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Alejandro Hortal

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Sumário

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Alejandro Hortal**

Abstract

Although vaccines are considered an efficient public health tool by medical experts, people's confidence in them has been decreasing in different countries. COVID-19 has elevated medical scientists' and practitioners' social reputation, and it may have reduced global vaccination hesitancy. Still, this alone will not altogether remove the existent frictions that prevent people from complying with vaccination schedules. This paper will review the common causes behind vaccination hesitancy. It will also explore different public policy interventions that health experts in governments and institutions employ to fight vaccine hesitancy and non-compliance. The main objective of this article is to argue that, considering the nature of the issue (vaccine hesitancy and its causes), among the various possibilities, policies based on behavioral insights can provide an effective instrument to remove those frictions. Among them, special attention will be devoted to nudges which promise efficiency while avoiding some of the ethical and political costs of other interventions, thanks to their libertarian paternalistic frame. The article concludes by suggesting that public health policymakers should consider the libertarian paternalistic approach of nudges when deploying interventions that aim at changing people's attitudes and behavior.

Keywords: vaccine hesitancy; nudge theory; public health; decision theory; behavioral public policy; libertarian paternalism.

Resumo

Embora as vacinas sejam consideradas uma ferramenta eficiente de saúde pública por especialistas médicos, a confiança das pessoas nelas vem diminuindo em diferentes países. O COVID-19 elevou a reputação social de cientistas e profissionais médicos e pode ter reduzido a hesitação global de vacinação. Ainda assim, isso por si só não removerá totalmente os atritos existentes que impedem as pessoas de cumprir os calendários de vacinação. Este artigo revisará as causas comuns por trás da hesitação na vacinação. Também explorará diferentes intervenções de políticas públicas que especialistas em saúde em governos e instituições empregam para combater a hesitação e a não conformidade com as vacinas. O objetivo principal deste artigo é argumentar que, considerando a natureza do problema (hesitação

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** Ph.D. Philosophy of Behavioral Economics and Public Policy. Senior Lecturer, University of North Carolina - Greensboro. ORCID iD https://orcid.org/0000-0001-6255-4488. E-mail: a_hortal@uncg.edu.

vacinal e suas causas), dentre as várias possibilidades, políticas baseadas em ciências comportamentais podem fornecer um instrumento eficaz para eliminar esses atritos. Entre eles, atenção especial será dedicada aos nudges que prometem eficiência, evitando alguns dos custos éticos e políticos de outras intervenções, graças ao seu quadro paternalista libertário. O artigo conclui sugerindo que os formuladores de políticas de saúde pública devem considerar a abordagem paternalista libertária dos nudges ao implantar intervenções que visam mudar as atitudes e o comportamento das pessoas.

Palavras-chave: hesitação vacinal; Nudges; saúde pública; teoria da decisão; política pública comportamental; paternalismo libertário

1 Introduction. Vaccines and behavioral public policy: a promising approach

Vaccines are considered one of the most efficient public health tools we have to fight different diseases. Accordingly, countries and regions adopt various regulations to mandate, educate, and incentivize their use. Notwithstanding all measures taken by public health specialists, governments, pharmaceutical companies, and medical practitioners to increase vaccine uptake, some people delay or refuse to take them. Vaccine hesitancy is the "delay in acceptance or refusal of vaccines despite the availability of vaccine services [...] It is influenced by factors such as complacency, convenience, and confidence"[1]. Vaccine hesitancy is complex, contextual, and varies through time, location, and type of vaccine. Research shows that vaccination is an effective tool for individuals to become immune to specific diseases while giving community protection. While vaccines are not 100% effective and may produce adverse effects on rare occasions, their benefits outweigh their risks.

Although a survey conducted in May 2020 across 19 different countries[2] concluded that only around 70% of people would be very or somewhat likely to get a COVID-19 vaccine, we are yet to see the full effects of this pandemic on vaccine hesitancy. Even after a year of pandemic, hesitancy has not improved much. A tracking survey conducted by The USC Center for Economic and Social Research's Understanding Coronavirus in America (https://covid19pulse.usc.edu/) showed that in June 2021, the rate of people willing to get the vaccine is just around 76% (vaccinated or somewhat likely to get vaccinated). Vaccine refusal is increasing worldwide[3] and in the United States, "over the past decade, vaccine refusal has accelerated in the USA, with increased non-medical exemptions to school immunisation requirements that have been linked to outbreaks of vaccine-preventable diseases"[4]. A recent systematic review of global vaccine acceptance rates shows that while in some countries hesitancy is very low, others, like Italy, their confidence is not greater than 54%:

> Among adults representing the general public, the highest COVID-19 vaccine acceptance rates were found in Ecuador (97.0%), Malaysia (94.3%), Indonesia (93.3%) and China (91.3%). However, the lowest COVID-19 vaccine acceptance rates were found in Kuwait (23.6%), Jordan (28.4%), Italy (53.7), Russia (54.9%), Poland (56.3%), US (56.9%), and France (58.9%)[5]

[1] WORLD HEALTH ORGANIZATION. WHO. Improving vaccination demand and addressing hesitancy. 2020. Disponível em: https://www.who.int/immunization/programmes_systems/vaccine_hesitancy/en/. Acesso em: 21 jun. 2020.

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[3] YIGIT, Metin; OZKAYA-PARLAKAY, Aslinur; SENEL, Emrah. Evaluation of COVID-19 vaccine refusal in parents. The Pediatric Infectious Disease Journal, v. 40, n. 4, p. e134-e136, 2021.

[4] COMMISSIONERS OF THE LANCET COMMISSION ON VACCINE REFUSAL, ACCEPTANCE, AND DEMAND IN THE USA. Announcing the lancet commission on vaccine refusal, acceptance, and demand in the USA. The Lancet, v. 397, n. 10280, p. 1165-1167, 2021. p. 1165.

[5] SALLAM, Malik. COVID-19 vaccine hesitancy worldwide: a concise systematic review of vaccine acceptance rates. Vaccines, v.

General data from previous years regarding different types of vaccines can provide a framework of reference to understand hesitancy causes and the possibility to apply this knowledge to current COVID-19 vaccination policies. With this information, new public policy developments based on behavioral insights may show a promising path to reduce hesitancy[6], avoid mandates' ethical compromises, and the high cost of (sometimes) inefficient educational campaigns.

