

In the above figure, we also plot the daily number of people taking their first shot (green). Is this a good indicator of public enthusiasm towards vaccination? Since the number of eligible people for each day is different, I think a more accurate gauge is given by the daily total normalized by the number of people eligible to choose to get vaccinated for each day. To do that, we first compute the size of three groups: (a) those aged above 60, (b) those aged between 30 and 60, and (c) those aged between 16 and 30. We can get these numbers from the Census statistics the government published in April 2021 [2]. The published numbers are for slightly different groups: age 0-14, 15-34, 35-64 and 65+ (given in white boxes). We can estimate the group numbers we need by assuming even distribution of age in each group given by the census, as shown (in shaded color). The eligible group before 16 March was (a) plus some front line workers; between 16 March and 23 April was (a) plus (b) plus some additional front line workers; and all (a), (b) and (c) are eligible after 23 April. I have not further adjusted group sizes by the number of front line workers in each period, which can be done for a more detailed study.

age	number	percent
0-14	869.3	11.6
0-16	1038.3	13.9
15-34	1690.2	22.6
16-30	1183.1	15.8
35-64	3550.5	47.5
30-60	3415.1	45.6
65up	1371.8	18.3
60up	1845.2	24.7
total	7481.8	100.0

The number of eligible people for a given day is the size of the eligible group for that day minus the number of people already vaccinated thus far, which can be easily done. After normalization, the resulting plot is shown here. Focus on the green curve. It is defined as the total number of people taking their first vaccine out of the number of people eligible to make that choice, for each day. The unit of the y-axis is the number of vaccinated per 100 eligible. This can be treated as the "gauge" or thermal meter, measuring the enthusiasm of the people eligible to get vaccination. The blue and yellow curves are simply the contribution of S and B respectively to the total. Based



on the booking records, although some popular vaccination locations were fully booked, there were always some locations not fully booked, so we know these enthusiasm readings are never constrained by vaccination capacity. Based on our estimate, the capacity for S and B should each be greater than 1/100 per day, with sufficient extra capacity to take care of those going for the second shot.

From this plot, it can be observed that the enthusiasm drops more over time than the drop in the earlier vaccination count plot. Since more young people become eligible as time go on, it is tempting to conclude that enthusiasm drops monotonically with age. But since the eligible groups also include front-line workers, and combination of age groups, this assertion may not be strictly true. Actually the government web site [1] also publishes the number of people vaccinated in each age group, and the contribution to the total vaccination count by each age group, as shown in column 2 and 3. It is easy to further calculate the vaccination rate of each age group (up to 17 May) as shown in the fourth column of the small table. This shows the vaccination rate is not monotonically decreasing with age; up to the time of writing, the vaccination rate (number of people taken their first shot divided by total number of people in that age group) is highest for the middle (30-59) group. While the 60+ group may need vaccination more, they are apparently more hesitant.

age group	#vaccinated	contribution %	rate %
16-29	122959	10.4	10.4
30-59	799379	67.8	23.4
60 up	258105	21.8	14.0

Reflections

I wrote a blog 2 months ago, trying to predict the success of Hong Kong's vaccination program [3]. It was a bit speculative, based on talking to people in my small circle of friends. The observation is that the relatively good efforts of our government in controlling the Covid-19 transmissions, and being transparent in providing information to public, has made the vaccination effort more challenging, though we have secured more than enough vaccines.

Gauging public opinion is important for public policy in this challenging time. In this blog I try to make some observations based on publically available vaccination numbers thus far. More thorough study of public opinion is typically done through carefully designed surveys, e.g. [4], though this kind of study will involve lots of man power and time. A previous survey [5] review various methods used in these studies.

Besides these discussions and studies of public sentiments, I now offer some person opinions. First, I have already taken the Covid-19 vaccine, and I am among the first 4% of Hong Kong people to do so – a little bit of hesitation as I had been eligible from day one.

Regarding how to come to a logical decision, I have the following suggestion. The vaccines available to us, S or B, have been applied to hundreds of millions of people already. This amounts to a much larger scale of experimentation than the initial trials. If there are significantly higher risks for people with certain type of conditions, this type of knowledge is already known. So a key step in our decision process should be to determine if we belong to the group of people with extra risks, especially for

older folks and people with certain medical conditions that need doctor's help and medication. Unless you are very knowledgeable yourself, it would be best to do this by consulting a doctor who knows your conditions (e.g. a specialist who treated you before). You may need to do an up-to-date blood test or other checkup if the doctor is not familiar with your conditions. If the doctor does not think you belong to the group with higher risks, he may say "I do not think there is any contraindication…", which simply means that you do not need to take special consideration compared to any random healthy person. Else, the doctor may point out the contraindications you need to consider. This level of advice is already the best you can expect, considering the complexity of the matter. For people with higher risks, they do need to determine next the tradeoff between taking the vaccines versus not, which is not easy. They can try to get the doctor's advice if possible, and may make a decision on the conservative side. But the percentage of people in this category should be small, maybe a few percent in the 60+ group and much fewer in the younger age group. For the vast majority of the "no-contraindication" people, I do not feel it is necessary to do a risk-benefit analysis as I described in [3] (my analysis was more trying to model the prevailing group behavior), because the risk level we are talking about is so small and random. You can then make a decision to get vaccinated, since there are many clear personal and public benefits, unless you have other personal beliefs against vaccination. For example, I have friends who would shy away from even taking western medicine because their belief in longer term effects and alternative approaches to health care. I do respect people will have different beliefs and make different choices on that basis.

References

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