Prosocial preferences and care for others: an experimental case study of COVID-19

Alexis Belianin, Alexander Filatov

Extended abstract

COVID-19 has been a major challenge for the humankind of the XXIst century. The unprecedented character of this challenge has lead to heterogeneous response in most societies (Avery e.a., 2020), resulting in polarized attitudes towards the methods to fight pandemic spread. The most acute debate has been between supporters of vaccination, viewed by most scientists and governments as the best method to fight pandemia like SARS-CoV-19, and anti-vaccers, a very heterogeneous group of people who oppose the idea of mass vaccination. Indeed, vaccination rates vary a lot both within large countries and across countries. For instance, in Russia, by December 2021, vaccination rate was just 40%, much below the crowd immunity level, which for SARS-CoV-19 is estimated to be at least 70%. The US are somewhat short of that level, but still it reaches 61%, whereas in China it is 81% (https://yandex.ru/covid19/stat#vaccinations). The need to raise crowd immunity calls for increasing voluntary vaccination rates, and for understanding the reasons that prevent people from doing so, as well as possible instruments to raise these rates.

In this project we study the spread and scale of this last attitude by means of online (crowdsourcing) experiments. We focus on the spillovers which vaccination of a single person bring to the society, and on the role of social concerns and considerations in individual decisions to vaccinate. Specifically, we aim at measuring the relative importance (weights) put on social welfare vs individual income in different cities of Russia. Participants in this experiment make a simple decision between potentially safer but currently hazardous option (‘get vaccinated’), or more dangerous in the long run, and socially irresponsible (‘go antivax’). This last decision not only exhibits one to the danger of becoming heavily ill by way of COVID, which depreciates one’s utility, but also invokes negative spillovers on the rest of the participants by relegating the time of reaching the state of collective immunity. Here we ignore several potential complications, such as 1) emergence of new stams of the SARS-CoV — an issue whose effect largely remain unexplored (Adam e.a., 2020, Farboodi e.a., 2020), 2) various natural (geographical distance/population density) and ad hoc (quarantine) policy interventions, and 3) specificites of the crowdsourcing platform participants, and (departure from) representativeness of this sample.

In the background model of the study, \( N \) people independently and simultaneously choose one of two actions: \( \text{In} \) (get vaccinated) or \( \text{Out} \) (do not do that). Default state of each individual is ‘healthy’, which yields fixed utility \( w \). An ill person may be lightly
ill which implies small cost \( x > 0 \), or large cost \( X > x > 0 \).

Vaccination (action In) by default brings small fixed cost \( y > 0 \) (disutility of vaccination), but it need not necessarily help: any vaccinated person is still exposed to positive, yet low chances of getting ill. Further, even those who are ill shall be lightly ill with relatively large probability \( p_{In}^L > 0.5 \), and heavily ill with relatively low probability \( p_{In}^H < 0.5 \). Not vaccinating (action Out), again by default, yields no immediate cost, but higher chances of becoming ill. Further, in light of the epidemic experience, we assume that an unvaccinated person who gets infected will become lightly ill with probability \( p_{Out}^L \), and heavily ill with complementary probability \( p_{Out}^H \), \( p_{Out}^L + p_{Out}^H = 1 \).

The final component of the model is the probability of getting ill, which depends on the epidemic situation, i.e. on the number of people who endogenously decided to vaccinate. We assume that the baseline exogenous probability of getting ill for fully unvaccinated society is \( Q < 1 \), for some people who will have strong immunity and will stay uninfected notwithstanding the level of reached collective immunity. The more people are getting vaccinated, the lower will be the share of infected people. Technically, this share can be defined as one minus the logistic distribution

\[
\pi = \frac{1}{1 + \exp(-mR_0R)} \tag{1}
\]

where \( m \) is the number of people who choose to go In (vaccinated) and \( R_0 \) is the basic reproduction rate, i.e. average number of people who are infected by way of a single infectious individual. This rate determines the share of infected people up to the collective immunity rate \( \pi_l \). This latter rate shows the number of immunized people in the population at which full reproduction rate \( R = (1 - \pi_l)R_0 \), does not exceed 1, meaning that each infected person contaminates less than one more. Accordingly, this collective immunity rate is

\[
\pi_l = 1 - \frac{1}{R_0} \tag{2}
\]

and once factual number of vaccinated people reaches that level, infection dies out except for a small exogenous group.

In sum, total utility of a vaccinated person as a function of the number of vaccinated people \( n \) is

\[
U^{In} = w - y - \pi(m)(Xp_{In}^L + xp_{Out}^L) \tag{3}
\]

and that of unvaccinated person,

\[
U^{Out} = w - \pi(m)(Xp_{Out}^L + xp_{Out}^L) \tag{4}
\]

where, as defined above, \( p_{Out}^L < p_{In}^L \) and \( p_{Out}^H > p_{In}^H \). These parameter values, together with cost \( y \), determine the decision tradeoff: if you go unvacced, you do not suffer losses \( y \), but you expose yourself to higher risk and impose negative externality on the society, and an empirical question is whether individuals in a particular group (region, city) would be willing to do so.