In recent years, public policy experts have started to rely on behaviorally informed interventions[7] based on a model that assumes that individuals tend to fall short of the ideal of rationality prescribed by standard economics. As Amos Tversky and Daniel Kahneman suggested[8], our judgment errs predictably and systematically. Herbert Simon, rejecting the standard economics' idealistic view of rationality, coined the term "bounded rationality"[9], referring to our cognition's limitations when deciding. For the sake of efficiency, any public health policy must account for these limitations, which is what behavioral public policy attempts: it develops and deploys interventions assuming that agents violate the rational assumptions of standard economic theory. With a robust evidence-based methodology, this assumption makes the behavioral approach a promising path to decreasing vaccine hesitancy.

In 2008 Richard Thaler and Cass Sunstein published *Nudge*[10], a book that set in motion a different approach to policy interventions based on behavioral insights: libertarian paternalism. Far from the liberty restricting regulations and mandates and removed from the difficulties and high cost of traditional educational campaigns, nudges propose a third alternative centered on choice architecture, defaults, and the exploitation of people's actual decision-making processes to alter their behavior and increase their wellness as judged by themselves.

> A nudge, as we will use the term, is any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid. Nudges are not mandates. Putting fruit at eye level counts as a nudge. Banning junk food does not[11].

Their soft paternalistic[12] perspective can make nudges very attractive for policymakers due to their promise of effectiveness, low cost, and liberty-preserving characteristics.

Nudges are not the only behavioral tool in public policy. Following the policy cube designed by Adam Oliver[13], interventions, in general, can be found mainly between the spectrum of three different coordinates based on their degree of liberty (or regulation), their consideration of the rational boundaries of agents (behavioral or rational), and the target of the interventions (external or internal). Hence, a financial penalty for not getting vaccinated, similarly to the law proposed by the Galician Parliament in Spain[14], would be external, rational (as opposed to behavioral), and regulatory. A message to a patient by a practitioner assuming by default that she would get a specific vaccine would be a behavioral, liberty-preserving (non-regulatory) internal intervention. Vaccinating schoolchildren by default at school without parents' explicit consent (while respecting their freedom to opt-out) will also be a behavioral non-regulatory, internal intervention. Adam

9, n. 2, 2021.

[6] MILKMAN, K. L.; PATEL, M. S.; GANDHI, L. et al. A megastudy of text-based nudges encouraging patients to get vaccinated at an upcoming doctor's appointment. Proceedings of the National Academy of Sciences of the United States of America, v. 118, n. 20, 2021.

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[11] THALER, Richard H.; SUNSTEIN, Cass R. Nudge: improving decisions about health, wealth and happiness. Penguin, 2009. p. 6.

[12] SOUZA, L. C.; RAMOS, K. T. F.; PERDIGÃO, S. C. R. V. Análise crítica da orientação de cidadãos como método para otimizar decisões públicas por meio da técnica nudge. Revista Brasileira de Políticas Públicas, v. 8, n. 2. 2018.

[13] OLIVER, Adam. The origins of behavioural public policy. Cambridge: Cambridge University Press, 2017.

[14] HUETE, Cristina; LINDE, Pablo. Coronavirus: Galicia, primera comunidad en prever multas por no vacunarse. Sociedad. El País, 2021.

Oliver suggests that a comprehensive toolbox of behavioral public policy should also contain internal and external regulations: *shoves* and *budges*, respectively. Shoves are internal, and as "with nudges, [they] are informed by behavioural economics in that they aim to counter errors, caused by, for instance, present bias, in individual behaviours, and is also focused on addressing internalities, i.e., on protecting people from themselves"[15]. A smoking ban will be considered a shove. On the other hand, budges are behaviorally informed external regulations that target agencies or corporations that might profit from individuals' rational weaknesses. Regulations that target tobacco companies or gambling websites are good examples of budges.

On the other side of the spectrum (or cube), we have rationally (as opposed to behaviorally) oriented regulations and mandates (mandatory vaccination for children at schools), which take the shape of traditional tools public policy experts use, for example, to ensure vaccination schedules. Often, these regulations work in tandem with educational interventions to ensure people's understanding of how vaccines work and why they are essential individually and socially.

Therefore, the idea behind behavioral public policy is to focus on interventions that move away from the idealistic rational assumptions of traditional policies. Ethically and politically speaking, these public policy approaches are not exempt from a debate (manipulatory, non-transparent, not as liberty-preserving as they present themselves, based on a pessimistic view of human rationality, etc.). Still, they have a clear advantage over other alternatives: they are data-driven, assuming a realistic model of how humans decide, and, in the case of nudges, they can be avoided.

Without a doubt, education should be the foundation of any effort to increase vaccine confidence. However, the results of educational approaches vary depending on who is providing the information (governments, pharmaceutical companies, etc.) and to whom the information is presented. In vaccination, for example, those who are the least confident (anti-vaxxers) are usually more informed about vaccines than those who follow the recommended schedule: "Vaccine refusers are not only more educated, but they also often have more knowledge about vaccines than parents who vaccinate"[16].

Experts need to understand how our rationality works when imposing mandates, educating, or attempting to alter people's behavior in any way. Ethically, mandates compromise people's freedom and sometimes backfire, decreasing vaccination rates. Traditional regulations and educational campaigns based on an ideal model of our rationality and behavior will fall short of their goal if they do not regard the empirical reality of our decision-making processes. Experts need to consider policies based on behavioral insights due to their realistic approach to how people decide. Above all, nudges are becoming a promising tool due to their success in navigating efficiently between the (so-called) libertarian approach of education and the paternalistic frame of mandates and regulations.

In recent years, vaccine hesitancy (delays and refusal) has been causing a reduction in immunization rates worldwide, particularly in the European Union. The following section will review the current state of hesitancy of different vaccines (including COVID-19). Since some of the reasons behind hesitancy are similar among vaccines and will be the same with the appearance of new diseases, their understanding may help increase current vaccination confidence. The paper later examines a variety of policy approaches, arguing for the inclusion of behavioral public policies in general and nudges in particular among the set of alternatives to reduce hesitancy due to their ethical, political, and epistemological benefits.

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[16] NAVIN, Mark. Values and vaccine refusal: hard questions in ethics, epistemology, and health care. Routledge, 2015.

2 Vaccine hesitancy: rates and reasons

The following paragraphs will examine global hesitancy aiming at understanding the current state of affairs for various diseases. After presenting the data, the paper looks at a variety of structural and behavioral reasons for such hesitancy. A recent report on Europe[17] shows that while some countries like Greece or Slovenia are becoming more confident about vaccines, others like the Czech Republic, Finland, Poland, and Sweden, are increasingly hesitant about their use. For example, 36 % of general practitioners "surveyed in Czech Republic and 25% in Slovakia do not agree that the MMR vaccine is safe and 29% and 19% (respectively) do not believe it is important"[18]. People in various countries have different confidence levels in vaccines: The UK, Spain, and Portugal show a low-level hesitancy regarding influenza vaccine, while France, Latvia, and Austria are more hesitant about its safety. Most general practitioners have a higher degree of confidence in vaccines than other people in every country except the Czech Republic. For example, in this country, spirituality and non-religious association are linked to vaccine refusal[19].

