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# Reducing administrative burdens to increase the take-up of public services: the case of vaccination intentions

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## ABSTRACT

The literature on administrative burdens has directed attention to why citizens struggle to engage with state services that would benefit them. In a paired conjoint experiment with Italian adults, COVID-19 vaccination intention is positively impacted by reducing administrative burdens, after controlling for vaccine's efficacy and side effects: automatic enrolment of citizens through pre-scheduled appointments, offering a convenient location, less time required to get vaccinated and social norms whereby the majority is in favour of getting vaccinated. Reductions in burdens are especially relevant for adults over the age of 64 and those with neutral or high vaccination intention.


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**KEYWORDS** Administrative burden theory; public healthcare management; discrete choice experiment

## Introduction

This study offers an empirical analysis of the relationship between perceived administrative burdens and vaccine hesitancy. The topic is of growing importance given the centrality of vaccines to public health, and the growth of vaccine hesitancy in wealthy countries (Bedford et al. 2018; Yaqub et al. 2014). In wealthy countries, significant attention has been devoted to individual attitudinal resistance to Covid vaccinations, ranging from lack of trust in institutions to susceptibility to misinformation. While these are critical factors driving vaccine hesitancy and reduced take-up, less attention has been paid to structural and organizational factors that might influence vaccine behaviours. To consider this question, we conducted a paired conjoint experiment with forced choice on a sample of the Italian adult population ( $n = 12,322$ ) to test the relative effect that implementation barriers in the form of administrative burdens in a COVID-19 immunization initiative have on the probability of vaccination uptake.

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Covid created a governance test at every level, as citizens assessed the performance of public officials across a variety of tasks (Amirkhanyan et al. 2023; Mizrahi, Vigoda-Gadot, and Cohen 2021). Persuading citizens to take vaccines was one of those tasks, presenting unique challenges in terms of the need for mass vaccination at high speed, in the context of significant public uncertainty about a new vaccine. Recent studies document a high risk for another pandemic within our lifetime (38 per cent), with evidence that this risk could double in the coming decades. In short, a pandemic similar to Covid-19 may not be novel anymore (Marani et al. 2021). Given the potential for additional public health events, or the need for routinized annual vaccine boosters for COVID-19 or other viruses, it is vital to understand how administrative factors can be structured to minimize burdens.

Italy was the first western country struck severely by the pandemic. The government responded with an early national lockdown, while Italians were blocked from travelling to other countries. However, by the time of our survey, in December 2020, and January 2021, the death rates had dropped to levels consistent with other countries. The restrictions imposed were not unusual, but they were less than in some countries such as the United States. The timing of the survey was a period when vaccines were new and in high demand, amidst a second Covid wave, renewed lockdowns and 'pandemic fatigue' (Beccia et al. 2022).

Our study seeks to demonstrate how an administrative burden framework can help inform public health policy and public management regarding how to increase peoples' willingness to be vaccinated. In doing so, we both expand the range of applications of administrative burden, while connecting public management to public health research (see also Bell et al. 2023; Heinrich et al. 2022; Herd and Moynihan 2021). For instance, our work naturally complements public health scholarship that identifies and measures five psychological antecedents of vaccination that include constraints (Betsch et al. 2018). Similarly, our endeavour nicely resonates with public health work that estimates how constraints affect COVID-19 boosters uptake across different vulnerable groups (Gaffney et al. 2023) or in low- and middle-income countries (Fox, Choi, and Lin 2023). Administrative burden research demonstrates that even seemingly small burdens, like complicated scheduling or distance from a service, can have an outsized impact on access, even when people explicitly want or clearly need that service or benefit (Baekgaard and Krogh Madsen 2023; Halling, Herd, and Moynihan 2022; Sapat et al. 2023). An administrative burden framework offers clear value in connecting public management to public health service delivery. However, administrative burden research centred on health has focused on how poor health undermines access to benefits (Bell et al. 2023; Martin, Delaney, and Doyle 2023) or from a policy perspective, how burdens limit access to health insurance (Fox, Feng, and Reynolds 2023; Fox, Stazyk, and Feng 2020). Attention to how burden impacts public health management, or health care services more broadly, has been negligible. This reflects a tradition within administrative burden research of focusing on enrolment processes for safety net services, but much less on the actual use of specific services, especially for health (for exceptions, see Ali and Altaf 2021, Barnes 2021; Zhang and Wang 2023). In our analysis, we measure the effect that a set of managerial features of a COVID-19 vaccination programme have on the probability that citizens will get vaccinated, while accounting for the clinical features of the vaccine. While much of the behavioural literature on vaccine centres on messaging treatments, we focus instead on the relationship between how burdensome people expect the administrative process to

be with their intent to get vaccinated (vaccine intentions). In short, rather than changing attitudes towards vaccines, we test how easing administrative barriers may affect peoples' willingness to get vaccinated.

With Covid vaccines, conspiracy theories were mainstreamed. Not surprisingly then, much of the existing research on vaccine hesitancy focuses on individual attitudes, and less on administrative actions governments can take (Carpiano et al. 2023; Oost et al. 2022). A flurry of research has documented how political views, distrust in government, distrust in medicine, social relationships, and even moral values, impact peoples' views and behaviours related to the COVID-19 vaccines. Such beliefs clearly matter and may be becoming even more important over time (Stoler et al. 2022). However, as noted by Bedford et al. (2018), not all of those unvaccinated are driven by these attitudes. In short, vaccination up-take can still be affected by policy and managerial changes (Omer et al. 2021).

