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Increasing Organ Donor Registration as a Means to Increase Transplantation: An Experiment with Actual Organ Donor Registrations†

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The United States has a severe shortage of organs for transplant. Recently—inspired by research based on hypothetical choices—jurisdictions have tried to increase organ donor registrations by changing how the registration question is asked. We evaluate these changes with a novel "field-in-the-lab" experiment, in which subjects change their real organ donor status, and with new donor registration data collected from US states. A "yes/no" frame is not more effective than an "opt-in" frame, contradicting conclusions based on hypothetical choices, but other question wording can matter, and asking individuals to reconsider their donor status increases registrations. (*JEL* C91, D12, D91, I11, I18)

Over 100,000 people in the United States are currently on a waiting list for a life-saving organ transplant, and every year over 10,000 people die while waiting (Organ Procurement and Transplantation Network 2022). These patients are waiting for an organ from a deceased donor, an individual whose organs are made available for transplant after their death. Estimates from a recent decade suggest that each year in the United States an average of 35,000–40,000 people die in a way that would allow their organs to be transplanted, representing 1.5 percent of all deaths and 5 percent of all hospital deaths each year (Organ Procurement and Transplantation Network 2016).[1] During the same period, however, the United

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[1] Estimates of deceased organ donor eligibility provided by UNOS. We calculate eligibility as a percentage of all deaths in the United States using data from National Vital Statistics Reports provided by the CDC (see https://www.cdc.gov/nchs/products/nvsr.htm (accessed 8/8/2023)). We similarly calculate eligibility as a percentage of all inpatient hospital deaths using data from the National Hospital Discharge Survey (NHDS) annual summaries provided by the CDC (see https://www.cdc.gov/nchs/nhds/nhds_publications.htm (accessed 8/8/2023)). When

States averaged only 7,228 deceased organ donors each year (Organ Procurement and Transplantation Network 2023).

Increasing the number of deceased organ donors can have a big impact. One deceased donor can provide multiple organs (kidneys, lungs, liver, heart, pancreas, and intestine) and tissues to potential recipients. To become a deceased donor, an individual must either have registered as one—typically at a state's department of motor vehicles (DMV)—or must have their organs donated by their next of kin after death. Unsurprisingly, organ donor registration is associated with an increased likelihood of eventual donation.[2]

Because of the opportunity from deceased donor organs, there has been both a policy and a research focus on encouraging individuals to register as donors. Survey results suggest that only 49.9 percent of individuals are registered as organ donors but that 90.4 percent support organ donation (Health Resources and Services Administration 2020). This large gap between registration rates and stated support for organ donation has led researchers to wonder whether *how individuals are asked to become organ donors* might impact registration rates. In particular, researchers hypothesized that individuals who support organ donation in principle might register as donors if forced to respond to a yes/no question about organ donation (i.e., where an individual is asked to give a positive or a negative response to organ donation) but fail to do so if given the opportunity to opt in (e.g., by checking a box or signing their name to indicate a desire to register as an organ donor). This difference in registration rates might arise because the opt-in frame emphasizes that the default is not being a donor, which individuals might construe as an implicit recommendation of policymakers (Johnson and Goldstein 2003). A difference might also arise because individuals find it unpleasant to think about their own mortality, and the opt-in frame allows them to avoid considering their mortality by skipping the question (i.e., not engaging with it and thus not opting in), while a yes/no frame requires they make a selection and thus requires they engage with the question.

Early work exploring the role of choice frame documented promising evidence based on hypothetical registration decisions. Johnson and Goldstein (2003, 2004) found that 42 percent of their experimental subjects reported a willingness to register as an organ donor when asked to opt in to a donor registry, but that the rate was a dramatically higher 79 percent when subjects were required to say either "yes" or "no" to organ donation, a staggering 37 percentage point treatment effect.[3]

Consequently, many attempts by policymakers to increase organ donation over the past two decades have focused on framing the organ donor registration question

annual summaries are not available, we use data on inpatient deaths from CDC Data Highlights tables, which are also based on the NHDS. See https://www.cdc.gov/nchs/nhds/nhds_tables.htm (accessed 8/8/2023).