In the EU, the level of hesitancy is associated with socioeconomic factors and age: "Across all survey questions, age is strongly associated with vaccination views, with younger age groups less likely than older groups to have positive vaccination views"[20]. While in some European countries, the confidence level in vaccines is increasing, it is decreasing in others (like Poland). Coincidently, in Poland, a recent survey[21] collected the highest rate of negative responses regarding a possible COVID-19 vaccination. Data shows a correlation between vaccination hesitancy rates before and during the pandemic.

Hesitancy is also a problem in Africa. In 2003, a polio vaccine boycott in Nigeria caused a five-fold increase in cases between 2002 and 2006[22]. Some authors describe how challenging immunization efforts across the continent can be:

> Cholera immunization in Mozambique, tetanus vaccination in East and West Africa, and measles-rubella vaccination in Zimbabwe, have shown that even well-planned vaccination programs can be crippled rapidly when uncertainties about vaccine safety and efficacy arise. Similarly, the recent Ebola vaccination experience in some African countries pointed out that the introduction of new vaccines as a crucial public health intervention strategy can be met with social-cultural, religious, and political resistance.[23]

As mentioned before, we are yet to see the full effects of the COVID-19 pandemic on vaccine confidence, but previous research may give experts clues regarding issues and possible solutions. A worrisome recent study conducted by NORC (University of Chicago) shows that "if a vaccine against coronavirus becomes available to the public, 49% say they plan to get vaccinated, and 20% say they will not. Another 31% are not sure"[24]. Another survey conducted in Jordan, Kuwait, and other Arab countries, showed that "beliefs that

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[18] LARSON, H.; FIGUEIREDO, A.; KARAFILLAKIS, E.; RAWAL, M. State of vaccine confidence in the EU 2018. Luxembourg: European Commission, 2018. p. 7.

[19] KOSARKOVA, Alice; MALINAKOVA, Klara; VAN DIJK, Jitse P.; TAVEL, Peter. Vaccine refusal in the Czech Republic is associated with being spiritual but not religiously affiliated. Vaccines, v. 9, n. 10, 2021.

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[23] EKWEBELEM, O. C.; YUNUSA, I.; ONYEAKA, H.; EKWEBELEM, N. C.; NNOROM-DIKE, O. COVID-19 vaccine roll-out: will it affect the rates of vaccine hesitancy in Africa?. Public Health, 2021.

[24] NORC UNIV. OF CHIC. Expectations for a COVID-19 vaccine. APNORC.org. The Associated Press-NORC Center for Public Affairs Research, 2020. Disponível em: http://www.apnorc.org/projects/Pages/Expectations-for-a-COVID-19-Vaccine.aspx. Acesso em: 9 jul. 2020.

COVID-19 vaccines are intended to inject microchips into recipients and that the vaccines are related to infertility were found in 27.7% and 23.4% of respondents, respectively"[25].

Although most people anxiously expect vaccines' positive effects, many anti-vaccine groups are already wary of any government interventions to increase vaccination rates. Some of these groups, for example, have organized demonstrations in COVID-19 vaccination sites, resulting in the closure for a day of at least one of them (Dodger's stadium in Los Angeles, CA). These movements in particular and hesitancy, in general, are a public health risk. Vaccines provide individual and group protection against specific diseases. Individuals that are not vaccinated can suffer the consequences of a preventable illness while causing others to be infected[26]. Vaccine hesitancy, therefore, is an individual issue that becomes a social problem since, to obtain herd immunity, a minimum percentage of the group has to be vaccinated.

To avoid the disease, an individual may choose to vaccinate or decide to act as a free rider, enjoying the benefits of such herd immunity[27]. Group or herd immunity is usually acquired when 80% or more of the population is immune to the disease. However, that varies from country to country[28], and it is dependent on the different diseases. For measles, a society may reach herd immunity if 92-95% of the population is immune and 83-90% in the case of rubella. For COVID-19, the minimum threshold has been set between 60% to 75%[29], with the CDC recommending 85%[30]. This rate may extend the benefit of immunization to those who cannot get vaccines due to other reasons. As Navin claims, a high vaccination rate may allow individuals to avoid vaccines "without imposing significant risks of serious harms on others"[31].

"The WHO estimates that vaccination prevents approximately 2.5 million deaths annually"[32], but the positive effects of vaccines are not only related to health, they are also indirectly tied to the economy:

> The United States spends ten billion dollars each year to treat vaccine preventable diseases. If the trend against vaccination continues to increase and more people are infected with vaccine preventable diseases, increased healthcare expenditures will inevitably follow. Although the economic impact is substantial, the impact on human life is even more alarming. Current figures suggest that approximately 30,000 people lose their lives each year as a result of vaccine preventable diseases[33].

Since vaccine hesitancy levels have been increasing in some parts of the world during the last few years, understanding their sources can shed light on the path health policy experts should take to reduce hesitancy during the COVID-19 pandemic. Although the diseases are different in the previous years, it is very plausible that some of the general reasons behind hesitancy are common[34]. This historical antecedent can

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be helpful in COVID-19 related policies. Mitesh Patel, director of the Penn Medicine Nudge Unit at the University of Pennsylvania in Philadelphia, and a physician at the Crescenz VA Medical Center claims, for example, that "health systems could check who has not received an influenza vaccine in the past, which might reveal who is likely to be vaccine hesitant"[35]. Since there is much that we can learn from previous research regarding hesitancy, considering the work conducted by leading experts like Heidi Larson and other authors can give public health specialists a head start in developing interventions to tackle possible issues in vaccine uptake even before they appear.

Extensive research conducted by Larson herself and others[36], while describing the state of vaccine confidence, suggested three different causes for hesitancy: complacency (related to the perceived risk of the disease), convenience (related to the accessibility of vaccine services), and confidence (related to the trust in the safety and effectiveness of vaccines and/or health care providers). Hesitancy, Larson claims[37], has different components that belong to three domains: one being the historical, sociocultural, and environmental context; the other related to individual and group influences (perception of vaccines, etc.); and the third one related explicitly to vaccines themselves. This framework applies to different diseases (including COVID-19) and vaccination.

The different reasons and components behind hesitancy have to be tackled by different interventions. Understanding those common reasons and elements should be essential for policymakers to increase efficiency and equity in vaccination rates. The ethical and political analysis of policies must also consider that different reasons for hesitancy will demand different interventions. Therefore, any rigorous political or ethical analysis of a determined intervention must always ponder the reasons behind the hesitancy that it tries to change. Without knowledge of those reasons, policies would be flying blind, and their ethical analysis would be a stab in the dark. Research also shows that political action or inaction in one country or region can impact others worldwide[38].