Our conjoint experimental technique forces subjects to think concretely about how they would respond to specific choices when trying to access a vaccine – in this case different degrees of administrative ease or difficulty. While this is not directly based on an individual's administrative experience, prior work suggests a strong relationship between stated preferences captured using discrete choice experiments and revealed preferences in actual vaccine behaviour (Lambooj et al. 2015). Moreover, the subjects we study and the choices put to them can be generalized to the broader population. Given the growing interest in burden reduction in practice, agencies are being urged to use and generate evidence to better identify and reduce burdens, including consultation with clients and customer experience surveys (Office of Information and Regulatory Affairs 2023). Discrete choice experiments based on surveys represent a relatively low-cost and prospective way to gain causal insights information about perceived burdens, helping practitioners identify the most prominent 'pain points' likely to arise in accessing public services without using a field randomized controlled trial.

We find that intent to vaccinate is positively impacted by reducing administrative burdens. Automatic enrolment of citizens through pre-scheduled appointments, offering a convenient location, less time required to get vaccinated and reducing psychological costs by evoking social norms is conducive to stronger vaccine intention. These interventions go in the same direction of offering a vaccine that has higher efficacy or less frequent side effects. We find that reductions in burdens were especially relevant for adults over the age of 64 and those with neutral or high vaccination intentions. We caution that our results are taken from one country, Italy, which suffered significantly from the early Covid waves, but after a series of changes to the health care system, mortality rates fell in line over time (Beccia et al. 2022). We discuss how focusing on administrative burdens, as opposed to simply difficult-to-change attitudes, may be a more effective mechanism for policymakers to increase vaccine take-up, including in the context of novel viruses and vaccines.

### **Administrative burdens: implications for managing vaccination programmes**

The administrative burden framework offers a useful lens to better understand barriers to vaccine intent beyond attitudes and beliefs. Our theoretical goals in this section are to first apply the administrative burden framework to vaccine

intentions, and second, propose a series of related hypotheses. In terms of health care management more broadly, administrative burdens are not just an issue for physicians navigating complicated bureaucratic processes to ensure payment from the government or private insurers; patients also encounter significant administrative burdens when they are trying to access health care (Herd and Moynihan 2021; Kyle and Frakt 2021). These burdens include learning costs (what does someone need to know to access the service), compliance costs (resources spent on accessing the service, including time spent dealing with bureaucratic processes, administrative fees, or distance to travel to access a service) and psychological costs (such as frustrations, fears, or sense of stigma driven by social norms) (Herd and Moynihan 2018).

While it is not our focus to review the entire literature on vaccine hesitancy, we review research relevant to the types of burdens we test. We do not, for example, examine the effects of payments on vaccine uptake (e.g. Campos-Mercade et al. 2021), or seek to replicate the voluminous work that centres on behaviourally-informed messaging (Milkman et al. 2022; Steinert et al. 2022). Instead, we focus on the frictions involved, following the advice of Thaler and Sunstein (2021, 151): ‘If you want to encourage some behavior, figure out why people aren’t doing it already, and eliminate the barriers that are standing in their way. If you want people to [...] get vaccinated, make it simple for them, above all by increasing convenience’.

Existing evidence around administrative burdens in a range of settings, be it healthcare or other public services, repeatedly shows that even small burdens, such as proximity to a service, can have large impacts on access. For example, the closure of Social Security Administrative Offices, a space where people apply for disability benefits, led to large reductions in disability application and benefit access (Deshpande and Li 2019). The introduction of burdens into enrolment processes significantly reduced access to public health insurance (Arbogast, Chorniy, and Currie 2022). Those with existing poor physical and mental health are disproportionately affected by those burdens (Bell et al. 2023).

The mass vaccination required by the COVID-19 pandemic is an excellent example where administrative burdens can loom large (Brewer et al. 2017; T. Dai and Song 2021; Volpp, Loewenstein, and Buttenheim 2021). The more individuals get vaccinated, and do so quickly, the higher the probability of ending a pandemic, with the least societal costs. But the logistical and managerial challenges of mass vaccination create an implementation problem, not just for the administrators overseeing it but for clients who may be discouraged by long waits or other difficulties. For example, a study in Brazil found that a 30-day delay in COVID-19 vaccination start-up led to more than 30,000 excess deaths (Libotte et al. 2022). Management and implementation capacity that fails to address administrative and organizational barriers which, in practice, make it more difficult for people to get vaccinated, may negatively impact vaccine intent (Betsch et al. 2017; Brewer et al. 2017; Herd and Moynihan 2018). Administrative barriers may be especially problematic for people who have doubts or uncertainty about a new vaccine (Heinrich et al. 2022).

