

Keeping Doors Open: Another Reason to Be Skeptical of Fine-Based Vaccine Policies

Stefano Calboli and Vincenzo Fano

University of Urbino Carlo Bo

Abstract

An impressive effort by the scientific community has quickly made available SARS-CoV-2 vaccines, indispensable allies in the fight against COVID-19. Nevertheless, in liberal democracies, getting vaccinated is an individual choice and a not-negligible number of persons might turn out to be vaccine refusers. Behavioral and Cognitive (B&C) scientists have cast light on the key behavior drivers of the vaccine choice and suggested choice architectures to boost vaccine uptake. In this paper, we identify a somehow neglected psychological phenomenon, that it is reasonable to believe to hamper the vaccine uptake whereby fine-based coercive policies are in place. We begin by presenting the default effect, peer pressure, and the case versus base-rate effect as examples of psychological mechanisms relevant for vaccine choice. We show interventions on the choice environment conceived to manipulate such mechanisms (§1). Next, we focus on what B&C scientists have investigated as well the conditions under which monetary disincentives become ineffective policy measures. To do this, we discuss in detail the case of the crowding-out effect (§2). In section 3 we present the original point of the paper. We argue that imposing monetary disincentives on vaccine hesitant could turn out to be ineffective also because of the human tendency to keep options open, albeit doing so bears some cost. In section 4 we draw an experiment aimed to begin testing whether the tendency to keep options open factually plays a role within the context of the vaccine choice (§4). Finally, concerning the COVID-19 emergency, we defend an attitude of epistemic humility in translating behavioral and cognitive research results into policy suggestions (§5).

Keywords: Keeping doors open, Behavioral and cognitive sciences, Evidence-based policy, COVID-19 emergency, Vaccine hesitancy.

1. Introduction

The body of knowledge made available by behavioral and cognitive (henceforth B&C) scientists is of utter importance for those policy-makers whose aim is to promote vaccine uptake. This is because in modern liberal democracies institutions cannot physically constrain competent citizens to get vaccine jabs since it

would violate the principle by which a medical procedure can be undertaken only if consent is given. So, both being vaccinated and refusing vaccines are options on which citizens choose freely, even if coercive policies are in place. Indeed, when scholars discuss the implementation of mandatory vaccination policies in liberal democracies, they refer to policies whereby incentives and disincentives of different nature and severity are adopted and never to cases in which citizens are compelled by force. Coercive measures may correspond to financial incentives and disincentives. For instance, in 2015, the Australian government introduced the so-called “No Jab No Pay” policy, for which financial child support was withheld from parents of unvaccinated children when medical exemptions were excluded (Trentini et al. 2021).¹ Furthermore, coercive policies can be based on non-financial incentives and disincentives, as in the case of the so-called “Lorenzini Law”. In 2017, in response to alarmingly decreasing vaccine coverage rates and to several measles outbreaks (Siani 2019), the Italian government approved the 119/2017 law, aka the “Lorenzini Law”. The Lorenzini Law made ten vaccines mandatory for children through requiring proof of vaccination as a condition to see children admitted into preschools, day-care centers, or primary schools (Signorelli et al. 2018). In addition, the 119/2017 law included a further, and arguably more severe, coercive tool: administrative sanctions which were imposed on the families of unvaccinated children. However, it should be noted that these sanctions have been meted out very occasionally (Magnano 2019). Finally, over the course of the years, governments around the world have exploited an even more coercive policy instrument to curb the vaccine refusal rate, namely the incarceration of vaccine decliners (Gravagna et al. 2020).²

Inasmuch the vaccine uptake by adults is a free choice, although more or less effectively influenced by policies, the role that B&C sciences could play in shaping vaccine uptake is twofold. B&C sciences shed light on the decision processes underpinning the vaccine choice, revealing which psychological mechanisms ease and which hamper the vaccine uptake. B&C scientists also investigate which modifications of the choice environment influence such mechanisms. Variations of this sort are called “nudges”: roughly speaking modifications of the choice environment inhabited by decision-makers that do not imply any form of coercion, ban or significant economic incentives or disincentives (Thaler and Sunstein 2008).³ Concerning vaccines, B&C scientists have investigated several psychological mechanisms turned out to be relevant. Although it is beside the point of this article to exhaustively list them, we discuss some exam-

¹ It should be noted that the “No Jab No Pay” policy is slightly different from classic financial disincentives. Indeed, this Australian policy does not entail the incurring of a cost, instead preventing access to financial supports. The “No Jab No Pay” set a peculiar choice environment that could bring some advantages in view of the endowment effect (Kahneman et al. 1990).

² For overviews on compulsory vaccination policies around the world see also Walkinshaw 2011.

³ Although some scholars categorically reject the use of nudges, overall the use of such soft interventions is considered legitimate in liberal democracies, being regarded as a measure that preserves individual freedom. However, the conditions under which this is factually the case is debated, see Goodwin 2012, Grüne-Yanoff 2012 and Schmidt 2017.

ples to realize the role nudges play in enhancing vaccine policies.⁴ For instance, policy-makers can effectively take advantage of B&C research on both the strength of the default setting and the allure of social norms in order to promote vaccine uptake.

The default effect emerges when a specific option, within a certain set, is more likely to be chosen if it is the default option, viz. the option with which the chooser ends up if nothing is done. The default effect has been found out to be relevant in shaping human decisions in a wide range of contexts (Jachimowicz et al. 2019), for instance, decisions relevant to health (Halpern et al. 2007) such as enrolling in and adhering to a behavioral intervention program for patients with poorly controlled diabetes (Aysola et al. 2016) or donating organs (Johnson and Goldstein 2003). Making an appointment for vaccine uptake is no exception and the role of the default effect in driving the vaccine appointment has been repeatedly confirmed, although it is unclear if it translates into an increase of actual vaccine uptake (Chapman et al. 2010; Lehmann et al. 2016). Hence policy-makers can effectively take advantage of the default effect through opt-out strategies, for which vaccine appointments are set up by default. In this case, no action is required to make the appointment; instead it is cancelling an appointment that requires action.

The strength of social norms and peer pressure in favoring health-promoting behavior is another aspect underlined by B&C research. Our behaviors are conditioned on what we think other people believe it is right to do and on what we think they factually do. Indeed, knowing that the vast majority of our reference social network believe that a certain behavior is right and act accordingly spurs human beings to behave the same way (Abrams et al. 1990; Cialdini and Goldstein 2004; Bicchieri and Dimant 2019; Bicchieri 2016). The impact of social norms on human behaviors has been detected in a wide range of contexts. Some of them are unrelated to the choices relevant to curb the spread of the SARS-CoV-2 virus, as for instance the use of hotel towels (Goldstein et al. 2008) or the decisions taken facing economic games (Fischbacher et al. 2001); others that are deeply related to the current pandemic include wearing medical face masks and respecting physical distancing (Nakayachi et al. 2020; Bicchieri et al. 2020).⁵ Norm-nudging precisely leverages social norms and peer pressure. It indeed consists of implementing communication strategies that emphasize either that the vast majority of the reference network is behaving as policy-makers desire or, at least, that an increasing percentage of that network is opting for the target behavior (Sparkman and Walton 2017). A creative and effective kind of norm-nudging consists of providing items that allow citizens who have already chosen the target option to signal their choice to others (Bond et al. 2012; Hayes et al. 2015; Yoeli et al. 2013). Such items, for example the "I Got my COVID-19 Vaccine" Facebook profile frame, has led observers to infer the popularity of the target choice. In general, peer pressure has been confirmed to

⁴ For lists of research results from B&C sciences potentially relevant for the COVID-19 emergency, see Bavel et al. 2020, Wood and Schulman 2021, World Health Organization 2020, and finally Lunn et al. 2020.