It is necessary to distinguish between confidence, hesitancy, and refusal, as they are the three different individual approaches to vaccinations. Any of those approaches can also be compliant or non-compliant: someone may be fully confident but not-compliant due to external frictions (i.e., financial, transportation) not following, therefore, her vaccination schedule; it is also possible that someone hesitant may get a vaccine (compliant) thanks to a default option in place when she visits a health care provider. The reasons for non--compliance can be social, economic, cognitive, related to psychological biases, axiological, or geographical. Someone confident may not comply with vaccination due to lack of transportation, for example. Those reasons interconnect to create a complex plurality of causes for vaccine hesitancy. When an individual is confident, the goal is to remove structural frictions and ensure that she does not fall into hesitancy or refusal. When someone refuses, interventions from different approaches have to be used to switch their mind. Policymakers should focus their efforts on hesitant people since they have a higher chance of becoming vaccinated than those who refuse. Nudges, a set of tools from behavioral public policy, show promises with hesitant individuals in different scenarios[39], particularly in vaccination[40]. Some research shows a direct

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[40] MILKMAN, K. L.; PATEL, M. S.; GANDHI, L. et al. A megastudy of text-based nudges encouraging patients to get vaccinated

increase in vaccination rates after the deployment of nudges[41]. This paper will examine the connections between nudges and hesitancy in future pages. The following paragraphs will review a collection of general causes that touch different diseases and vaccines, intending to show that behavioral public policy interventions can provide an efficient approach without raising serious ethical or political issues.

Social norms affect our attitudes (hesitancy, confidence, or refusal) and behavior (compliance or not) towards vaccination[42]. They alter people's behavior and attitudes in the "right" or "wrong" direction: "People's behaviour is influenced by social norms: what they perceive that others are doing or what they think that others approve or disapprove of"[43]. Different racial and ethnic groups may have different attitudes that come from the group's norms. For example, Black Americans in the USA may not trust vaccination due to the particular history of oppression and structural racism from the government and the experiments they were subjected to in The Tuskegee Syphilis Study[44]. This sentiment is still significant during the COVID-19 pandemic. A survey conducted[45] showed that Black Americans reported lower influenza vaccine uptake and COVID-19 vaccine acceptance than any other racial group. Regarding COVID-19 vaccination, hesitancy for African-Americans was 41.6%, while for Hispanics, it was 30.2%[46]. Naturists and homeopaths are hesitant as a group due to cognitive reasons: according to them, vaccines weaken the immune system, so they are not the best approach[47].

Social media currently plays an important role here. It is not enough to consider the information distributed (fake or not), but also who shares it. Our brain weighs differently the information shared by socially and politically aligned individuals and groups. Anti-vaccine movements, for example, have been targeting HPV vaccination with negative posts on social media[48]. Russian accounts have also been polarizing the debate[49] about vaccines: "Of particular importance for public health, the pro-Trump personas tended to oppose vaccines, while the anti-Trump ones did not." A recent piece by National Public Radio of the USA (NPR) highlighted that although the chance of dying after getting a COVID-19 vaccine is practically nonexistent, some days, more than 25% of the news shared were related to someone dying after getting the vaccine[50]. In our current pandemic in the United States, those against masks' use are aligned with anti-vaccine sentiments and often politically placed at the conservative right[51]. Those who were chanting "stop the steal" after the election are also those who are becoming more hesitant, calling the COVID-19 vaccines

at an upcoming doctor's appointment. Proceedings of the National Academy of Sciences of the United States of America, v. 118, n. 20, 2021.

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45 MALIK, Amyn A.; MCFADDEN, SarahAnn M.; ELHARAKE, Jad; OMER, Saad B. Determinants of COVID-19 vaccine acceptance in the US. EClinicalMedicine, v. 26, 2020.

46 KHUBCHANDANI, Jagdish; MACIAS, Yilda. COVID-19 vaccination hesitancy in Hispanics and African-Americans: a review and recommendations for practice. Brain, Behavior, & Immunity Health, v. 15, p. 100277, 2021.

47 GRIGNOLIO, Andrea. Vaccines: are they worth a shot?. Springer International Publishing, 2018.

48 PERKINS, Rebecca B.; FISHER-BORNE, Marcie; BREWER, Noel T. Engaging parents around vaccine confidence: proceedings from the national HPV vaccination roundtable meetings. Human Vaccines & Immunotherapeutics, v. 15, n. 7-8, p. 1639-1640, 2019.

49 WALTER, Dror; OPHIR, Yotam; JAMIESON, Kathleen Hall. Russian Twitter accounts and the partisan polarization of vaccine discourse, 2015-2017. American Journal of Public Health, v. 110, n. 5, p. 718-724, 2020.

50 PARKS, Miles. Misleading facts fuel COVID-19 misinformation, evade social media moderation. NPR: National Public Radio, 2021.

51 MAYS, Mackenzie. From anti-vax to anti-mask: school districts brace for parent resistance. Politico, 2020. Disponível em: https://www.politico.com/states/california/story/2020/07/02/from-anti-vax-to-anti-mask-school-districts-brace-for-parent-resistance-1295968. Acesso em: 6 jul. 2020.

a "bioweapon"[52]. As mentioned before, hesitancy is context-dependent, so social and peer pressure affects how people feel and behave[53].

There are also economic reasons for vaccine non-compliance[54]. Socio-economic factors are associated with vaccine acceptance[55]. For instance, in the United States, individuals with private health insurance may have to cover the cost of co-pays if the vaccine is administered in a health clinic. People may also have to pay for transportation or take time off work. The type of health care system in a region is additionally one of the economic factors involved in vaccination uptake, as well as the economic level of the country, which is an associated factor in vaccination: "vaccination uptake in high-income countries such as the United Kingdom, European, and North American countries is not associated with socioeconomic factors, while socio-economic factors are strongly, positively correlated with vaccination uptake in less developed regions of the world"[56]. Besides the financial elements, other external factors are associated with vaccine hesitancy: geographical reasons and other location-related issues are frictions that contribute to vaccination non-compliance. Research shows that having a medical home increases vaccination compliance[57]. To reduce frictions and incentivize people's travel to a facility for vaccination purposes, Esther Duflo and others, for example, increased the vaccination rate by providing lentils as a reward in a region in India[58].

