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The Coming Big Rationing

Polio had ravaged the world for over five decades. A terrible disease that caused paralysis and death, primarily in children, was feared by all. In 1955, after decades of research, a safe vaccine produced in Jonas Salk's laboratory at the University of Pittsburgh had arrived. The US government sped it into production, but that rush was to prove costly. Manufacture the vaccine imperfectly, and it can turn from a suppressor into a spreader. For polio, one bad process let to 200 cases and 11 deaths.[i] With those tragic lessons learned, production was slowed. The result of this was that the vaccine would not be widely available. It would take years for vaccinations to be at a level that the disease was effectively suppressed. Even then, cases still emerged through community transmission until 1979.

Experience and basic economics tell us that when a vaccine for the novel coronavirus, we will not instantly end the pandemic. Instead, there will be a period of time — many months or a year — that there will be a shortage of doses. The efforts documented in *Economics in the Age of COVID-19* to use Advanced Market Commitments understand this and want to build capacity quickly so that doses are readily available and life can return to normal quickly. But, right now, it is unclear how successful those efforts will be. Thus, it is natural to ask: **what will happen if there are persistent shortages of the vaccine both within countries and worldwide?**

Let's dismiss one option right away: the use of markets to allocate scarce doses. This might seem strange for an economist to say, but while markets do an excellent job of allocating scarce resources in normal circumstances when it comes to products with high health consequences, market processes come up short in terms of driving outcomes that a generally thought of as socially equitable. Put simply, if your goal was to allocated vaccine doses to those you wanted them the most — in terms of what other purchases they would be willing to give up in order to obtain the vaccine sooner — markets can do a good job. If there are a limited number of doses that are allocated to the highest bidders, then people will bid up to their monetary value for a vaccine — including both health benefits and the ability to move around safely afterwards. However, those values may be distorted if there are many people who simply do not have the money to be competitive in that bidding — that is, they are wealth constrained. In this situation, it is unlikely that vaccines will be allocated to those who actually value them the most and, instead, will find their way to people who just have money to spare. Thus, this is a situation where the economist's presumption that markets can deal with scarcity in an efficient manner cannot be presumed.[ii] Fortunately, as we will see, most governments have understood this when it comes to health resources and have become accustomed to finding non-market ways of rationing scarce things.

Making a List

When it comes to vaccines, governments have anticipated that there may be shortages and have generated plans and protocols to allocate doses should they be scarce. The primary way this is done is to make a list of various groups of people who should receive priority and then, depending on availability, supply those higher up on that list first. This is something that is done by governments in other areas: for instance, many governments give priorities to work visas to people with desirable skills or who already have family members who have immigrated.

To take an example with respect to vaccines, the US CDC has five tiers of recipients for a typical flu vaccine.[iii] There are two dimensions of priority: occupational groups (reflecting the earlier economic criteria) and high-risk populations (reflecting the at-risk criteria for harm from the virus). In tier 1 are the occupational groups who are already priorities for non-isolation during the containment phase today, including healthcare and security services. Tier 2 continues to include essential workers, especially with regard to infrastructure services, while the remainder of those are part of tier 3. Using the at-risk criteria, tier 1 includes pregnant women and babies; tier 2 expands that to high-risk children and people who work with young children; tier 3 includes the rest of children; tier 4 is high-risk adults, and the rest is part of tier 5. Notice that there are no occupational groups in tiers 4 and 5.

For COVID-19, the occupational group ordering makes sense and is in line with current practices regarding who are asked to work freely as being part of essential services. However, the at-risk ordering does not reflect what is currently understood about COVID-19, that is, that the older you are, the more at-risk you are. The CDC guidelines take age into account when considering children. However, for COVID-19, it appears that the younger you are, the less at-risk you are (although children may be vectors for disease spread). In other words, the guidelines for influenza, in general, do not reflect the realities of risk with respect to COVID-19. Thus, one would expect those to change. This will also generate a decision regarding healthy adults of working age and those who have retired. The latter are far more at-risk, while for the former, there are economic criteria that will favour them. My point is to highlight this potential issue and suggest that there will be no easy decision in this regard.