⁵ We prefer "spatial distancing" over the widespread and misleading "social distancing". The COVID-19 emergency calls for limiting close physical human connections and not for restricting social interactions. Nowadays, we can reach out to other persons through many communication tools that do not entail physical contact (see Abel and McQueen 2020).

be one of the key behavior drivers of the vaccine choice (Bish et al. 2011; Xiao and Borah 2020), and it appears the same applies to the case of the SARS-CoV-2 vaccine uptake (Thaker 2020, Preprint). Hence, communication strategies promoting citizens' perception that their peers are vaccinated (Bruine de Bruin et al. 2019; Felletti 2020) as well strategies that take advantage of social signaling tools, are ways to effectively promote vaccine uptake. For the same reason, communicating social disapproval for a specific behavior increases the chance that an alternative conduct, endorsed by peers, will be preferred. By extension, evidence from research on social norms and peer pressure suggests that communication strategies that lead citizens to infer the popularity of the behavior that policy-makers want to counter are to be avoided (Schultz et al. 2007). In the case of vaccines, this translates into public information campaigns that emphasize the support for vaccine uptake instead of giving voice to the few, yet vocal, naysayers, to discredit them.

B&C research reveals, as well, the psychological mechanisms and the features of the choice environment that keep citizens away from vaccines. In this respect, B&C scientists strongly warn policy-makers about an especially powerful damper for vaccine uptake, namely the case versus base-rate effect, for which human beings irrationally overweight event-specific information and underweight base-rate statistics (Lynch and Ofir 1989). Such an effect seems to be related to the availability heuristic, where the likelihood assigned by human beings to an event heavily depends on the readiness with which instances of that event come to their mind (Tversky and Kahneman 1973). The case versus base-rate effect raises concerns regarding the vaccine uptake rate particularly because mass media, users of social networks and circles of acquaintances are constantly displaying and commenting on both rumors and anecdotes of adverse events that occurred soon after the uptake of SARS-CoV-2 vaccines. As a result, B&C scientists have recommended physicians counteract the detrimental effect of anecdotes about medical issues that emerged after the vaccine uptake by turning the allure of anecdotes to their advantage. For example, they suggest augmenting statistical explanations with anecdotes about the social benefits that result from vaccination uptake (Wood and Schulman 2021). Hence, B&C research enhances our understanding of the drivers of the behaviour relevant in fighting the spread of the SARS-CoV-2 virus. However, research results from B&C sciences not only pave the way toward the use of unconventional policy means such as nudges, but also throw light on the conditions that guarantee the effectiveness of traditional means such as, for instance, monetary disincentives. This is the focus of the following section.

2. Skepticism about Fining Vaccine Refusers

The standard economic theory of punishment makes clear predictions on how fines influence human behaviors. Let's consider the case in which two options are available, x and y , and one of them, say x , involves the payment of a fine. Let's refer initially to the choosers who would have maximized their utility with x if any fine was imposed. The theory predicts that the fine could have one of two possible consequences over them. On the one hand, the punishment could be substantial enough to determine a switch of the preferences and lead them to maximize utility choosing y instead. On the other hand, the punishment could not be enough substantial to generate a preferences switch, hence they still max-

imize their utility choosing x over y , despite the fine. The standard economic theory of punishment further predicts that a fine, regardless of its entity, does not make any difference in the decision processes of those who would have maximized their utility choosing y regardless of whether a punishment was imposed on x (Becker 1968). B&C scientists, however, point out that the effects of punishment over human behaviors are not so straightforward. There are indeed several cases in which imposing punishments over a certain behavior promotes it instead of discouraging it. In other words, there are conditions under which monetary punishments could easily backfire (Xiao 2018).

Getting inoculated is perceived as a prosocial choice by many, being a choice that preserves the health of others, especially in that it contributes to reaching herd immunity, which is a public good (Buttenheim and Asch 2013). Regarding the specific case of the SARS-CoV-2 vaccines, so far it is uncertain whether those who get the vaccine indirectly protect unvaccinated people or whether they keep spreading the virus to the unvaccinated, even if recent research offers grounds for optimism (Petter et al. 2021; Levine-Tiefenbrun et al. 2021; Mallapaty 2021. However, see also Subbaraman 2021). However, regardless of whether the SARS-CoV-2 vaccines either stop spread transmission of the virus altogether, or reduce spread significantly, or do not reduce it at all, receiving the SARS-CoV-2 vaccine is in any case rightly perceived as a prosocial choice. Firstly, getting the SARS-CoV-2 vaccine is a prosocial choice because the more persons who are vaccinated, the fewer opportunities the SARS-CoV-2 virus has to replicate itself, reducing the emergence of new potentially worrisome variants (McCormick et al. 2021). Secondly, the persons in need of treatment for the Coronavirus disease are causing an atypical and massive flow to hospitals, compromising the function of health systems around the world. The resources of health systems, in terms of medical personnel and beds, are limited. Getting the vaccine is, therefore, a prosocial choice in that it would reduce the number of such patients, preventing the draining of such currently highly demanded resources (Maringe et al. 2020).

The prosocial value of behaviours has been found to motivate human choices and vaccine uptake seems to be no exception (Betsch et al. 2013). Consequently, communication strategies aimed at emphasizing the social benefits that spring from vaccination prod citizens to get vaccinated (Quadri-Sheriff et al. 2012; Korn et al. 2018). Unfortunately, the intrinsic motivations to behave prosocially are typically crowded out when monetary disincentives are imposed on those who prefer the course of action which does not imply social benefits. Such a phenomenon is an instance of the so-called “motivation crowding-out effect”. It has been found to be relevant in several contexts and to be triggered even when monetary incentives reward behaviours motivated by “moral sentiments” (Fehr and Falk 2002; Gneezy et al. 2011; Ariely et al. 2009; Bowles 2008; Mellström and Johannesson 2008; Fehr and Gächter 2002; Fehr and Rockenbach 2003; Gneezy and Rustichini 2000; Calabuig et al. 2016). Vaccine uptake is not immune to the motivation crowding-out effect (Buttenheim and Asch 2013; Madrian 2014) and experts in the B&C sciences have already raised doubts about policies that either introduce monetary disincentives for SARS-CoV-2 vaccine decliners or monetary incentives to award vaccine takers (Santos Rutschman 2020; Schmelz 2020). Instead, they suggest adopting non-financial incentives and disincentives. For instance, Richard Thaler—one of the fathers of behavioral economics—has proposed introducing COVID-19 health passports

that would ensure the possibility of gaining access to public spaces as a perk for vaccine takers (Thaler 2021). This measure has already been taken into consideration by several governments (Phelan 2020) and already implemented in some cases (Ministry of Health of Israel, n.d.; European Parliament and European Council 2021).

It could be said that the concerns based on the detrimental motivation crowding-out effect are not really that worrying. Indeed, policy-makers can solve the root of the problem imposing financial disincentives severe enough to make the expected cost of refusing vaccination so high as to lead most citizens to get vaccinated. Nevertheless, to impose fines high enough to overcome the expected gain of refusing the vaccine is inadvisable for two reasons. Firstly, it requires costly monitoring (Bicchieri et al. 2021), and secondly, it could foster the perception of fines as unfair acts, resulting in a hostile atmosphere and eventual retaliation (see Xiao 2018). Hence, what is factually viable for policy-makers is weak fines that, unfortunately, could potentially trigger the motivation crowding-out effect. However, this is not the only effect at play.