People sometimes have cognitive reasons for refusal "Vaccine refusers are not only more educated, but they also often have more knowledge about vaccines than parents who vaccinate"[59]. Accordingly, as we will see, it would be challenging and costly to use education to reduce hesitancy in this group of people. Cognitive reasons are difficult to change, and sometimes, although some educational approaches seem to increase vaccination rates[60], other educational interventions are not enough. There is a lot of noise, and adding more information for its sake without weighing its effects, can produce the opposite result.

Ever since Amos Tversky and Daniel Kahneman published his famous work[61], we have been aware of how heuristics and biases affect our decision-making. These types of biases are at the center of behavioral public policy. As mentioned before, people may have omission bias or status quo bias (the default choice may be non-vaccination). They may also show optimism bias and will not get vaccinated, underestimating the likelihood of getting infected[62]. They may suffer from framing effects when considering the risk of infection. People may not get vaccinated because that is what they have been doing, and they have not fallen ill (inertia). Some may show present biases, tending not to think about future consequences as much as the

[52] MACFARQUHAR, Neil. Far-right extremists move from 'stop the steal' to stop the vaccine. The New York Times, 2021.

[53] LARSON, Heidi J.; JARRETT, Caitlin; ECKERSBERGER, Elisabeth; SMITH, David M. D.; PATERSON, Pauline. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007-2012. Vaccine, v. 32, n. 19, p. 2150-2159, 2014.p. 2151.

[54] EVANS, William Douglas; FRENCH, Jeff. Demand creation for COVID-19 vaccination: overcoming vaccine hesitancy through social marketing. Vaccines, v. 9, n. 4, 2021.

[55] LARSON, Heidi J.; JARRETT, Caitlin; ECKERSBERGER, Elisabeth; SMITH, David M. D.; PATERSON, Pauline. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007-2012. Vaccine, v. 32, n. 19, p. 2150-2159, 2014.

[56] GIUBILINI, Alberto et al. Nudging immunity: the case for vaccinating children in school and day care by default. HEC forum: an interdisciplinary journal on hospitals' ethical and legal issues, v. 31, n. 4, p. 325-344, 2019. p. 326.

[57] SMITH, Philip J.; SANTOLI, Jeanne M.; CHU, Susan Y.; OCHOA, Dianne Q.; RODEWALD, Lance E. The association between having a medical home and vaccination coverage among children eligible for the vaccines for children program. Pediatrics, v. 116, n. 1, p. 130-139, 2005.

[58] BANERJEE, A. V.; DUFLO, E.; GLENNERSTER, R.; KOTHARI, D. Improving immunization coverage in rural India: a clustered randomized controlled evaluation of immunization campaigns with and without incentives. British Medical Journal, v. 340, n. C2220, 2010.

[59] NAVIN, Mark. Values and vaccine refusal: hard questions in ethics, epistemology, and health care. Routledge, 2015. p. 10.

[60] BLAKE, Holly; FECOWYCZ, Aaron; STARBUCK, Hollie; JONES, Wendy. COVID-19 Vaccine Education (CoVE) for health and care workers to facilitate global promotion of the COVID-19 vaccines. International Journal of Environmental Research and Public Health, v. 19, n. 2, 2022.

[61] TVERSKY, A.; KAHNEMAN, D. Judgment under uncertainty: heuristics and biases. Science, v. 185, n. 4157, p. 1124-1131, 1974.

[62] VAN BAVEL, Jay J. et al. Using social and behavioural science to support Covid-19 pandemic response. Nature Human Behaviour, v. 4, n. 5, p. 460-471, 2020.

present ones (since vaccines carry a present cost for a possible safety in the future, people may argue that they do not need to get them). Subjective perception of risks influences vaccine confidence. "From a rational choice perspective, vaccination is more likely when subjective risks of the disease outweigh risks of the vaccination"[63]. People's biases "might lead them to disregard or misinterpret available evidence"[64]. Suppose a person knows someone who suffered painful side effects due to vaccination. In that case, availability heuristics may induce a bias that can cause COVID-19 vaccine refusal (similar to people not wanting to go to the ocean if there was a shark attack a few days before).

Knowledge regarding vaccine development can influence values. For example, although not very common, some people may be aware that there are vaccines manufactured from elective abortions: three of these vaccines, M-M-R-II (rubella), VARIVAX (varicella), and HAVRIX (hepatitis A), utilize cell lines WI-38 or MRC-5 derived from fetal tissues from elective abortions in the 1960s to produce the weak viruses used in these immunizations whose efficacy has been confirmed[65]. Another example: using the term "Operation Warp-Speed" for vaccine development in The United States by President Trump's administration could have reduced people's confidence since it indicated a rush in its development[66].

People may also have the wrong information. Some may have the false[67] idea that there is a link between vaccines and autism (caused by the infamous retracted study published by Andrew Wakefield in *The Lancet*). In general, people are not good with probabilities and statistics (i.e., most people who get disease had been vaccinated), and they do not understand risk factors (some people cite the risk of vaccination effects neglecting the risk of non-vaccination). Furthermore, Russian trolls have been infesting social media with noise and misinformation[68], increasing the chance for false beliefs.

In some cases, individuals have value-related reasons (axiological) for refusing or being hesitant to vaccines. Their religion might not allow the use of some vaccines if they were developed from the tissue of electively aborted fetuses[69]. Other socio-political values (libertarians, naturalists, homeopaths, or anti-establishment) may produce different attitudes against vaccines. Moral values can also be a contributing cause. For example, if successful, vaccines may motivate omission by egoists: "There is evidence that forgoing vaccination for oneself because others are vaccinated (free-riding) is evident in some adults' vaccine decisions for themselves"[70]. This aspect is interesting from a classical rationality approach. It may seem irrational to do something that will carry costs when it is not needed due to herd immunity.

As a conclusion for this section, a worrisome structural challenge is worth mentioning: equity in vaccine distribution. Since there is global inequity between countries' different access to vaccination, and nationally, specific populations are left behind, some are already calling for racial equity in vaccine distribution[71]. For example, at the time this paper was written, vaccination levels in Chicago were higher in affluent neighborhoods where the disease infection rate is lower[72]. In the USA, the Health Resources and Services Ad-

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[64] GIUBILINI, Alberto et al. Nudging immunity: the case for vaccinating children in school and day care by default. HEC forum: an interdisciplinary journal on hospitals' ethical and legal issues, v. 31, n. 4, p. 325-344, 2019. p. 326.

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[71] BRUCE, Lori; TALLMAN, Ruth. Promoting racial equity in COVID-19 resource allocation. Journal of Medical Ethics, 2021.