While the overwhelming body of evidence from COVID-19 focuses on attitudes, there were a few studies that documented how specific burdens, especially learning and compliance costs, may negatively impact access. Some studies have examined how appointment reminders might help (Milkman et al. 2022; Sasaki, Saito, and Ohtake 2022). For example, Dai et al. (2021) show that text-based reminders increased the

scheduling of appointments to get the first dose of the vaccine across different demographic groups, with effects persisting for at least 8 weeks.

A few non-experimental studies have focused on a package of options to reduce burden. The adoption of practices such as making vaccine information easily available, removing documentation requirements and accommodating non-native speakers has been associated with higher COVID-19 vaccine take-up in US state governments (Heinrich et al. 2022). A discrete choice experiment study in the United Kingdom found that altering clinical characteristics (such as a vaccine level of protection being 50, 70 or 90 per cent) and managerial features (such as location where the shot is administered being a local general practitioner or a mobile unit) influenced vaccine intention, with the impact of the former being larger than that of the latter and with effects more pronounced for those aged 55 or over (McPhedran and Toombs 2021).

Some studies focus on psychological processes, taking an explicitly behavioural approach. For example, the positive effect of a text-based appointment reminder was heightened when the reminder specified to receivers that the vaccine was reserved for them, thus leveraging on psychological ownership (H. Dai et al. 2021). Similarly, Keppeler, Sievert and Jilke (2022) find that the use of possessive pronouns (e.g. ‘your vaccination’) in messaging increased vaccine intentions, while Milkman et al. (2022) find that text-based reminders that emphasize a flu vaccine was ‘waiting for you’ were more effective than other reminders.

In our study, we employ an experimental design to test a package of approaches that reduce learning, compliance and psychological costs. Our general theoretical logic is that as individuals encounter more burdens, they are less inclined to state a desire to access vaccines. Zhang and Wang (2023) provide some evidence to support this claim in the context of monkeypox vaccines in China. They find that greater information outreach, social norms around vaccination, geographical availability of vaccines, number of doses and out-of-pocket costs all contribute to vaccine hesitancy. Our analysis explores the impact of the following means to reduce administrative burdens: default reservations reduce learning about booking processes and the compliance cost of setting up an appointment. Providing appointments at accessible locations reduces the perceived compliance costs of travelling to the venue. Social norms reinforce the idea that others are using vaccines, reducing potential stigma and psychological costs. The remainder of the section is dedicated to integrating our experimental attributes with the scholarship on burden reduction in the context of public health services.

### ***Default appointments***

The World Health Organization (2020) proposes that governments can increase the acceptance and uptake of the vaccination against COVID-19 by relying on defaults, increasing the accessibility of the vaccination site and simplifying logistics. While some organizations changed the default about individual choices for their employees to require vaccinations, governments have not done so with the general population, perhaps worried about citizen responses to coercive authority (Amirkhanyan et al. 2023). However, they can use defaults in other less intrusive ways, such as scheduling vaccines. In a large-scale study with healthcare workers, default responses anchoring towards a high rather than a low vaccination intention against the seasonal flu increased the willingness to immunize (Cantarelli, Belle, and Quattrone 2021). The benefit of appointment defaults is to compel a concrete commitment. The value of such

commitments is reflected in behaviourally inspired evidence that a planning prompt to write down both a day and a time for a flu vaccination increased the vaccination rate by 4.2 percentage points (Milkman et al. 2011). The hassles involved in setting up an appointment have been shown to matter to participation. For example, Homonoff and Somerville (2021) find that welfare applicants seeking to renew their status who are randomly provided appointments later in the month, and thus closer to their cut-offs for renewals, were more likely to lose valuable benefits because it proved so onerous to find another appointment if they needed to change their original one.

In administrative burden terms, default appointments reduce both learning and compliance costs. By default appointments, we mean an appointment that is automatically confirmed unless one cancels it, as opposed to a reservation procedure where appointments must be actively selected from available options. Such an appointment means that individuals do not have to find out information about a variety of factors: how and when appointments can be made, where they are available, if they are eligible now or at a later date, what type of vaccine they should get. Automatic appointments also reduce the perceived compliance costs of the time and effort spent actually setting up an appointment, which could involve going online, calling providers or visiting a site to find a potentially scarce appointment. We therefore propose that:

**H1:** Default appointments increase vaccine intentions.

### ***Accessibility of the vaccination centre and time needed for vaccination***

Vaccine providers can reduce the perceived compliance costs of vaccines by conveying that they are geographically accessible and quick. Geographical accessibility of public services matters to whether they are used or not (Deshpande and Li 2019). For example, abortion rates decline the further providers are from where the patient lives (Thompson et al. 2021). Zhang and Wang (2023) find higher vaccine intention if a vaccine is offered on site. The compliance cost of a further distance to travel is enough to put people off from seeking out even a valuable resource. Similarly, expectations that an appointment would be time-consuming generate another type of compliance cost that would discourage use. Within the administrative burden framework, time travelled to access services or time spent waiting for those services is categorized as compliance costs (Herd and Moynihan 2018). Here, the compliance costs can take two forms. One is the perceived convenience of the location of the vaccination centre. Convenience implies not just distance, but also ease of access. For example, is there easy public transportation, or parking nearby? The other is the time involved. Time allocated to completing the process of accessing a service is typically viewed as a compliance cost (Herd and Moynihan 2018), and a useful heuristic for communicating how burdensome a process is. Based on these logics, we posit the following hypotheses:

**H2:** A conveniently located vaccine centre increases vaccine intentions.

**H3:** Shorter times to complete vaccine processes increase vaccine intentions.



## **Social norms**

Social norms affect the psychological costs of accessing public services. Social networks have an impact, both positively and negatively, on people's behaviour also in the decision to get vaccinated (Bavel et al. 2020). Social norms tend to trigger conformity because individuals like to conform to others rather than being outcasts (Belle and Cantarelli 2021; Cialdini, Kallgren, and Reno 1991). A study of Italian health professionals showed that communicating that the majority of employees get vaccinated against the seasonal influenza – compared to communicating that the minority gets vaccinated – increases the propensity to get the flu shot by 5.5 percentage points and the propensity to promote the vaccination campaign among colleagues by 6.4 percentage points (Belle and Cantarelli 2021). Knowing that more people are taking a monkeypox vaccine also reduced vaccine hesitancy in China (Zhang and Wang 2023). A recent study with adults from the United States found that a 10 per cent increase in the expected proportion of others getting vaccinated against COVID-19 is correlated with an average increase in one's own willingness to vaccinate of 6.8 per cent (Agranov, Elliott, and Ortoleva 2021). By contrast, stigma against public services can create psychological costs that reduce participation (Lasky-Fink and Linos 2022). Thus, we assume that if people believe that the majority of their social network favours vaccination, this will increase supportive social norms and reduce stigma against taking the vaccine. Drawing on this evidence, we formulate the following hypothesis:

**H4:** Knowledge of vaccine-supportive social norms increases vaccine intentions.

To compare administrative processes and associated burdens with the inherent quality of the vaccine itself, we also include information about vaccine efficacy. Beliefs about vaccine efficacy or side-effects spread both through geographical and online communities, centring on, for example, fertility (Diaz et al. 2021). Such hesitancy is often framed as a desire to 'wait and see' indicating an openness to persuasion on evidence about how a novel vaccine works (Trojan and Pirofski 2021). A number of studies focused on fear about the safety and reliability of the vaccine. Messaging may address such fears. In a sample of French adults, among those who did not show an outright refusal, vaccination intentions depended on efficacy, risks of severe side effects if positive to the virus, as well as the region of the world where the vaccine was manufactured, and the place of vaccination administration (Schwarzinger et al. 2021). In the United States, Motta (2021) found people are mostly likely to accept vaccines that were made in the US, are more than 90 per cent effective and have a less than 1 per cent risk of minor side effects. Such concerns about a new vaccine, one subject to very public debate and criticism on safety, are not irrational. In a study of a hypothetical Covid vaccine, Petersen et al. (2021) found that transparent information increases trust in health authorities, but negative information on qualities like efficacy reduced vaccine acceptance.

As a final point, it is important to consider that a defining theme of the administrative burden literature is that burdens may have distributive effects: that is, they are harder to overcome for some groups more than others (e.g. Tiggelaar and George 2023). Such differences may fall heavier on more vulnerable groups with fewer resources such as human capital (Bell et al. 2023). For example, Heinrich et al.



(2022) find that Latinos were less likely to be offered vaccine information when they called information centres. An especially relevant consideration is that human capital differences might be correlated with administrative burdens. For example, those with lower education may struggle more with bureaucratic language and documentation requirements. Older adults, or those with poorer health, may struggle more with unfamiliar processes that require engaging with online interfaces or travelling to unfamiliar physical locations (Christensen et al. 2020).

While the existing literature detailed above provides a plausible rationale to employ the burden reduction strategies we test here, the existing literature specifically on how burden reductions may affect vaccine intentions has problems that limit our ability to draw clear inferences about how burden reductions may affect vaccine intentions. First, the existing research on vaccines (unlike the broader burden literature) typically tests single burden reductions, despite the possibility that a package of burden reductions may be more impactful than a single measure, or the whole may be greater than the sum of its parts. Second, because vaccine hesitancy has been especially pronounced for the Covid vaccine, and because it is such a new vaccine, it is not clear whether findings from prior studies, especially those testing less controversial and more long-standing vaccines, would hold. More broadly, the value of this study is its attention to the potential benefits of focusing on administrative processes, rather than on changing individual attitudes about vaccines, which has tended to dominate most of the current research, especially on controversial vaccines, like for Covid.