Our original contribution to the discussion is to show that, in light of B&C research, it is reasonable to believe that there is another major, and somehow neglected, mechanism that justifies skepticism about imposing weak fines on vaccine hesitant. This mechanism, rather than concerning the crowding-out effect, consists of the human tendency to keep options open, when the chance is given, even if doing so bears some cost.

3. Fines as Opportunities to Keep Options Open

In the present section, we suggest that research results from B&C sciences make it sensible to conjecture that there is a reason other than the crowding-out effect to be doubtful about the effectiveness of using of monetary disincentives to prevent vaccine refusing. Discussion of this reason is made urgent by the fact that in the past, since the UK Vaccination Acts of 1853, imposing fines has been among the tools employed to vaccine refusals (Wolfe and Sharp 2002). Moreover, some governments have already levied financial penalties on SARS-CoV-2 vaccine decliners (see Yoon 2012; Rich and Hida 2021). Hence, it is pivotal to investigate if there are overlooked reasons to question fine-based policy measures.⁶ We argue that the tendency to keep options open is one of these reasons.

What counts in human decision processes is not exclusively the expected values assigned to the outcomes. Obviously, the features of the outcomes associated with the available options play a crucial role in human beings' decisions, yet the same can be said about the mere availability of the options themselves, regardless of the attraction exerted by the related outcomes (Simonson 1990; Kahneman and Snell 1992; Walsh 1995; Bown et al. 2003; Carmon et al. 2003). Such attraction does not necessarily lead to desirable choices, indeed could even prevent human beings from optimizing their happiness (Gilbert and Ebert 2002). Jiwoong Shin

⁶ Although many concerns have been raised regarding the effectiveness of fine-based policy measures (see Drew 2019), as noted by Gravagna and colleagues, there is a lack of epidemiological studies on the efficacy of mandatory policies: "Rigorous and comprehensive studies that can evaluate which aspects of vaccine mandates, if any, and which types of penalties, if any, are effective at increasing vaccination coverage in multiple contexts are needed" (Gravagna et al. 2020: 7872).

and Dan Ariely conceived a straightforward strategy to test, through the analysis of a series of economic decisions, whether human beings are willing to suffer an economic loss rather than losing their chance to keep their options available (Shin and Ariely 2004). In line with the wording proposed in their work, let's refer to this specific tendency as "keeping doors open", henceforth KDO. Their experimental setting works as follows. Three doors, one blue, one green and the other red, appear on a computer screen. Clicking on a door gives access to a related room. The participants' task consists of distributing a limited number of clicks over the doors (door-clicks) and over the related rooms (room-clicks). After each click, regardless of whether used on a door or on a room, the number of clicks available is reduced by one (Figure 1). A crucial aspect of the experimental set-up is that the room-clicks are associated with actual economic gains, whereas the door-clicks do not guarantee any gain. How much a participant can earn by each room-click strongly depends on which room is entered. Indeed, if on the one hand, the average of the payoff distributions is the same for all the three rooms, on the other hand the skewness and the variance of the payoff distributions differ from door to door, making each option diverse from the alternatives. Due to the fact that door-clicks do not guarantee any gain and that the number of clicks is fixed, each door-click, with the exception of the first, implies an opportunity cost of 3ϕ , namely the expected value of each room-click.

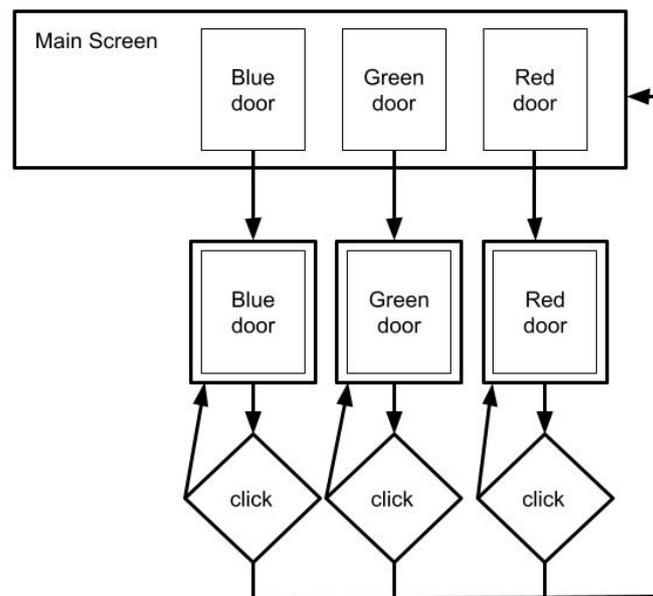


Figure 1

The main possible manipulation in the experiment concerns the consequences of a series of room-clicks. According to the so-called "constant-availability conditions" (henceforth CAC), all the three doors remain available, regardless of how participants decide to distribute the clicks at their disposal through the task. In contrast, the "decreased-availability conditions" (henceforth DAC) involves the eventuality that doors disappear and such eventuality de-

pends directly on the choices made by the participants. Indeed, if the DAC is in place, when a room remains unclicked for 15 consecutive clicks, it disappears permanently. Participants can prevent the disappearance of a door and its related room exclusively by:

1. clicking on the door;
2. spending the subsequent click on the related room.

For instance, the DAC implies that if a participant clicked for the 15th time in a row on the blue room, (s)he would necessarily cause the permanent disappearance of both the red and the green doors. In contrast, in the CAC none of the doors are at risk to disappear. Shin and Ariely have conceived and tested several variations of both these conditions. The results obtained when three variations of the DAC concerning the information availability were in place are particularly relevant for the purpose of the present work. In one variation, participants did not receive any piece of information concerning the payoff distributions associated with each door. This is the “no-prior-information” variation. On the other hand, in the “practice-information” variation, before taking part in the proper and paid game, participants had the chance to practice with the task through a session without financial consequences, being informed that the payoff distributions associated with each room reflect the rooms’ payoff distributions of the proper and paid game. Given the third and last variation—the “descriptive-information” variation—participants were explicitly informed about some of the salient features of the payoff distributions right before taking part in the game. In the latter setting, participants were made aware of the fact that the average payoff distribution is the same for each of the three rooms and about the difference in terms of skewness and variance between the rooms’ payoff distribution. However, according to this variation, participants were unaware of which skewness and variance of distributions featured which of the three rooms.

Shin and Ariely then measured the mean with which a kind of very peculiar behavior occurs, viz. once a participant has already entered a room (s)he switches to another room, clicks on the corresponding door and, finally, switches back to the previous room. The authors of the article defined such behavior as “pecking”. There are two main reasons why participants could decide to switch rooms when the DAC is in place, regardless of the pieces of information available. On the one hand, participants could want to increase their own knowledge of the payoff distributions of each room, perfectible under each variation. On the other hand, switching could be intended to avoid one of the doors permanently disappearing. However, pecking cannot be interpreted as an attempt to gain information on the payoff distributions, in that one room-click provides little information about the payoff distribution associated with the room. Therefore, pecking behavior cannot be prompted by anything but the will to keep options open. The results of the experiment are somewhat surprising: when respondents faced the DAC, they showed a stronger tendency of pecking than when doors were constantly available, irrespective of what variation in terms of information availability was in place. Hence, not only is the KDO tendency in fact triggered by the threat of option-disappearance, but it is also resilient no matter what pieces of information are possessed by the decision-makers concerning the available options and the relative outcomes.