[72] CHASE, Brett; MALAGÓN, Elvia. Chicago vaccine distribution: few on South Side, West Side get COVID shots so far. Chicago

ministration (HRSA) and the Centers for Disease Control and Prevention (CDC) are launching a program to remedy these types of inequity. In vaccination, there are structural and behavioral reasons for non-compliance. It would be unfair (and inefficient) to limit policy efforts to change individuals' behavior without also fixing the systemic issues behind the health care gaps.

Therefore, policymakers must ensure equity while deploying interventions to ensure high enough vaccination uptake to guarantee herd immunity. It is only then that vaccination achieves the health and economic benefits expected. When examining possible policies, experts must think about efficiency, political and individual liberties, ethical aspects, expenses, and people's bounded rationality: "Governments have moral and legal responsibilities to safeguard their populations, both collectively and individually, facilitating as much freedom as can be justified in a democratic, rights-oriented society"[73]. There is robust research about traditional interventions based on a complete rationality model (mandates, educational tools). Still, more research is needed about how behavioral insights may help navigate between the Scylla of paternalism and the Charybdis of libertarian principles. Public policies based on behavioral insights can provide a more efficient theoretical framework capable of dealing with ethical and political issues readied by those traditional approaches. The following sections will examine the different proposals from this new field to explore the possibility of its use to increase vaccination confidence and compliance.

3 Behavioral Public Health Policy: ethics, politics, and efficiency

Experts may focus on structural frictions, attitudes, and behavior to increase vaccination rates and achieve herd immunity. Accordingly, different interventions must be used depending on what the aspiration is. The following pages will mainly focus on interventions that target attitudes and behaviors.

To increase the effectiveness of policies, one must consider a comprehensive approach of individuals' rationality: individuals not only act to achieve goals with their behavior, but they also express themselves, their values, and their social and political identity. Since their attitudes and behavior will also be the outcome of a rationality that is bounded (the behavioral side of the policy cube), policymakers should assume and incorporate, therefore, the instrumental, axiological, cognitive, ecological, social, and bounded (behavioral) elements of rationality in the development of interventions. Understanding rationality comprehensively[74] also considering the behavioral aspects[75] will help experts account for the different reasons behind vaccine hesitancy, deploying, consequently, interventions that target those reasons. A monistic view of rationality that reduces decision-making as merely instrumental will cause people to think that agents may be acting irrationally when refusing vaccination, while in reality, most people have reasons for doing what they are doing. Understanding those reasons (expressive rationality) will provide more robust and effective interventions.

The intersection between the distinct but connected reasons to avoid vaccination mentioned in the previous section can lead experts to a comprehensive view of the complex issue of vaccine hesitancy and, consequently, to interventions that are more efficient while considering ethical and political aspects of society (since they incorporate and understand the reasons people have behind their hesitancy).

Sun-Times, 2020.

[73] MACDONALD, Noni E.; HARMON, Shawn; DUBE, Eve; STEENBEEK, Audrey; CROWCROFT, Natasha; OPEL, Douglas J.; FAOUR, David; LEASK, Julie; BUTLER, Robb. Mandatory infant & childhood immunization: rationales, issues and knowledge gaps. Vaccine, v. 36, n. 39, p. 5811-5818, 2018. p. 5813.

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[75] HORTAL, Alejandro. Nudging and educating: bounded axiological rationality in behavioral insights. Behavioural Public Policy, v. 4, n. 3, p. 292-315, 2020.

These interventions must always account for our bounded rationality resting on behavioral insights to have a more realistic view of human decision-making. The idea that if we just educate citizens about the importance of vaccines by only providing facts (the rational, non-regulatory, internal edge of the policy cube described before) is politically and ethically relevant but naive since it neglects individuals' behavioral components. Betting simply on mandates, regulations, and financial incentives or punishments is politically and ethically compromising, and in democratic societies, it may backfire.

Behavioral public policy is a recent field that tries to close the gap between the interventions that assume humans are perfectly rational and the reality of human behavior. Suppose a policymaker attempts to increase blood donation in a region where donors give for free on a volunteer basis. A traditional approach based on a complete rationality model would suggest that a monetary reward would cause an increment in people giving blood since they were not receiving any compensation before. Research shows that there was an opposite effect when this was tried in some instances, and blood giving decreased[76]. The answer is complex, but experts claim that when monetary incentives are added, the action may no longer be considered moral, becoming a financial exchange not worth performing, crowding out people[77]. When a financial aspect is added, we reframe the situation, thinking differently about our choices (2017, 153). Sometimes it is crucial to make salient the moral aspect of a situation.

Epistemologically speaking, data should support the efficiency of interventions. Ethically, policymakers should find a balance between freedom not to get vaccinated and the responsibility of health policies that protect the community. The following paragraphs will review some philosophical aspects of traditional (rational) and behavioral interventions to clarify how experts may use them to increase vaccination confidence and uptake.

Traditional mandates, regulations, and financial penalties are the classical (rational) regulatory approach. They are often used in vaccination efforts, but they may backfire if not deployed with educational and cognitive approaches. There is no standard approach to mandatory vaccination[78]. Citizens must understand the need for mandates since, ultimately, patients will have to accept vaccination, or parents will have to expose their children to vaccines. Mandates usually target employees in specific settings (healthcare facilities) and children. For example, in the United States, "All 50 states allow children to be exempted for medical contraindications to vaccines, 48 states (all but West Virginia and Mississippi) allow religious exemptions, and 19 states allow personal belief or philosophical exemptions"[79]. In Ukraine, for example, vaccines are mandatory and free of charge, but the vaccination refusal rate has been increasing dramatically from 4,893 in 2007 to 23,147 in 2016[80]. Poland's case is similar. In this country, STOP NOP, a group fighting mandatory vaccination, organizes demonstrations and sends letters to the president to change regulations. Standard mandates backfire, and in democratic societies may cause deregulations. If a country or a region moves towards mandatory regulation, governments must ensure "financial sustainability, uninterrupted supply and equitable access to all the population"[81]. Mandates require evidence and monetary compensation if problems arise since no drug is 100% effective or safe.

[76] MELLSTRÖM, Carl; JOHANNESSON, Magnus. Crowding out in blood donation: was Titmuss right?. Journal of the European Economic Association, v. 6, n. 4, p. 845-863, 2008.

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[78] MACDONALD, Noni E.; HARMON, Shawn; DUBE, Eve; STEENBEEK, Audrey; CROWCROFT, Natasha; OPEL, Douglas J.; FAOUR, David; LEASK, Julie; BUTLER, Robb. Mandatory infant & childhood immunization: rationales, issues and knowledge gaps. Vaccine, v. 36, n. 39, p. 5811-5818, 2018.