## Materials and methods

We use an econometric procedure known as a discrete choice experiment (DCE) in the form of a paired conjoint with forced choice (Hainmueller, Hangartner, and Yamamoto 2015). Belle and Cantarelli (2018) provide a methodological illustration of this design in the context of public administration and management, where this choice model has recently proven a useful and widely used tool to understand how citizens consider tradeoffs in public administration decision-making (Belle and Cantarelli 2022; Pedersen, Favero, and Park 2023; Ripoll et al. 2023). This design holds the promise of being a means to inform burden reduction efforts, which governments and public managers now need to think about meaningfully (e.g. Office of Information and Regulatory Affairs 2023). DCEs offer a tool to help them do so, and our work illustrates its utility. Respondents in our study are forced to choose one of two situations, namely the situation in which they would be more likely to get vaccinated against COVID-19 and cannot accept or reject both situations. In other words, our design qualifies as a choice model and the dependent variable is binary. The attributes (i.e. target construct) and attribute-levels (i.e. operations for target construct) are as follows: (i) default appointments – you must book the day and time of the vaccination appointment, choosing among the available options vs. they tell you the day and time of the vaccination appointment, which is automatically confirmed unless you cancel it; (ii) accessibility of the vaccination centre – the vaccination centre is not convenient vs. convenient for you to reach; (iii) time required to get vaccinated – getting vaccinated requires in total 90 vs. 30 min of your time; (iv) social norms – the majority of people you know are against vs. in favour of vaccination; (v) vaccine's efficacy – the vaccine's efficacy is 94 vs. 96 per cent; (vi) frequency of vaccine's mild side-effects – the vaccine causes mild side-effects in 8 vs. 6 per cent of the cases.

**Table 1.** A sample choice-set in our DCE.

In which of these two situations, X or Y, would you be more likely to get vaccinated against Covid-19?	
Situation X	Situation Y
You must book the day and time of the vaccination appointment, choosing among the available options	They tell you the day and time of the vaccination appointment, which is automatically confirmed unless you cancel it
The vaccination centre is not convenient for you to reach	The vaccination centre is convenient for you to reach
Getting vaccinated requires in total 30 minutes of your time	Getting vaccinated requires in total 90 minutes of your time
The majority of people you know are in favour of vaccination	The majority of people you know are against vaccination
The vaccine's efficacy is 94%	The vaccine's efficacy is 96%
The vaccine causes mild side-effects in 6% of the cases	The vaccine causes mild side-effects in 8% of the cases

We selected attributes and attribute-levels in accordance with well-established guidelines in conducting DCEs in healthcare management (Ryan et al. 2012) to maximize realism and the validity of respondents' choices. The attribute-levels related to the vaccine – that serve as a robustness test for our administrative burden framework – were designed based on the clinical evidence available at the time in which we collected data. In particular, the European Medical Agency, whose decisions are binding for European Union member States, had just approved the Pfizer BioNTech COVID-19 vaccine, which had high efficacy and low side-effect incidence. The rationale behind the use of a forced choice with no opt-out option is also context dependent. Vaccine mandates were not in place at the time in which we collected our data but were still a considered option that covered political and social debates daily. Later, in fact, vaccine became mandatory for certain subgroup of workers, such as public healthcare professionals, public school teachers, or workers in agriculture and agriculture-related services. The absence of an opt-out option in our work is not unique, since other COVID-19 vaccination work of the same nature also employed a forced choice (Duch et al. 2021).

The combination of the six attributes with two levels each generated 64 (i.e. 2<sup>6</sup>) unique situations. Using a full factorial design, we kept all 64 combinations derived from the full set of attributes and levels. Using the cyclical fold-over technique proposed by Street, Burgess, and Louviere (2005), then, we created 64 choice-sets by pairing each situation with its mirror alternative. Table 1 shows a sample choice-set, with its corresponding two situations.

To limit cognitive fatigue and avoid overload, each subject in our samples is only presented with three choice-sets, selected at random from all 64 possible choice-sets. Table A1 in Appendix A portrays 3 of the 64 possible choice-sets to mimic a respondent's experience. To simultaneously consider the binary nature of the dependent variable and the hierarchical structure of the data, which features three observations per subject, we fitted a multilevel, mixed-effects logistic regression model.

Our sample consisted of 12,322 adults in Italy, recruited by Qualtrics between 20 December 2020, and 28 January 2021. Our sample has been recruited to be fairly representative of the adult Italian population as far as geographic area of residence and age group are concerned. Female and graduates are slightly overrepresented in our sample. Table B1 in Appendix B provides respondents' demographic breakdown.

## Results

Model 1 in Table 2 shows the results of a multilevel, mixed-effects logistic regression. We find that all the attributes that we manipulated experimentally affected respondents' choice so that the reduction of each burden would increase vaccination intention, controlling for vaccine's characteristics. The most prominent factor is the convenience of the vaccine location. All else equal, as predicted in Hypothesis 1, communicating appointments to subjects and automatically confirming them, unless they cancel, increases the log odds of a respondent selecting a situation in which it is more likely to get vaccinated by .15 ( $p < .0005$ ). In line with Hypothesis 2, the log odds go up by .63 ( $p < .0005$ ) – equivalent to an 88 per cent increase in the odds – when the vaccination centre is convenient to reach rather than not. Moreover, we find support for Hypothesis 3 because the log odds increase by .31 ( $p < .0005$ ) when the time that it takes to get vaccinated is 30 min rather than 90 min. Consistent with Hypothesis 4, when the subjects are told that the majority of people are in favour of vaccination, the log odds of a respondent selecting a situation in which it is more likely to get vaccinated go up by .30 ( $p < .0005$ ). Reassuring about the efficacy and the side effects of vaccines also was effective. The log odds of a respondent selecting a situation in which it is more likely to get vaccinated go up by .39 when told the vaccine efficacy is 96 per cent rather than 94 per cent. Then, keeping everything else equal, the log odds that individuals would choose a situation decrease by .48 ( $p < .0005$ ) when the vaccine's incidence of mild side effects is 8 rather than 6 per cent. Thus, our study demonstrates that, after controlling for clinically related features, factors related to implementation provide a unique contribution to a successful COVID-19 vaccination campaign.