At this point, we suggest that the DAC, given both the practice-information and the descriptive-information variations, depicts a choice environment worry-

ingly analogous to the one inhabited by those who face the vaccine choice in the event that a fine-based compulsory policy is introduced. Let us develop the analogy. Concerning the first aspect of the analogy, the pecking behavior and the payment of a fine due to the refusal of the vaccine are two similar decisions. To see why, let's consider the following scenario that roughly describes what would happen if a SARS-CoV-2 vaccine mandatory policy based on fines was introduced forthwith:

Fine Scenario

The national health system of a state is in possession of several brands of vaccine, about which information circulates freely, like the information on the SARS-CoV-2 virus. Nevertheless, being in short supply, the national health system cannot guarantee a vaccination campaign that rapidly covers all the citizens who can safely be vaccinated. Hence, the government decides which categories of the population to treat first, following certain priorities. Furthermore, for organizational reasons, the government denies citizens the possibility of expressing their preference on which Covid-19 vaccine they will get. In order to maximize the vaccine uptake rate in each category, the government opts to impose monetary weak punishment to those summoned citizens who decline to get vaccinated when their turn occurs. The measure adopted establishes that each time citizens decline to be vaccinated, they incur a fine, the amount of which is always the same irrespective of the number of refusals already made.

This measure would force citizens to choose between two options, on the one hand to get vaccinated and avoid incurring a fine, on the other hand to persist in remaining unvaccinated by paying a fine each time a chance to be inoculated appears.

A salient feature of the *Fine Scenario* is alarmingly similar to a feature of the DAC described above. Indeed, in both cases the decision-makers are asked to perform a costly act to avoid the disappearance of one of the options available from the beginning. In the DAC the respondent who wants to keep the doors open has to undertake the opportunity cost of the door-click spent on the disappearing door. Likewise, in the vaccine scenario the citizens are asked to pay a fine to avert the possibility that one of the options, namely to remain unvaccinated, definitively disappears. So, in both cases, keeping the options open implies incurring an economic loss.

Moreover, there is a second aspect for which the choice environments that characterize the DAC and the *Fine Scenario* are analogous. This aspect concerns the partiality of the information available and the uncertainty about the possible outcomes of the decision. In the DAC, knowledge of the gains obtainable by clicking the three rooms is perfectible, regardless of which variation of information availability is in place. In the "no-prior-information" this is obviously the case, but the same goes for the "practice-information" variation, since the practice session does not last enough to get enough information on the payoff distributions. Furthermore, in the "descriptive-information" variation, participants are unaware of which distribution skewness and variance featured which of the three rooms and so even their level of information can be improved. Likewise, in the *Fine Scenario*, the information on both the SARS-CoV-2 virus and vaccine brands, which circulates freely among citizens, leads to the citizens' partial uncertainty about the outcomes. Citizens have easy and constant access to a dense flow of information, all

relevant for the vaccine choice. Scientific journals, mass media, social media, and circles of acquaintances are producing a massive quantity of information on COVID-19 and SARS-CoV-2 vaccines, to the point that it has led scholars to define the situation as an infodemic (Gallotti et al. 2020). Citizens are having constant access to an impressive amount of information on the features that characterize the options at hand, especially on the possible side effects related to the uptaking of SARS-CoV-2 vaccines, the chance to contract the virus, and the related health consequences. The point is that such pieces of information define a condition of partial uncertainty exactly like the condition experienced by the participants assigned to all the three versions of DAC.

In the light of these analogies between the experimental setting conceived by Shin and Ariely and the *Fine Scenario* just outlined, it is reasonable to expect that the KDO tendency would play a not negligible role on the vaccine choice, whether or not a fine-based coercive policy was introduced. Furthermore, the KDO tendency could emerge regardless of the degree of information obtained, the nature of the resources exploited and the tenability of the pieces of information collected by citizens. As said in §2, governments of liberal democracies can neither adopt policies in which citizens are compelled by force to get the vaccine nor impose fines on vaccine decliners high enough to overwhelm the expected gain of refusing the vaccine for the vast majority of the citizens. Hence, a fine-based mandatory policy scenario, whereby the punishments imposed are weak, is a policy that could be realistically implemented by a government of a liberal democracy to address the COVID-19 emergency. Unfortunately, the human KDO tendency leads to the conjecture that the fines imposed within a policy so characterized could be perceived as an opportunity to keep options open rather than as a deterrent by those citizens who have some interest in both avoiding vaccination and being vaccinated. Strong vaccine refusers do not have any interest in leaving open the opportunity to get vaccinated, hence they perceive the weak financial disincentive described in the *Fine Scenario* as a cost to take on rather than a tempting opportunity. So, to claim that the KDO tendency plays a role in strong vaccine refusers' choices is hardly plausible.

Rather, we specifically refer to the phenomenon called “vaccine hesitancy”, which is one of the main concerns among the governments engaged in SARS-CoV-2 vaccines campaigns (Lazarus et al. 2020). Vaccine hesitant are those who “[...] delay in acceptance or refusal of vaccines despite availability of vaccine services” (SAGE 2014: 7) and so arguably the category attracted to a mean that will allow them to persist in their hesitancy.⁷ Concerning the COVID-19 emergency, vaccine hesitancy especially raises concerns because one of its determinants is the exposition of conspiracy theories (Jolley and Douglas 2014; Roozenbeek et al. 2020) which are rapidly spreading through social media nowadays. To make things even worse, it seems reasonable to believe that concerning the COVID-19 emergency, introducing such a policy would trigger the KDO tendency in vaccine hesitant to an even larger extent than in the DAC described by Shin and Ariely (2004). The two cases at hand are indeed typically dissimilar in terms of preference ratio. When the DAC was in place, the average of pecking behaviors was high, despite the fact that the disappearing doors were related

⁷ For a more detailed analysis of the vaccine hesitancy phenomenon that captures the difference between denialism and refusal, see Navin 2015.

to rooms of little interest for the chooser, as shown by previous decisions. To the contrary, concerning the SARS-CoV-2 vaccines, vaccine hesitant assigns a considerable interest to avoiding vaccination or to get an alternative vaccine than the assigned one, interests sufficient to make them hesitant about what to do. This is particularly worrying from a policy making standpoint in that vaccine hesitant should be the main target of policy measures, being the most sensitive to changes in the choice environment and representing a vast part of the population (Leask 2011; Buttenheim 2020). Hence, policies that impose weak financial disincentives on vaccine decliners seem to provide an especially fertile ground to lead to interpret fines as unmissable opportunities to keep options open.

4. A Laboratory Experiment

In the present manuscript we initially considered peer pressure, the default effect, and case versus base-rate effect as examples of psychological mechanisms relevant for the vaccine choice as well some nudges that can be used to moderate these. Then we focused on what B&C scientists have investigated regarding the conditions under which imposing fines turns out to be an effective policy measure. In particular, we discussed the case of the crowding-out effect as a reason to be skeptical about the introduction of fines as a way to curb vaccine declination. The major contribution of the paper is our claim that there is another and somehow neglected reason to be skeptical, i.e. the KDO tendency, which is threatening in light of the vaccine hesitancy phenomena.