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[81] MACDONALD, Noni E.; HARMON, Shawn; DUBE, Eve; STEENBEEK, Audrey; CROWCROFT, Natasha; OPEL, Douglas J.; FAOUR, David; LEASK, Julie; BUTLER, Robb. Mandatory infant & childhood immunization: rationales, issues and knowledge gaps. Vaccine, v. 36, n. 39, p. 5811-5818, 2018. p. 5811.

In vaccination, most consider having a choice as essential, and many people agree that coercive vaccination policies are not desired unless they are needed for the safety of the group[82]. For example, in infant vaccination, Navin argues that parental autonomy in pediatric decision-making is not as morally valuable as adult patients' autonomy. Mandates should have less friction in the pediatric field[83].

Incentives can also be used, and, in theory, they are a form of mandate. A monetary approach, although difficult to implement, should be close to a regulation where non-vaccinated individuals have a higher co-pay or higher insurance costs (similar to tobacco users): "Charging higher insurance premiums based on an individual's vaccination status would provide the same incentive that a tax would achieve"[84]. A discount for a pre-commitment to vaccination may be more efficient. Individuals will not see this as paying more but as getting a discount if they are up to date with vaccination. Other financial incentives can be used similar to what Duflo and others did with lentils in India[85]. Mandates and regulations tend to have a different spectrum of rigidity depending on the vaccine, the country, and the region. Sometimes just the announcement of a mandate can result in an increase in vaccination.[86]

Some researchers[87] have argued that vaccination benefits are comparable to the use of seat belts and that a similar approach can be taken by public policy experts arguing that a form of coercion is justified. Ethically, mandates are complex tools, and governments should only deploy them with evidence and education. As Sunstein claims: "It should be agreed that if a mandate would increase social welfare, suitably defined, there is a strong argument on its behalf"[88]. If mandates are in place, they should work parallel with educational campaigns that consider behavioral aspects of our cognition and bounded rationality. Suppose a nudge, as we will see, is found to be effective in maintaining a high immunization rate. In that case, it should be preferable since it can respect choices while guaranteeing herd immunity. Nudges must also work in tandem with educational approaches, as Hortal argues[89].

Educational interventions based on merely informing about facts are costly and sometimes do not work. For example, while most people are broadly educated about diet and exercise, education rarely affects behavior. From a behavioral perspective, it is not evident that possessing the information and having the knowledge will work towards vaccination, but it is necessary politically and ethically. Their effectiveness depends on who provides the information and how it is provided. Traditional education interventions based on the assumption that humans are entirely rational, neglect that the message is often affected by the person who delivers, where it is delivered, how, or when: "Empirical work suggests that convincing people to vaccinate their children is often not a matter of educating them by providing more factual information"[90]. Educational efforts, for example, often backfire if the message provided is about politically loaded issues[91].

[82] GIUBILINI, Alberto et al. Nudging immunity: the case for vaccinating children in school and day care by default. HEC forum: an interdisciplinary journal on hospitals' ethical and legal issues, v. 31, n. 4, p. 325-344, 2019.

[83] NAVIN, Mark C. The ethics of vaccination nudges in pediatric practice. HEC forum: an interdisciplinary journal on hospitals' ethical and legal issues, v. 29, n. 1, p. 43-57, 2017.

[84] ESSHAKI, E. The Affordable Care Act, experience rating, and the problem of non-vaccination. U. Mich. JL Reform Caveat, v. 49, 2015. p. 79.

[85] BANERJEE, A. V.; DUFLO, E.; GLENNERSTER, R.; KOTHARI, D. Improving immunization coverage in rural India: a clustered randomized controlled evaluation of immunization campaigns with and without incentives. British Medical Journal, v. 340, n. C2220, 2010.

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[90] GIUBILINI, Alberto et al. Nudging immunity: the case for vaccinating children in school and day care by default. HEC forum: an interdisciplinary journal on hospitals' ethical and legal issues, v. 31, n. 4, p. 325-344, 2019.

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In some instances, parents' negative stories about vaccination are challenging to counteract with scientific evidence, and their exposure to false narratives can also result in a decrease in vaccination[92]. Nudges may work better in these situations. When people share their personal experiences with vaccination online, a new dimension appears, adding complexity and noise to the discussion. Our bounded rationality will make recent cases the norm, especially when they are negative: "The results of one large-scale experimental study done by Betsch and collaborators have shown that surfing on an anti-vaccination website for 5–10 min had a negative influence on risk perceptions regarding vaccinations and on the decision to vaccinate"[93].

Nudges are libertarian paternalistic behavioral interventions that may help policymakers navigate between the ethical, political, and efficiency difficulties of mandates and educational tools. They influence people's behavior by organizing the choice environment to produce an outcome that increases the happiness of the group and the individual as judged by themselves. Concerning vaccination, the CDC in the USA posits that psychological components are a fundamental factor for hesitancy. Experts should consider them when researching policies: "The Centers for Disease Control and Prevention Healthy People 2020 initiative set a target influenza vaccination goal of at least 70% for all individuals aged 6 months and older. However, vaccination rates remain lower than 50% nationally [...] obstacles to annual influenza vaccination include psychological barriers that drive vaccine hesitancy […]"[94]. By their own definition, nudges do not carry costs or burdens to any of the alternatives, reduce options, or hide relevant factual information[95].

Nudges are liberty preserving by nature and cost-effective[96]. They target specific biases of our brains, and they tend to be cross-cultural: a default, the placement of a poster, the lines on the grocery store during COVID-19 to mark the 6 feet of separation, or the noise from the car when the seat belt is not on. Although usually considered separated, social nudges are a particular form of intervention[97]. Social nudges tend to make people's behavior salient when others observe it. In vaccination, this can be achieved by showing people getting the vaccines (as Elvis Presley did with the poliomyelitis vaccine). Establishing or extending social norms can be done by identifying role models and ensuring that they show the desired behavior, not only informing people. Descriptive behavior has more power to influence[98]. Decision heuristics (highlighting consensus or descriptive norms among a group of trusted experts) may also work[99]. Research shows that group goals are more effective than individual goals in some contexts[100], or even making the idea of reciprocity salient by pointing out that if they did it for you, you should do it for them[101].

[92] GÖKÇE, Ayşe; KARAKAŞ, Neşe; ÖZER, Ali; BENTLI, Recep. Investigation of knowledge, attitude and behaviours of parents refusing childhood vaccines in Malatya, an eastern city of Turkey. Central European Journal of Public Health, v. 29, n. 3, p. 183-186, 2021.

[93] DUBÉ, Eve; LABERGE, Caroline; GUAY, Maryse; BRAMADAT, Paul; ROY, Réal; BETTINGER, Julie. Vaccine hesitancy: an overview. Human Vaccines & Immunotherapeutics, v. 9, n. 8, p. 1763-1773, 2013. p. 1766.