What the criteria also do not reflect in any sense of network theory. For instance, prison populations are potentially risky areas where infections can break out. If testing was not available, there are arguments that they should receive priority for a vaccine.

Lotteries

Even looking beyond the use of guidelines to assign priority, there will be a large pool of people for whom there is a vaccine shortage but no identifiable way of prioritizing them. In that case, a lottery will likely be used (as it was in the movie Contagion).

A lottery randomly assigns available doses to people. In contrast to a market where it is likely that people who have both high valuations and high wealth will be vaccinated first, everyone has an equal chance for priority in a lottery. In particular, some people who have high valuations for the vaccine but low wealth will receive an allocation. Thus, a lottery reduces the wealth bias compared to markets but potentially at the cost of assigning vaccines to people who do not value them as urgently.

The idea of a lottery is to treat everyone equally. However, it may be that, as was already discussed in the ‘list-making’ approach to rationing, that there are classes of people that you might like to give priority for and to have lotteries within those classes. For instance, you may decide that you want health care workers to receive allocations first and then others to receive their allocations via a lottery. In other cases, you might just want to prioritize health care workers but also give other people a potential allocation in a lottery — for instance, you may decide that you do not want all of the scarce doses being used by health care workers and to leave some for others.

The choices of how to create those buckets for priority is not something an economist has special knowledge. It involves considerations of public health

management, health risk and also ethical considerations. However, economists can point out that the details of how you operate such a system can matter.

For instance, suppose that you had 100 doses of a vaccine in a town. You decide that health care workers should receive a priority, but there are 100 of these people, so you want a system that reserves some doses for them but not all of them. Suppose you reserve half of the doses for health care workers and the rest are assigned by lottery to anyone (including health care workers) who remain. Suppose, just to make our mathematics easier, that there are 100 others in the town. In this situation, health care workers will receive 50 doses and then of the remaining 50 doses, other people will receive 2/3 of them (as there are 100 other people among the 150 still to be vaccinated) and health care workers will receive 1/3. Thus, in the end, 67 health care workers receive doses.

Notice, however, that how you conduct this lottery matters. For instance, suppose you decided to reserve 50 doses for health care workers but only allocate them to those workers who miss out on the general lottery. In this case, half of those in the general lottery will likely be health care workers, and so 25 doses will be allocated to them in that stage. Then 50 more doses will be allocated afterwards bringing their total to 75. In other words, simply by reversing the stages — allocating generally before the specific reserve buckets — increases the number of health care workers who receive doses. The point here is that these two approaches look the same but have very different outcomes. Thus, depending on what you want to achieve in terms of actually prioritizing some group of people, you need to be sensitive to the procedure for allocation. Some economists have developed a procedure whereby people actually self-select into different priority categories as a way of signalling their own valuation in a quasi-market arrangement.[iv]

Nonetheless, regardless of whether lotteries are used, or a list is used, there will be a decision that needs to be made regarding categories of people that might be given special priority or treatment as vaccine doses are rationed.

Resale Markets

One possibility that arises when a lottery system is used to ration scarce resources is whether resale is allowed once someone has been assigned a dose in a lottery. While, at first blush, this might seem to undermine any desire to ensure that low wealth people receive doses sooner, it may be that everyone is better off by having this option.

Recall that one of the things that happen with a lottery is that some of those who have relatively low valuations for being vaccinated early receive do while some who have high valuations miss out. In this case, there is an amount of money that someone with both high wealth and a high valuation

is willing to part with to receive a dose that is greater than an amount that would persuade someone with a low valuation who won a lottery dose to part with theirs. As this latter trade is purely voluntary, it must be the case that both parties are better off for having the option. The end result is that more high valuation people actually receive doses independent of their wealth levels and so this outcome is potentially superior to both a pure market and a pure lottery (without resale) allocation.[v]

Non-monetary Signaling

Thus far, the methods of allocating scarce vaccine doses have relied upon whether someone has wealth (a market process) or whether someone is a member of a category that is deemed to require priority. Otherwise, the doses are allocated using some random mechanism. But what if the fact that there is likely to be vaccine scarcity is used to create incentives for better behaviour prior to that point in time. After all, we are asking people to engage in costly activities — most notably socially distancing or being tested with a risk of being required to isolate — that perhaps some priority in getting vaccines might compensate for.