Nevertheless, that imposing a fine could be perceived by vaccine hesitant as an unmissable opportunity to keep the options open rather than a deterrent to hesitancy is so far nothing more than a reasonable conjecture. Hence, at this stage, our claim has only limited practical use for policy-makers. We suggest a design for testing our conjecture. In exploring its reliability for policy purposes, a laboratory experiment could be set as follows. Participants could be randomly assigned to one of two conditions. Those assigned to the first condition would be asked to read a scenario in which the government of his/her home state introduced a coercive policy measure, imposing fines on the citizens who decline to be vaccinated when summoned. In this condition, the citizens would have several chances to be vaccinated, let's say one month away from each other. This condition mirrors the *Fine Scenario*. The second condition, then, could depict a more tragic emergency whereby the home state of the participant is said to be suffering from a really severe short in vaccine supply due to some kind of force majeure, for instance vaccine batches repetitively getting lost due to natural disasters or terrorist attacks. These setbacks will have made it impossible for the health system to guarantee further chances to get vaccinated in the near future for those who refuse the vaccine when summoned for the first time. Indeed, the second chance will not come before a considerable amount of time, let's say at least two years succeeding the first chance. Like in the first scenario, refusing to be vaccinated is penalized with a fine. In this last condition, to refuse to get the vaccine jab when the first chance comes means to miss out on the vaccination coverage for an extended part of the COVID-19 emergency, which equates to the disappearance of the option of being vaccinated, although not permanently, arguably at the time of greatest need. Conversely, in the first condition the vaccine refuser finds in the fine an opportunity to keep both the options open during the COVID-19 emergency. Asking the participants assigned to each con-

dition about their propensity to refuse the vaccine when their first turn comes is a preliminary way to test if the KDO tendency is a determinant. Indeed, if this is the case, the propensity to refuse the vaccine should be higher given the first condition than the second one, in that only the first condition entails a policy in which the fine imposed allows one to keep both the options open over the course of the pandemic. The results from the experiment just outlined would be a good first step to investigate if the KDO tendency has in fact a role in influencing the vaccine choice. However, considering the eventual results of the experiment as a research result ready to be taken into account in planning policies on the vaccine uptake should be firmly avoided. The reason for such cautious approach is the subject of our concluding remarks.

5. Concluding Remarks

We share the position defended by many scholars that B&C scientists should be extremely careful in considering the research results from their fields as pieces of knowledge relevant for facing the COVID-19 emergency (e.g. IJzerman et al. 2020). Indeed, due to methodological drawbacks, the solidity and the quality of the vast majority of the B&C research potentially relevant for anti-COVID-19 policies are not good enough to play a role in policy decision processes. In fact, overall the psychological sciences are going through a reproducibility crisis (Open Science Collaboration 2015), and research from B&C sciences often relies on samples drawn from a slice of populations that is scarcely representative (Henrich et al. 2010). Furthermore, these research investigations are often based in laboratory settings and aim to collect data on intention through self-reported scales which, in both cases, provide results that say little about actual behavior (Webb & Sheeran 2006; Baumeister et al. 2007; Levitt and List 2007). Finally, often the very same phenomenon can clearly emerge in one context but not, or just in a milder form, in a different one (Shimizu and Udagawa 2018). It could be the case of the KDO tendency, which has been repetitively found to influence economic choices, could be mild or even absent when human lives are at stake.

All of this should lead B&C scientists toward *epistemic humility* regarding the role that should be played by the investigative insights from their fields in shaping anti-COVID policies. The epistemic humility can be waived when the results obtained concern reversible kinds of events as, for instance, in the case of the strength of peer pressure to dissuade someone from littering (Cialdini et al., 1990). Nevertheless, when the events are irreversible, epistemic humility is mandatory. Clearly, this is the case with the COVID-19 emergency, where the health and lives of the world population are at stake. In other words, the risks of over-generalizing could not be higher. Hopefully, this risk is well understood by B&C scientists, 681 of which signed in 2020 a public letter to distance themselves from the UK government. These B&C scientists asked the UK government to avoid the mistake of considering “behavioral fatigue” as a justification for delaying the introduction of strict measures to fight against COVID-19, being “not convinced that enough is known about ‘behavioural fatigue’ or to what

extent these insights apply to the current exceptional circumstances” (Open Letter 2020).⁸

Other than advocating caution, B&C scientists are taking action to improve the robustness of their research results to make them ready for policy-makers. Firstly, projects like the Psychological Science Accelerator (PSA) have emerged to improve the reliability of experimental results and test the generalizability of insights from psychological science through crowdsourced research carried on by networks of laboratories (Moshontz et al. 2018). Secondly, the need for science-based insights to address the COVID-19 emergency has spurred B&C scientists to focus on the methodological issues of their disciplines. Currently, B&C scientists are discussing the criteria that research should fulfill for results to be considered suitable to use to plan-COVID policies. Right after the COVID-19 pandemic was declared, two main criteria were advanced to assess the readiness of the research results from B&C sciences. Kai Ruggeri and colleagues proposed a framework called “Theoretical, Empirical, Applicable, and Replicable Impact rating system” (THEARI) based on a five-tier rating. This system ranges from a pure theoretical level to the highest level in which the findings are “validated at the highest conceivable power (i.e., populations) through real-world testing and replication of effects in multiple settings” (Ruggeri et al. 2020). Furthermore, Hans IJzerman and colleagues proposed a rating system of nine levels of evidence readiness adapted from the system NASA uses to assess the maturity level of technologies (IJzerman et al. 2020). The experiment we sketched at the beginning of this section would be at the lower levels of both these scales, hence categorizing it as unready to be used in making policy decisions. However, as it is reasonable to believe that the KDO tendency plays a role in vaccine choice, we believe it is worth it to begin testing it. If it turns out it does have validity, B&C scientists could advance the research to the point where it could be suitable for policy implementation. Possibly, the results obtained could make it urgent to investigate the connection between each of the determinants of a complex phenomenon as vaccine hesitancy and the KDO tendency. The determinants of vaccine hesitancy are indeed different in nature from each other, being related to negative emotions triggered by vaccines, bounded rationality, misinformation, and as well the introduction of information, as the availability of a new vaccine (SAGE 2014). For this reason, it might turn out that some determinants and groups of them affect the KDO tendency differently than others.⁹

⁸ At the beginning of the COVID-19 emergency, the UK government preferred a mild “keep calm and carry on” approach. Only on the 23rd of March 2020, slow off the mark, did Prime Minister Boris Johnson make an unavoidable U-turn and impose more strict measures. British mass media have imputed part of the responsibility for the delay in the intervention to some of the government’s behavioral consultants. Allegedly, some members of the “Behavioural Insights Team” brought “behavioural fatigue” into play as a reason to delay the introduction of strict measures (Yates 2020).

⁹ The authors would like to express their gratitude to two anonymous reviewers for their constructive and in-depth comments on this article.