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Practitioners should use presumptive language[102] instead of participatory: Presumptive language treats vaccination as default, while participatory considers it an option that must be elected. Presumptive language as default works: "three times as many parents resisted vaccine recommendations when providers used a participatory rather than presumptive initiation format"[103]. Defaults tend to work, and even if there is no statistical significance, most times, the default option on influenza vaccination, being in the opt-out condition, did increase the likelihood of getting the vaccine[104]. Precommitment devices and techniques also use nudges, so calendars, reminders, text messages, or phone calls shall be used. Defaults at schools, sport-clubs, or medical facilities, also help to battle inertia[105].

To make information match the cognitive capabilities of individuals, practitioners and policy experts should inform patients and caregivers with natural frequencies instead of probabilities[106].

Some nudges have been deployed to fight practitioners' decision fatigue[107] by incorporating shared decision-making among health care staff and enhancing automated features in the electronic health record. Some nudges use different communication frames and informative messages to make specific aspects salient to the different demographics. For example, suppose experts want to target economically-minded individuals. In that case, they can use an economic message ($10 Bill and 30,000 lives are wasted every year in vaccine-preventable diseases): "Parents who refuse to vaccinate their children do not just threaten their children's health and their community's health; they also contribute to substantial economic costs"[108]. For environmentally minded people, experts can exploit the idea that vaccinated individuals are less likely to be sick, need medicines, and be hospitalized.

Besides nudges, there are other tools available that rest on behavioral insights. Budges[109] are a type of mandate (external) that considers behavioral insights, mainly to prevent private corporations from exploiting people's biases for their benefit and with negative consequences for citizens. Since objectively vaccinations carry positive effects, these regulations had to be deployed towards others who may try to prevent vaccination efforts (Russian trolls, misinformation in social media, or fake news).

Whereas nudges rely on defaults and the manipulation of choice architecture to steer people towards better choices, the objective of *boosts* is to develop good decision-making competences[110]. Boosts aim at building new decision competences or fostering existing ones. Accordingly, experts can establish self nudges if they know how they work[111]. This approach would work for practitioners and health care facilities to ensure compliance with reminders. To this end, Ralph Hertwig proposes three different types of boosts: Risk literacy, uncertainty management, and motivational boosts[112].

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[104] LEHMANN, Birthe A.; CHAPMAN, Gretchen B.; FRANSSEN, Frits M. E.; KOK, Gerjo; RUITER, Robert A. C. Changing the default to promote influenza vaccination among health care workers. Vaccine, v. 34, n. 11, p. 1389-1392, 2016. p. 1391.

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Ethically and politically speaking, among all different alternatives in public policy regarding vaccination (external, internal, behaviorally informed or based on rational assumptions, regulatory, or liberty preserving), nudges (internal, liberty preserving, and non-regulatory) promise to deliver efficient interventions without carrying the ethical and political costs of other approaches. As long as governments implementing them are transparent about their use and are aware of their limitations[113], nudges can be a promising tool to steer people's behavior. Like Gerd Gigerenzer[114], some authors argue that nudges are not as efficient as they promise, and sometimes they may be a type of manipulation[115]. There is also the danger of thinking that all problems are behavioral, neglecting the systemic or structural causes of specific issues in our society. Vaccine hesitancy and refusal have some structural roots that policymakers must also address.

4 Concluding remarks

Mandates and regulations, although necessary in certain circumstances for the benefit of a group in order to achieve herd immunity, reduce freedom. They are sometimes ethically justifiable if efficient for the group's safety, and no other intervention can be used. "Mandatory immunization requires a principled calculus, a careful weighing of the indications, evidence, and arguments, regarding the responsibilities of public authorities to act in support of the public good"[116]. They are also justified in the case of infant vaccination since patients are under the care of others and cannot independently decide[117]. Mandatory approaches should always consider individuals' rights, and that is always an arduous task to accomplish when dealing with public health. Mill's harm principle can provide a basic philosophical foundation for a case of mandatory vaccination. If mandatory vaccination is in place, financial compensation for adverse effects shall be provided (these compensation programs are not common in low-income countries). Mandates may backfire and produce an adverse reaction in a democratic society as it happened in Ukraine, Poland, or Serbia.

Considering the political issues with mandates, and since educational interventions incur costs and may not be practical, nudges and other behavioral interventions can provide a robust and ethical approach to vaccination policies. Nudges are not exempt from ethical and political problems: they may represent a challenge to individuals' autonomy if they work under their radar, may be seen as manipulation, or may not be effective, causing more damage than benefit. According to Alberto Giubilini[118], there are three reasons why nudging vaccination is nevertheless ethically acceptable: they benefit individuals and the community if they undermine autonomy, they do it ethically considering the objective they seek and exploit the biases that would lead people to make choices they would not object to when deliberating[119]. If nudges (as in mandates) are used, some type of educational approach must always be in place as disclosure.

In some scenarios, boosts can be more effective than traditional educational tools since they use our heuristic processes. They target our competences and have a longer-lasting effect than nudges. Budges can be

Psychological Science, v. 12, n. 6, p. 973-986, 2017.

113 RIBEIRO, Marcia Carla Pereira; DOMINGUES, Victor Hugo. Paternalismo libertário e políticas públicas: intervenção e transparência. Revista Brasileira de Políticas Públicas, v. 11, n. 1, 2 abr. 2021.

114 GIGERENZER, Gerd. On the supposed evidence for libertarian paternalism. Review of Philosophy and Psychology, v. 6, n. 3, p. 361-383, 2015.

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118 GIUBILINI, Alberto et al. Nudging immunity: the case for vaccinating children in school and day care by default. HEC forum: an interdisciplinary journal on hospitals' ethical and legal issues, v. 31, n. 4, p. 325-344, 2019.

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considered a better approach to traditional mandates for they consider a behavioral point of view. Nudges, boosts, shoves, and budges are (or should be) evidence-based instead of resting on ideological factors. Most nudges, for example, are tested using randomized control trials. Although they do not guarantee effectiveness, trials can at least prove that the policy worked in a specific setting[120].

External frictions, internal attitudes, and limited cognitive processes are some of the causes behind vaccine hesitancy. This paper has argued that policymakers should rely on nudges in conjunction with other behavioral interventions to improve vaccine confidence. The libertarian paternalistic approach of nudges, since it does not remove choices, is a convenient and effective procedure to create policies without paying the high political and ethical costs of mandates. Educational intervention should always be deployed but understanding their limited potential. One element to consider in their defense is that nudges cannot be avoided: the choices must always be organized in a specific way, there will always be a choice architect, and a default option will always exist, even if the default is no option.

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