We use a particular parametrisation of the above task to transform the choice to vaccinate or not into a task of decision under endogenous risk whose scale depends on the
decisions of the local population, as all participants in the session by design represent
the same city. In the parameterised model, expected return (in utility terms (3) and (4)
of vaccinated people is larger when vaccination rates are low, because unvaccinated
people suffer higher risks. However, as vaccination rates grow up, unvaccinated ones
start benefitting from the emerging collective immunity, and get larger expected gains
at the interior tipping point. Another, kickoff point takes place at the level of collective
immunity, over which only sporadic infections are possible. As common for the
experimental interventions, experimental subjects are explained this logic, and make
their decisions to vaccinate or not knowing only their high and low expected utilities,
in case of vaccination or abstinence from it, but not the actual decisions made by other
subjects from the same pool.

Besides decisions to vaccinate across Russian regions, we are interested in reasons
to vaccinate — in particular, personal safety vs concern for social norms (Bicchieri,
2006). This latter reason may take at least two contrarian forms. Some people may
be willing to vaccinate no matter what because they want to contribute to collective
immunity. Other people may vaccinate only if sufficiently many fellow compatriotes
have done so — they follow the wisdom of the crowd. To estimate these two motives,
we complement the design with several other questions:

1) Strategy method evaluation of your decision to vaccinate. After experimental
subjects have made their decisions, they are asked the following set of questions:

   Suppose x% of citizens have decided to vaccinate. Would you decide to vaccinate
   for yourself if this x equals: 0, 15, 33, 50, 66, 75, 80, 90? For each of these 7 values,
   say yes or no.

   Several revealed patterns are possible along this scale. If for every level the answer
   is yes, vaccination is purely for personal safety and social safety, which cannot be
disentangled.

   If it increases with percentage — vaccination is done by way of social norm/pressure
   or norm obedience

   If it decreases with percentage, e.g. yes before 66% but not after that — it is driven
   by personal health concerns but not social concerns, for once sufficiently many other
   people do vaccinate to reach the crowd immunity, you prefer not to do so.

   Finally, if you do not vaccinate, you are just antivaccer.

2) Estimation of decision of other people:

   In response to previous question, what percentage of your fellow citizens would
   say yes if the share of people known to have decided to vaccinate is 0, 15, 33, 50, 66,
   75, 80, 90?

   This answer is incentivized by quadratic scoring rule: the closer is your estimate of
   this percent to the factual percent at each value, the higher is your reward. The reason
   why this is needed is not to get correct estimate but to obtain true evaluation (beliefs)
   about social norms: if you believe that people in your city change their preferences
   just in line with what you do, you are norm compliant person, but if you believe their
   preferences go at odd with what you do, you are norm violator. Share of these violators
   or compliants determines share of people willing to follow the injunctive norm.

---

1Lim and Zhang (2020) have recently implemented a similar experiment, but it has been done in the lab
and in repeated (within-subject) settings. These features make their study less ecologically valid and more
engaged to confounders stemming from repeated interactions.
3) We also want to solicit their expectations how many people they think have made the decision to vaccinate in their city, also in an incentivized way. This measure is needed for estimation of preferences in the structural model of preferences, in which we explicitly disentangle individual from collective motives for vaccination.

In such models, binary decision to vaccinate is modeled using Fechner specification (Moffatt, 2015) which assumes that overall utilities of both decisions to vaccinate, Y, and not, X, are perceived with random errors \( \epsilon_y \) and \( \epsilon_x \), respectively. Assuming additivity in utility and random terms, for the decision to vaccinate \( \delta = 1 \) we have

\[
Pr(\delta = 1) = Pr(u(Y) + \epsilon_y > u(X) + \epsilon_x)
\]  

(5)

where utility of vaccination and not is given by (3) and (4), respectively. In line with the literature, error terms \( \epsilon_y \) and \( \epsilon_x \) may be decomposed further into personal health preferences \( \nu_x \) and \( \nu_y \), social preferences \( \eta_x \) and \( \eta_y \), and pure noise \( \epsilon_x \) and \( \epsilon_y \), which may be assumed to be distributed normally with mean 0 and finite standard deviations.

Parameters of these utility functions are estimated by maximum likelihood with individual heterogeneity controlled by the regressors from individual questionnaire and belief about others’ decision (question 3 above). In that way, our paper (proviso made for data collection to be implemented in early 2022) shall shed light to policy relevant question and provide new knowledge to an important social dimension of the contemporary Russian society.

References