The notion that people might take some non-monetary action to achieve priority when there is scarcity is not new. For instance, this happens when there is a new release of a limited supply product like Taylor Swift concert tickets or a new iPhone, and rather than prices rising, people are given the opportunity to queue up with the first people in line getting priority. While this can be a way of low wealth people signalling their high valuation, the queuing process itself is quite wasteful.[vi]

Some economists realized that there might be ways to create a different type of market with respect to a treatment similar to a vaccine called convalescent plasma (CCP) therapy.[vii] In this therapy, a patient who has recently recovered from COVID-19 donates blood to give to others in order to provide anti-bodies that can attack the novel coronavirus. This can serve as a treatment to help COVID-19 patients recover quickly. As CCP donations are scarce, it was suggested that if someone donates their plasma, then they might receive vouchers that they could assign to friends or family members to receive priority should they fall ill. In other words, the donor is ‘paid back’ for their donation. Another way this could work is that someone who is already ill could commit to donating their plasma should they recover. In this way, they could ‘pay it forward’ if they receive CCP therapy. These incentives could increase the supply of CCP donors.

One could imagine similar ways of ‘earning’ vouchers for vaccines. For one, CCP donors could earn vouchers not just for CCP therapy for family members but vaccines. More interestingly, if there were verifiable ways of measuring someone’s social distancing, then they too could receive priority for vaccine allocations.[viii] In other words, we could use the prospects of

being able to receive a vaccine earlier as a way of encouraging more socially desirable behaviour during the pandemic.

In the end, rationing is an important issue that will most likely arise. By planning early, we can make that process better, fairer and potentially operate in a way that encourages good behaviour. Regardless, what we should anticipate is a very fraught process that few will likely forget.

[i] Elena Conis, Michael McCoyd and Jessir Moravek, "What to Expect When a Coronavirus Vaccine Finally Arrives," *New York Times*, May 20, 2020 https://www.nytimes.com/2020/05/20/opinion/coronavirus-vaccine-polio.html

[ii] Weitzman, Martin L. "Is the price system or rationing more effective in getting a commodity to those who need it most?." *The Bell Journal of Economics* (1977): 517–524.

[iii]. https://www.cdc.gov/flu/pandemic-resources/pdf/2018-Influenza-Guidance.pdf.

[iv]. This example comes from work thinking about how to use different criteria to ration other items in short supply like ventilators. The idea is to allow people to self-select what criteria might be appropriate and then use methods developed in market design — specifically, matching markets — to determine the rationing order. See Parag Pathak, Tayfun Sonmez, M. Utku Unver, and M. Bumin Yenmez, "Triage Protocol Design for Ventilator Rationing in a Pandemic: A Proposal to Integrate Multiple Ethical Values through Reserves," mimeo., MIT, April 2020 (http://economics.mit.edu/files/19358). Another option is to broaden the ability of ventilators to be shared across regions; see Simon Loertscher and Leslie M. Marx, "A National Ventilator Exchange Could Address Critical Shortages," The Hill, March 27, 2020 (https://thehill.com/opinion/healthcare/489858-a-national-ventilator-exchange-could-address-critical-shortages).

[v] Che, Yeon-Koo, Ian Gale, and Jinwoo Kim. "Assigning resources to budget-constrained agents." *Review of Economic Studies* 80, no. 1 (2013): 73–107. In addition, this paper shows that giving a subsidy to low wealth individuals prior to having a market process for obtaining vaccines can achieve some of the same benefits as a lottery with resale.

[vi] A similar effect occurs when sports leagues give priority in drafts of new players to teams who have performed poorly.

[vii] Scott Kominers, Parag Pathak, Tayfun Sonmez and M. Utku Unver, "Paying it Backward and Forward: Expanding Access to Convalescent Plasma

Therapy Using Market Design," mimeo., Harvard University (May 2020) (http://economics.mit.edu/files/19708).

[viii] I should note that both of these options would likely work better if these vouchers could be resold.

Coronavirus Covid-19 Vaccines Rationing