References

- Abel, T. and McQueen, D. 2020, "The COVID-19 Pandemic Calls for Spatial Distancing and Social Closeness: Not for Social Distancing!", *International Journal of Public Health*, 65, 231, doi: 10.1007/s00038-020-01366-7.
- Abrams, D., Wetherell, M., Cochrane, S., Hogg, M.A., and Turner, J.C. 1990, "Knowing What to Think by Knowing Who You Are: Self-Categorization and the Nature of Norm Formation, Conformity and Group Polarization", *British Journal of Social Psychology*, 29, 97-119, doi: 10.1111/j.2044-8309.1990.tb00892.x.
- Ariely, D., Gneezy, U., Loewenstein, G., and Mazar, N. 2009, "Large Stakes and Big Mistakes", *Review of Economic Studies*, 76, 451-69, doi: 10.1111/j.1467-937x.2009.00534.x.
- Baumeister, R.F., Vohs, K.D., and Funder, D.C. 2007, "Psychology as the Science of Self-Reports and Finger Movements: Whatever Happened to Actual Behavior?", *Perspectives on Psychological Science*, 2, 396-403, doi: 10.1111/j.1745-6916.2007.00051.x.
- Bavel, J.J.V., Baicker, K., Boggio, S. et al. 2020, "Using Social and Behavioural Science to Support COVID-19 Pandemic Response", *Nature Human Behaviour*, 4, 460-71, doi: 10.1038/s41562-020-0884-z.
- Becker, G. 1968, "Crime and Punishment: An Economic Approach", *Journal of Political Economy*, 76, 169-217, www.jstor.org/stable/1830482.
- Betsch, C., Böhm, R., and Korn, L. 2013, "Inviting Free-riders or Appealing to Pro-social Behavior? Game-theoretical Reflections on Communicating Herd Immunity in Vaccine Advocacy", *Health Psychology*, 32, 978-85, doi: 10.1037/a0031590.
- Bicchieri, C. 2016, *Norms in the Wild: How to Diagnose, Measure, and Change Social Norms*, Oxford: Oxford University Press.
- Bicchieri, C., and Dimant, E. 2019, "Nudging with Care: The Risks and Benefits of Social Information", *Public Choice*, doi: 10.1007/s11127-019-00684-6.
- Bicchieri, C., Dimant, E., and Xiao, E. 2021, "Deviant or Wrong? The Effect of Norm Information on the Efficacy of Punishment", *SSRN Electronic Journal*, doi: 10.2139/ssrn.3779018.
- Bicchieri, C., Fatas, E., Aldama, A., Casas, Deshpande, I., Lauro, M., Parilli, C., Spohn, M., Pereira, P., and Wen, R. 2020, "In Science we (Should) Trust: Expectations and Compliance During the COVID-19 Pandemic", doi: 10.21203/rs.3.rs-106840/v1.
- Bish, A., Yardley, L., Nicoll, A., and Michie, S. 2011, "Factors Associated with Uptake of Vaccination Against Pandemic Influenza: A Systematic Review", *Vaccine*, 29, 6472-84, doi: 10.1016/j.vaccine.2011.06.107.
- Bond, R.M., Fariss, C.J., Jones, J.J., Kramer, A.D.I., Marlow, C., Settle, J.E., and Fowler, J.H. 2012, "A 61-million-person Experiment in Social Influence and Political Mobilization", *Nature*, 489, 295-98, doi: 10.1038/nature11421.
- Bowles, S. 2008, "Policies Designed for Self-Interested Citizens May Undermine 'The Moral Sentiments': Evidence from Economic Experiments", *Science*, 320, 1605-1609, doi: 10.1126/science.1152110.
- Bown, N.J., Read, D., and Summers, B. 2003, "The Lure of Choice", *Journal of Behavioral Decision Making*, 16, 297-308, doi: 10.1002/bdm.447.

- Bruine de Bruin, W., Parker, A.M., Galesic, M., and Vardavas, R. 2019, "Reports of Social Circles' and Own Vaccination Behavior: A National Longitudinal Survey", *Health Psychology*, 38, 975-83, doi: 10.1037/hea0000771.
- Buttenheim, A.M. 2020, "SARS-CoV-2 Vaccine Acceptance: We May Need to Choose Our Battles", *Annals of Internal Medicine*, 173, 1018-19, doi: 10.7326/m20-6206.
- Buttenheim, A.M., and Asch, D.A. 2013, "Making Vaccine Refusal Less of a Free Ride", *Human Vaccines & Immunotherapeutics*, 9, 2674-75, doi: 10.4161/hv.26676.
- Calabuig, V., Fatas, E., Olcina, G., and Rodriguez-Lara, I. 2016, "Carry a Big Stick, or No Stick at all", *Journal of Economic Psychology*, 57, 153-71, doi: 10.1016/j.joep.2016.09.006.
- Carmon, Z., Wertenbroch, K., and Zeelenberg, M. 2003, "Option Attachment: When Deliberating Makes Choosing Feel like Losing", *Journal of Consumer Research*, 30, 15-29, doi: 10.1086/374701.
- Chapman, G.B., Li, M., Colby, H., and Yoon, H. 2010, "Opting In vs Opting Out of Influenza Vaccination", *JAMA*, 304, 43-44, doi: 10.1001/jama.2010.892.
- Cialdini, R.B., and Goldstein, N.J. 2004, "Social Influence: Compliance and Conformity", *Annual Review of Psychology*, 55, 591-621, doi: 10.1146/annurev.psych.55.090902.142015.
- Cialdini, R.B., Reno, R.R., and Kallgren, C.A. 1990, "A Focus Theory of Normative Conduct: Recycling the Concept of Norms to Reduce Littering in Public Places", *Journal of Personality and Social Psychology*, 58, 1015-26, doi: 10.1037/0022-3514.58.6.1015.
- Drew, L. 2019, "The Case for Mandatory Vaccination", *Nature*, 575, 58-60, doi: 10.1038/d41586-019-03642-w.
- European Parliament and European Council, 15 June 2021, Regulation 2021/953 on a framework for the issuance, verification and acceptance of interoperable COVID-19 vaccination, test and recovery certificates (EU Digital COVID Certificate) to facilitate free movement during the COVID-19 pandemic, L 211/1.
- Fehr, E. and Falk, A. 2002, "Psychological Foundations of Incentives", *European Economic Review*, 46, 687-724, doi: 10.1016/s0014-2921(01)00208-2.
- Fehr, E. and Gächter, S. 2002, "Do Incentive Contracts Undermine Voluntary Cooperation?", *SSRN Electronic Journal*, doi: 10.2139/ssrn.313028.
- Fehr, E. and Rockenbach, B. 2003, "Detrimental Effects of Sanctions on Human Altruism", *Nature*, 422, 137-40, doi: 10.1038/nature01474.
- Felletti, S. 2020, "'Trust me, I'm your Neighbour'. How to Improve Epidemic Risk Containment through Community Trust", *Mind & Society*, 1, 4, doi: 10.1007/s11299-020-00266-w.
- Fischbacher, U., Gächter, S., and Fehr, E. 2001, "Are People Conditionally Cooperative? Evidence from a Public Goods Experiment", *Economics Letters*, 71, 397-404, doi: 10.1016/s0165-1765(01)00394-9.
- Gallotti, R., Valle, F., Castaldo, N., Sacco, P., and De Domenico, M. 2020, "Assessing the Risks of 'Infodemics' in Response to COVID-19 Epidemics", *Nature Human Behaviour*, 4, 1285-93, doi: 10.1038/s41562-020-00994-6.
- Gilbert, D.T. and Ebert, J.E.J. 2002, "Decisions and Revisions: The Affective Forecasting of Changeable Outcomes", *Journal of Personality and Social Psychology*, 82, 503-14.