As shown in Figure C1 in Appendix C, each coefficient in Model 1 is statistically distinguishable from the others ( $p < .00005$ ), with the only exception of the impact of social norms and time required to get vaccinated, which do not differ at the standard significance levels ( $p = .665$ ). It follows that, for example, in the realm of reducing compliance costs, locating a vaccination centre where it is convenient to reach – rather than not convenient to reach – has a larger impact on the willingness to get vaccinated against COVID-19 than shortening the time that it requires to get vaccinated from 90 to 30 min. Along the same lines, the benefits of reducing by 1 percentage point the incidence of the vaccine's mild side-effects outweigh the benefits of improving by 1 percentage point the vaccine's efficacy. All in all, among our six attributes, a conveniently located vaccination centre appears to be the most influential factor in individuals' choice, whereas the procedure to take the vaccination appointment is the least influential. Figure C1.A in Appendix C suggests that the pattern of results seems robust to order effects.

In the remaining models of Table 2, we test heterogeneous effects to understand if more vulnerable groups are more affected by burdens. We test for differences between those older than 64 years and the rest of the respondents, between those with and without chronic conditions and between those reporting a low vaccination intention compared to subjects with a neutral or positive attitude towards vaccination.

As reported in Model 2 and displayed in Figure C2 in Appendix C, all experimental factors are significant for both those over 64 and respondents who are 64 or younger. However, the size of the effects is larger for subjects older than 64 except for vaccine's efficacy, which has a similar impact across that age threshold. As an example,

**Table 2.** Results from multilevel, mixed-effects logistic regressions estimating the impact of the experimental variables on the probability of choosing to get vaccinated against covid-19.

	$\beta$	<i>p</i>	SE	OR	$\Delta$ odds	$\beta$	<i>p</i>	SE	OR	$\Delta$ odds	
<b>Model 1: Burden Reductions</b>											
Automatically confirmed reservation	.15	**	.02	1.16	16%						
Convenient location	.63	**	.02	1.88	88%						
Shorter time	.31	**	.02	1.37	37%						
Majority pro-vaccination	.30	**	.02	1.35	35%						
Higher vaccine's efficacy	.39	**	.02	1.48	48%						
Higher risk of vaccine's side effects	-.48	**	.02	.62	-38%						
Constant	-.37	**	.03	.69							
	Number of respondents: 12,322;										
	Number of responses: 36,966;										
	Log-likelihood: -24,302; Prob>chi2: .000;										
	AIC: 48,620; BIC: 48,688										
<b>Model 2: Burden Reductions by age</b>											
Automatically confirmed reservation	.10	**	.03	1.10	10%	<b>Over64</b>	.47	**	.07	1.59	59%
Convenient location	.59	**	.03	1.80	80%		.93	**	.07	2.55	155%
Shorter time	.29	**	.03	1.33	33%		.49	**	.07	1.63	63%
Majority pro-vaccination	.26	**	.03	1.30	30%		.57	**	.07	1.76	76%
Higher vaccine's efficacy	.38	**	.03	1.46	46%		.49	**	.07	1.63	63%
Higher risk of vaccine's side effects	-.46	**	.03	.63	-37%		-.66	**	.07	.52	-48%
Constant	-.28	**	.03	.76			-.95	**	.09	.39	
	Number of respondents: 10,644;										
	Number of responses: 31,932;										
	Log-likelihood: -21,070; Prob>chi2: .000;										
	AIC: 42,156; BIC: 42,223										
<b>Model 3: Burden Reductions by Chronic Conditions</b>											
Automatically confirmed reservation	.11	**	.03	1.12	12%	<b>Chronic Conditions</b>	.23	**	.04	1.26	26%
Convenient location	.60	**	.03	1.81	81%		.72	**	.05	2.06	106%
Shorter time	.31	**	.03	1.36	36%		.33	**	.05	1.39	39%
Majority pro-vaccination	.28	**	.03	1.32	32%		.35	**	.05	1.41	41%

(Continued)

Table 2. (Continued).

	$\beta$	<i>p</i>	SE	OR	$\Delta$ odds	$\beta$	<i>p</i>	SE	OR	$\Delta$ odds	
Higher vaccine's efficacy	.37	**	.03	1.45	45%	.45	**	.05	1.57	57%	
Higher risk of vaccine's side effects	-.47	**	.03	.62	-38%	-.51	**	.05	.60	-40%	
Constant	-.31	**	.04	.74			**	.06	.60		
	Number of respondents: 8,684; Number of responses: 26,052; Log-likelihood: -17,184; Prob>chi2: .000; AIC: 34,384; BIC: 34,449										
<b>Model 4: Burden Reductions by Vaccination Intention</b>											
Automatically confirmed reservation	-.06		.06	.94	-6%	.20	**	.03	1.22	22%	
Convenient location	.41	**	.06	1.51	51%	.68	**	.03	1.97	97%	
Shorter time	.25	**	.06	1.28	28%	.33	**	.03	1.39	39%	
Majority pro-vaccination	-.07		.06	.94	-6%	.38	**	.03	1.47	47%	
Higher vaccine's efficacy	-.29	**	.06	1.33	33%	.42	**	.03	1.52	52%	
Higher risk of vaccine's side effects	-.47	**	.06	.62	-38%	-.49	**	.03	.62	-38%	
Constant	.02		.07	1.02		-.46	**	.04	.63		
	Number of respondents: 2,260; Number of responses: 6,780; Log-likelihood: -4,548; Prob>chi2: .000; AIC: 9,111; BIC: 9,166										

\*\**p* < .0005.

shortening the time required to get vaccinated increase the log odds by .93 among those older than 64 years and by .59 among younger respondents.