- Gneezy, U., Meier, S., and Rey-Biel, P. 2011, "When and Why Incentives (Don't) Work to Modify Behavior", *Journal of Economic Perspectives*, 25, 191-210, doi: 10.1257/jep.25.4.191.
- Gneezy, U. and Rustichini, A. 2000, "A Fine is a Price", *The Journal of Legal Studies*, 29, 1-17.
- Goldstein, N.J., Cialdini, R.B., and Griskevicius, V. 2008, "A Room with a Viewpoint: Using Social Norms to Motivate Environmental Conservation in Hotels", *Journal of Consumer Research*, 35, 472-82, doi: 10.1086/586910.
- Goodwin, T. 2012, "Why We Should Reject 'Nudge'", *Politics*, 32, 85-92.
- Gravagna, K., Becker, A., Valeris-Chacin, R., Mohammed, I., Tambe, S., Awan, F. A., Toomey, T.L., and Basta, N.E. 2020, "Global Assessment of National Mandatory Vaccination Policies and Consequences of Non-compliance", *Vaccine*, 38, 7865-73, doi: 10.1016/j.vaccine.2020.09.063.
- Grüne-Yanoff, T. 2012, "Old Wine in New Casks: Libertarian Paternalism Still Violates Liberal Principles", *Social Choice and Welfare*, 38, 635-45.
- Halpern, S.D., Ubel, P.A., and Asch, D.A. 2007, "Harnessing the Power of Default Options to Improve Health Care", *New England Journal of Medicine*, 357, 1340-44, doi: 10.1056/nejmsb071595.
- Hayes, K.J., Eljiz, K., Dadich, A., Fitzgerald, J.A., and Sloan, T. 2015, "Triability, Observability and Risk Reduction Accelerating Individual Innovation Adoption Decisions", *Journal of Health Organization and Management*, 29, 271-94, doi: 10.1108/jhom-08-2013-0171.
- Henrich, J., Heine, S.J., Norenzayan, A. 2010, "The Weirdest People in the World?", *Behavioral and Brain Sciences*, 33, 61-83.
- IJzerman, H., Lewis, N.A., Przybylski, A.K., Weinstein, N., DeBruine, L., Ritchie, S.J., Vazire, S., Forscher, P.S., Morey, R.D., Ivory, J.D., and Anvari, F. 2020, "Use Caution When Applying Behavioural Science to Policy", *Nature Human Behaviour*, 4, 1092-94, doi: 10.1038/s41562-020-00990-w.
- Jachimowicz, J., Duncan, S., Weber, E., and Johnson, E. 2019, "When and Why Defaults Influence Decisions: A Meta-analysis of Default Effects", *Behavioural Public Policy*, 3, 159-86, doi: 10.1017/bpp.2018.43.
- Johnson, E.J., and Goldstein, D. 2003, "Do Defaults Save Lives?", *Science*, 302, 1338-39, doi: 10.1126/science.1091721.
- Jolley, D., and Douglas, K. M. 2014, "The Effects of Anti-Vaccine Conspiracy Theories on Vaccination Intentions", *PLoS ONE*, 9, e89177, doi: 10.1371/journal.pone.0089177.
- Kahneman, D., Knetsch, J.L., and Thaler, R.H. 1990, "Experimental Tests of the Endowment Effect and the Coase Theorem", *Journal of Political Economy*, 98, 1325-48.
- Kahneman, D. and Snell, J. 1992, "Predicting a Changing Taste: Do People Know What They Will Like?", *Journal of Behavioral Decision Making*, 5, 187-200, doi: 10.1002/bdm.3960050304.
- Korn, L., Betsch, C., Böhm, R., and Meier, N.W. 2018, "Social Nudging: The Effect of Social Feedback Interventions on Vaccine Uptake", *Health Psychology*, 37, 1045-54, doi: 10.1037/hea0000668.
- Lazarus, J.V., Ratzan, S.C., Palayew, A., Gostin, L.O., Larson, H.J., Rabin, K. et al. 2020, "A Global Survey of Potential Acceptance of a COVID-19 Vaccine", *Nature Medicine*, doi: 10.1038/s41591-020-1124-9.

- Leask, J. 2011, "Target the Fence-Sitters", *Nature*, 473, 443-45, doi: 10.1038/473443a.
- Lehmann, B.A., Chapman, G.B., Franssen, F.M., Kok, G., and Ruiters, R.A. 2016, "Changing the Default to Promote Influenza Vaccination Among Health Care Workers", *Vaccine*, 34, 1389-92, doi: 10.1016/j.vaccine.2016.01.046.
- Levine-Tiefenbrun, M., Yelin, I., Katz, R. et al. 2021, "Decreased SARS-CoV-2 Viral Load Following Vaccination", doi: 10.1101/2021.02.06.21251283.
- Levitt, S. and List, J. 2007, "What Do Laboratory Experiments Tell Us About the Real World?", *Journal of Economic Perspectives*, 21, 153-74.
- Lunn, P.D., Belton, C.A., Lavin, C., McGowan, F.P., Timmons, S., and Robertson, D.A. 2020, "Using Behavioral Science to Help Fight the Coronavirus", *Journal of Behavioral Public Administration*, 3, doi: 10.30636/jbpa.31.147.
- Lynch, J.G., and Ofir, C. 1989, "Effects of Cue Consistency and Value on Base-rate Utilization", *Journal of Personality and Social Psychology*, 56, 170-81, doi: 10.1037/0022-3514.56.2.170.
- Madrian, B.C. 2014, "Applying Insights from Behavioral Economics to Policy Design", *Annual Review of Economics*, 6, 663-88, doi: 10.1146/annurev-economics-080213-041033.
- Magnano, R. 2019, "Vaccini, Fuori Chi non è in Regola ma le Sanzioni Restano sulla Carta", *Il Sole 24 Ore*, www.ilssole24ore.com/art/vaccini-fuori-chi-non-e-regola-ma-sanzioni-restano-carta-ABbYnucB.
- Mallapaty, S. 2021, "Can COVID Vaccines Stop Transmission? Scientists Race to Find Answers", *Nature*, doi: 10.1038/d41586-021-00450-z.
- Maringe, C., Spicer, J., Morris, M., Purushotham, A., Nolte, E., Sullivan, R., Rachet, B., and Aggarwal, A. 2020, "The Impact of the COVID-19 Pandemic on Cancer Deaths Due to Delays in Diagnosis in England, UK: A National, Population-Based, Modelling Study", *The Lancet Oncology*, 21, 1023-34, doi: 10.1016/s1470-2045(20)30388-0.
- McCormick, K.D., Jacobs, J.L., and Mellors, J.W. 2021, "The Emerging Plasticity of SARS-CoV-2", *Science*, 371, 1306-08, doi: 10.1126/science.abg4493.
- Mellström, C. and Johannesson, M. 2008, "Crowding Out in Blood Donation: Was Titmuss Right?", *Journal of the European Economic Association*, 6, 845-63, doi: 10.1162/jeea.2008.6.4.845.
- Ministry of Health of Israel (n.d.), What is a Green Pass?, Retrieved March 28 2021, from corona.health.gov.il/en/directives/green-pass-info/.
- Moshontz, H., Campbell, L., Ebersole, C.R., IJzerman, H., Urry, H.L., Forscher, P.S. et al. 2018, "The Psychological Science Accelerator: Advancing Psychology Through a Distributed Collaborative Network", *Advances in Methods and Practices in Psychological Sciences*, 1, 501-15, doi: 10.1177/2515245918797607.
- Nakayachi, K., Ozaki, T., Shibata, Y., and Yokoi, R. 2020, "Why Do Japanese People Use Masks Against COVID-19, Even Though Masks Are Unlikely to Offer Protection from Infection?", *Frontiers in Psychology*, 11, doi: 10.3389/fpsyg.2020.01918.
- Navin, M. 2016, *Values and Vaccine Refusal: Hard Questions in Ethics, Epistemology, and Health Care*, New York: Routledge.
- Open Letter (2020, March 16), *Open letter to the UK Government regarding COVID-19*. Retrieved March 28 2021, from sites.google.com/view/covidopenletter/home.

- Open Science Collaboration 2015, “Estimating the Reproducibility of Psychological Science”, *Science*, 349, 13, doi: 10.1126/science.aac4716.
- Petter, E., Mor, O., Zuckerman, N., Oz-Levi, D., Younger, A., Aran, D., and Erlich, Y. 2021, “Initial Real World Evidence for Lower Viral Load of Individuals Who Have Been Vaccinated by BNT162b2”, doi: 10.1101/2021.02.08.21251329.
- Phelan, A.L. 2020, “COVID-19 Immunity Passports and Vaccination Certificates: Scientific, Equitable, and Legal Challenges”, *The Lancet*, 395, 1595-98, doi: 10.1016/s0140-6736(20)31034-5.
- Quadri-Sheriff, M., Hendrix, K.S., Downs, S.M., Sturm, L.A., Zimet, G.D., and Finnell, S.M.E. 2012, “The Role of Herd Immunity in Parents’ Decision to Vaccinate Children: A Systematic Review”, *Pediatrics*, 130, 522-30, doi: 10.1542/peds.2012-0140.
- Rich, M. and Hida, H. 2021, “As the Pandemic Took Hold, Suicide Rose among Japanese Women”, *The New York Times*, www.nytimes.com/2021/02/23/world/as-the-pandemic-took-hold-suicide-rose-among-japanese-women.html.
- Roozenbeek, J., Schneider, C.R., Dryhurst, S., Kerr, J., Freeman, A.L.J., Recchia, G., van der Bles, A.M., and van der Linden, S. 2020, “Susceptibility to Misinformation about COVID-19 around the World”, *Royal Society Open Science*, 7, 201199, doi: 10.1098/rsos.201199.
- Ruggeri, K., van der Linden, S., Wang, Y.C., Papa, F., Riesch, J., and Green, J. 2020, “Standards for Evidence in Policy Decision-making”, *Nature Research Social and Behavioural Sciences*, 399005, go.nature.com/2zdTQIs.
- Strategic Advisory Group of Experts on Immunization (SAGE) 2014, *Report of the SAGE Working Group on Vaccine Hesitancy*, Retrieved September 12 2021, from www.who.int/immunization/sage/meetings/2014/october/SAGE_working_group_revised_report_vaccine_hesitancy.pdf?ua=1.
- Santos Rutschman, A. 2020, “Why the Government Shouldn’t Pay People to Get Vaccinated Against COVID-19”, *SSRN Electronic Journal*, doi: 10.2139/ssrn.3740198.
- Schmelz, K. 2020, “Enforcement May Crowd Out Voluntary Support for COVID-19 Policies, Especially Where Trust in Government is Weak and in a Liberal Society”, *Proceedings of the National Academy of Sciences*, 118, e2016385118, doi: 10.1073/pnas.2016385118.
- Schmidt, A. 2017, “The Power to Nudge”, *American Political Science Review*, 111, 404-17.
- Schultz, P.W., Nolan, J.M., Cialdini, R.B., Goldstein, N.J., and Griskevicius, V. 2007, “The Constructive, Destructive, and Reconstructive Power of Social Norms”, *Psychological Science*, 18, 429-34, doi: 10.1111/j.1467-9280.2007.01917.x.
- Shimizu, K. and Udagawa, D. 2018, “Is Human Life Worth Peanuts? Risk Attitude Changes in Accordance with Varying Stakes”, *Plos One*, 13, e0201547, doi: 10.1371/journal.pone.0201547.
- Shin, J. and Ariely, D. 2004, “Keeping Doors Open: The Effect of Unavailability on Incentives to Keep Options Viable”, *Management Science*, 50, 575-86, doi: 10.1287/mnsc.1030.0148.
- Siani, A. 2019, “Measles Outbreaks in Italy: A Paradigm of the Re-emergence of Vaccine-Preventable Diseases in Developed Countries”, *Preventive Medicine*, 121, 99-104, doi: 10.1016/j.ypmed.2019.02.011.

- Signorelli, C., Iannazzo, S., and Odone, A. 2018. "The Imperative of Vaccination Put into Practice", *Lancet Infectious Diseases*, 18, 26-27, doi: 10.1016/S1473-3099(17)30696-5.
- Simonson, I. 1990, "The Effect of Purchase Quantity and Timing on Variety-Seeking Behavior", *Journal of Marketing Research*, 27, 150, doi: 10.2307/3172842.
- Sparkman, G. and Walton, G.M. 2017, "Dynamic Norms Promote Sustainable Behavior, Even If It Is Counternormative", *Psychological Science*, 28, 1663-74, doi: 10.1177/0956797617719950.
- Subbaraman, N. 2021, "How Do Vaccinated People Spread Delta? What the Science Says", *Nature*, 596, 327-28, doi: 10.1038/d41586-021-02187-1.
- Teitelbaum, J.C. and Zeiler, K. 2018, *Research Handbook on Behavioral Law and Economics (Research Handbooks in Law and Economics series)*, Cheltenham: Edward Elgar Publishing.
- Thaker, J. 2020, "Planning for a COVID-19 Vaccination Campaign: The Role of Social Norms, Trust, Knowledge, and Vaccine Attitudes", Preprint 10.31234/osf.io/q8mz6.
- Thaler, R.H. 2021, "Getting Everyone Vaccinated, With 'Nudges' and Charity Auctions", *The New York Times*, www.nytimes.com/2020/12/09/business/corona-virus-vaccination-auctions-celebrities.html.
- Thaler, R.H. and Sunstein, C. 2008, *Nudge: Improving Decisions About Health, Wealth, and Happiness*, New Haven: Yale University Press.
- Trentini, F., Poletti, P., Melegaro, A., and Merler, S. 2019, "The Introduction of 'No jab, No school' Policy and the Refinement of Measles Immunisation Strategies in High-income Countries", *BMC Medicine*, 17, doi: 10.1186/s12916-019-1318-5.
- Tversky, A., and Kahneman, D. 1973, "Availability: A Heuristic for Judging Frequency and Probability", *Cognitive Psychology*, 5, 207-32, doi: 10.1016/0010-0285(73)90033-9.
- Walkinshaw, E. 2011, "Mandatory Vaccinations: The International Landscape", *Canadian Medical Association Journal*, 183, E1167-E1168, doi: 10.1503/cmaj.109-3993.
- Walsh, J.W. 1995, "Flexibility in Consumer Purchasing for Uncertain Future Tastes", *Marketing Science*, 14, 148-65, doi: 10.1287/mksc.14.2.148.
- Webb, T.L. and Sheeran, P. 2006, "Does Changing Behavioral Intentions Engender Behavior Change? A Meta-Analysis of the Experimental Evidence", *Psychological Bulletin*, 132, 249-68, doi: 10.1037/0033-2909.132.2.249.
- Wolfe, R.M. and Sharp, L.K. 2002, "Anti-Vaccinationists Past and Present", *BMJ*, 325, 430-32, doi: 10.1136/bmj.325.7361.430.
- Wood, S. and Schulman, K. 2021, "Beyond Politics—Promoting Covid-19 Vaccination in the United States", *New England Journal of Medicine*, 384, e23, doi: 10.1056/nejmms2033790.
- World Health Organization 2020, "Behavioural Considerations for Acceptance and Uptake of Covid-19 Vaccines: Who Technical Advisory Group on Behavioural Insights and Sciences for Health", I-Ii, Rep., doi:10.2307/resrep27868.1.
- Xiao, E. 2018, "Punishment, Social Norms, and Cooperation", in Teitelbaum, C.J. and Zeiler, K. (eds.), *Research Handbook on Behavioral Law and Economics*, Cheltenham: Edward Elgar Publishing, 155-73.

- Xiao, X. and Borah, P. 2020, “Do Norms Matter? Examining Norm-Based Messages in HPV Vaccination Promotion”, *Health Communication*, doi: 10.1080/10410236.2020.1770506.
- Yates, T. 2020, “Why is the Government Relying on Nudge Theory to Fight Coronavirus?”, *The Guardian*, www.theguardian.com/commentisfree/2020/mar/13/why-is-the-government-relying-on-nudge-theory-to-tackle-coronavirus.
- Yoeli, E., Hoffman, M., Rand, D.G., and Nowak, M.A. 2013, “Powering Up with Indirect Reciprocity in a Large-Scale Field Experiment”, *Proceedings of the National Academy of Sciences*, 110, 10424-429, doi: 10.1073/pnas.1301210110.
- Yoon, D. 2021, “Declining a Covid-19 Vaccine Risks Penalties in Some Countries”, *The Wall Street Journal*, www.wsj.com/articles/declining-a-covid-19-vaccine-risks-penalties-in-some-countries-11613998997.