Model 3 reports the results segmented by chronic conditions. Although coefficients are statistically significant for both groups, Figure C3 in Appendix C shows that the .95 confidence intervals do not overlap for automatically confirmed reservation and convenient location, thus indicating that the effect is stronger among respondents with chronic conditions. Specifically, for the automatically confirmed reservation the log odds are .11 for those without a chronic condition and .23 for the rest of respondents. As to the convenience of the location, the log odds shrink from .72 to .60 when we compare individuals with chronic diseases to the rest of the sample.

Finally, Model 4 breaks down the results by comparing respondents reporting a lower vaccination intention (i.e. 1 or 2 on a 5-point scale) with subjects reporting a neutral or positive attitude towards COVID-19 vaccination (i.e. 3, 4 or 5 on a 5-point scale). Interestingly, as evident from Figure C4 in Appendix C, an automatically confirmed reservation and being the majority in favour of vaccination are only effective among individuals with a neutral or high vaccination intention, but not among those who are more hesitant. Another noteworthy difference is that a convenient location is relatively less effective among those with a lower vaccination intention (log odds = .41) compared to less hesitant respondents (log odds = .68).

## Discussion

Our study adopts an administrative burden perspective to break down the barriers in the last mile of vaccination intentions. Specifically, we explore some of the levers that administrators can use to address the last-mile challenge of managing the implementation of effective COVID-19 vaccination programmes (Herd and Moynihan 2018), while also accounting for vaccine's objective characteristics. Overall, our work and findings seem to naturally resonate with broader efforts of government institutions to engage in burden reduction strategies for a wide array of services, including healthcare (Zhang and Wang 2023), that citizens are legally entitled to and/or make them better off (Bell et al. 2023; Fox, Feng, and Reynolds 2023; Masood and Azfar Nisar 2021).

The first contribution of our work is to demonstrate how the administrative burden framework can inform not only policy areas like poverty policy, immigration and educational policy but also lies on its simultaneous ability to expand the range of application of administrative burden research and explicitly connecting to core public healthcare management. Whereas abundant scholarship demonstrates that health matters to the ability of people to overcome burdens (e.g. Bell et al. 2023) and that burdens limit access or renewal of access to public services (e.g. Fox, Feng, and Reynolds 2023; Halling, Herd, and Moynihan 2022) mostly in the safety net domain, fewer scholarly efforts have been devoted to the use – intentional and actual – of specific high-stake public health services such as vaccines (e.g. Zhang and Wang 2023). Extant scholarship finds a positive relationship between stated preferences in discrete choice experiments and revealed preferences in behaviour when it comes to vaccines (Lambooj et al. 2015). Therefore, this research may stimulate the use of administrative burden theory to explain the consumption of discrete public health services, as well developing interventions to improve access to those services. The existing public health literature mostly focused on how COVID-19 vaccination uptake could be increased through either reminders and targeted messages (e.g. H. Dai et al. 2021; Keppeler,

Sievert, and Jilke 2022; Milkman et al. 2022) or better-quality vaccines (e.g. Motta 2021; Schwarzinger et al. 2021). Factoring in other administrative burden reductions, by thinking more holistically about broader learning, compliance and psychological costs, is a valuable complement to such work.

Secondly, the results of our conjoint experiment shed new light on the relative importance that different types of implementation barriers have on vaccination intention uptake, above and beyond the clinical characteristics of vaccines. Interestingly, we find that leaner administrative processes matter, even when controlling for a higher-quality vaccine. Specifically, learning, compliance and psychological costs have a unique impact on the outcome. This mode of analysis offers a tractable series of levers policymakers and public managers can target to increase vaccine take-up relative to changing entrenched beliefs about vaccines. In particular, our data show that the intent to vaccinate is negatively impacted by three types of costs incurred by citizens: learning and compliance costs associated with the more or less complicated reservation procedures, compliance costs associated with vaccination locations that are not convenient to reach as well as with a longer amount of time one must spend getting vaccinated and psychological costs in the form of social stigma from acquaintances who are against vaccination. The simultaneous and independent investigation of all costs is rather novel in our discipline (Martin, Delaney, and Doyle 2023; Zhang and Wang 2023). In fact, our research design is unique in its ability to provide estimates of which burden reductions are important to promote vaccination, and, even more interestingly, how important one burden reduction is in comparison to another. The results hold for those with chronic conditions and are even stronger among citizens over the age of 64 and citizens with neutral or high vaccination intentions. This may seem counterintuitive, since, for instance, sicker and older adults have strong incentives to seek out vaccines, and so should be less affected by relatively minor administrative barriers. Likewise, among the administrative burdens that we study, improving the accessibility of vaccination centres and reducing the time needed for vaccination also matter among citizens who are hesitant – even highly so – about getting vaccinated. This might seem unexpected since those unwilling to get vaccinated might be expected to be indifferent to reductions in administrative barriers. However, the finding points to the way that such decisions are not always driven by rational personal decision processes, and where certain populations may need more accommodations to take-up government services (Bell et al. 2023). It is important to note that our experimental attributes show different degrees of stability across subgroups, with the effects of a convenient location and shorter wait times being relatively more stable than the others. That said, the relative impact of the three typologies of costs is still provisional and represents a promising area for future work.

Thirdly, our results inform real-world vaccination programmes against any new waves of COVID-19 or other novel viruses and sustain efforts to reduce the costs associated with administrative burdens by using automatic reservation systems, favouring easy-to-reach vaccination sites, minimizing the time required for citizens to be vaccinated, and through campaigns aimed at invoking social norms – as long as they represent a desired behaviour – and reassuring fears about vaccines. Implementing cost-effective COVID-19 vaccination programmes has become a perennial responsibility of healthcare organizations and providers across the globe. Our evidence that management details matter, above and beyond objective characteristic of the vaccine itself, serves as an urgent call to factor in administrative burdens to



fight pandemic events and, more broadly, hard-to-tackle public administration challenges. Although the COVID-19 required vaccination programmes with virtually unprecedented parallel in recent decades, extant research on how to increase vaccination uptakes for other viruses – seasonal influenza included – can inform real-world interventions for future health emergencies. Such work reinforces the claim that administrative processes matter to aggregate outcomes consistent with our analysis (e.g. Banerjee et al. 2010). A systematic review identifies common factors that influence the implementation of school-based vaccination programmes and those factors include implementation details such as methods for obtaining consent, and clinic organization and delivery (Perman et al. 2017).

Lastly, our research design and methods represent a further contribution to any effort dedicated to reducing administrative burdens, so as to increase access to and use of public services that make citizens better off (e.g. Young et al. 2023). Specifically, by incorporating attention to administrative burden attributes, this study emphasizes the significant value of discrete choice models in the context of COVID-19 vaccine research (Horvath, Banducci, and James 2022; Schwarzinger et al. 2021). Overall, our study shows how conjoint analysis through discrete choice modelling, can be used in practice to address policy issues, which involve multiple dimensions, in a timely fashion. In fact, most public organizations do a poor job of collecting information about user preferences for administrative design. But a growing focus on customer experience is pushing them to do so (Office of Information and Regulatory Affairs 2023). In some cases, this involves focus groups, and in some cases using surveys. In a context where public officials are directing greater effort to examine user perceptions, we regard discrete choice experiments as no more onerous and a potentially more informative tool that is not being widely employed relative to other options.

Our results should be interpreted in the light of a series of limitations that our study shares with most experimental work based on stated rather than revealed preferences in choice models. That said, notwithstanding realism threats that are inherent to any survey experiment, discrete choice experiments are particularly well suited for modelling real-world decisions that entail trade-offs (Huls and de Bekker-Grob 2022), such as those faced by policy-makers called to choose between different vaccination programmes to limit the COVID-19 spread, because the effects estimated through conjoint survey experiments ‘match the effects of the same attributes in the behavioural benchmark remarkably well’ (Hainmueller, Hangartner, and Yamamoto 2015, 2395). Generalizing from our results should consider the particular timing and setting of the experimental design. Alongside the severity of the initial wave, the demand for vaccines we see at the time of our study is relatively high (Beccia et al. 2022). This implies that the estimates of differences between conditions are conservative, especially for administrative barriers, where subjects would have had a strong incentive to overcome burdens to receive vaccines, such as travelling further or waiting longer. Since the vaccines were relatively novel, reassurances on the efficacy and side effects may have been especially salient at this time. It is important to investigate whether our results would hold true in public service contexts distinct from the one we studied. This remains an open question worthy of further exploration. On the one hand, it is likely that our findings would translate across comparable vaccines, particularly those that are new and controversial. Given the projection that novel pandemics will occur more frequently, this case provides critical public health lessons in and of

itself. On the other hand, we have yet to systematically and rigorously examine how different contexts might moderate the effects of similar reductions in administrative burdens on outcomes in public services beyond vaccination.

There are a few additional caveats that we should note. First, while we did not include an opt-out option for respondents, this design choice aligns well with the real-world conditions of our study, partially mitigating concerns. Furthermore, accounting for participants' baseline intention to get vaccinated further alleviates concerns. Second, we did not vary the order in attribute presentations to respondents. We did not, however, identify discernible patterns in our results attributable to presentation order. That said, future research should investigate whether the sequence of attribute introduction systematically influences outcomes (Auspurg and Jäckle 2017). Finally, in terms of the external validity of our findings, we cannot answer whether similar patterns would emerge across different vaccines, various public health services, diverse samples of Italian citizens and respondents in other countries.

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## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Data consent

The participants of this study did not give written consent for their data to be shared publicly, so due to the sensitive nature of the research, supporting data are not available.

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