[2] New England Donor Services provides some data from 2010 to 2012: Among Medically Suitable Brain-Dead potential donors, recovery rates were 33 to 44 percentage points higher when the potential donor was registered; among Medically Suitable Cardiac Death potential donors, recovery rates were 32 to 40 percentage points higher when the potential donor was registered (Fitzpatrick 2013).

[3] Johnson and Goldstein (2003; 2004) also report results on an opt-out organ donation default question, both in their experiment and in data on organ donor registration rates from European countries. In an opt-out choice environment, individuals are defaulted into being registered donors and must remove themselves from a donor registry. We do not explore opt-out frames since such frames are not feasible under current US gift law, which requires an affirmative statement in support of organ donation for an individual to be added to a donor registry (Glazier and Mone 2019).

as a yes/no frame. California and New York both prominently passed legislation to switch to yes/no frames. The use of the yes/no frame for organ donation is widespread; of the 50 US jurisdictions with DMV forms posted online or made available to us as part of this research, 41 (82 percent) asked the organ donor registration question with a yes/no frame (see Supplemental Appendix Table 8).

Does the yes/no question frame actually increase organ donor registrations? Did the state-level changes have the intended effects? In this paper, we provide empirical evidence about how choice frame affects whether individuals *actually register* as organ donors. We first describe the design and results from a controlled experiment that tests whether the choice frame affects organ donor registration. We then present results from newly collected data on registration decisions from state DMVs, leveraging state-level changes in question wording as natural experiments. Both sets of empirical work find consistent, near zero impacts of choice frame on organ donor registration, suggesting that prior estimates using hypothetical data do not accurately describe behavior under actual incentives.

Our controlled experiment gives Massachusetts residents the opportunity to change their organ donor registration status. Registration in our experiment *is* registration on the Massachusetts Donor Registry, so subjects who register to be donors in our study leave the laboratory as registered donors. The experiment is thus a "field-in-the-lab" design in that we invite subjects into the laboratory ($n = 514$) or onto an online platform that we built ($n = 529$)—where we can observe choices and randomize question wording—but each subject decides about their *actual* organ donation status. Significant technical requirements were met to connect our laboratory computers to the Massachusetts Registry of Motor Vehicles online database and record each participant's interaction.[4] This connection allowed us to observe each subject's previous donor status and to make any changes to a subject's registration status in real time. Across three waves of data collection in the field-in-the-lab experiment, we find that a yes/no frame does not increase organ donor registration rates over an opt-in frame. Rates are directionally (but not significantly) lower when individuals are asked to provide a yes or no answer rather than just being given a chance to opt in.

We replicate this finding using a newly constructed panel dataset on organ donor registration rates across US states. We solicited data from each state on the number of individuals who were asked a donor registration question at the state's DMV and the number of individuals who registered in response to that question from 2010 through 2016, inclusive. We use these data to analyze how changes in registration questions influence registration rates. We leverage changes in registration question frame in California (in 2011), New York (in 2013), and Hawaii (in 2014), and find an overall null effect of the question frame on registration rates.

[4] For the wave 1 study, we designed a Firefox extension that allowed us to manage the interface subjects saw while keeping another hidden browser open to communicate with the Massachusetts database. This design ensured that personal information used to log into the MA organ donor registry stayed on the local device used by the subject (so our software never recorded identifiable data). In waves 2 and 3, we built an application on secure Wharton servers to collect and transmit data to the MA registry and push MA registration data back to the subject. This implementation maintained high data security and was necessary to allow subjects to participate remotely (in wave 3).

Our findings thus contrast with the findings of research based on hypothetical donation decisions (e.g., Johnson and Goldstein 2003, 2004; van Dalen and Henkens 2014) and suggest no gain from changing whether the organ donation question has an opt-in or yes/no frame.

However, additional findings from our field-in-the-lab study suggest other ways to increase organ donor registration. Other elements of the question wording (e.g., adding additional information about donation) may increase registration rates. In addition, we find that simply asking people to reconsider and potentially change their organ donor registration status outside of the DMV nets many new donors. We find that 27.1 percent of unregistered subjects choose to register as organ donors in our study, while less than 1 percent of those who were previously registered remove themselves from the registry. As a consequence, our experiment—which included 1,043 total subjects—generated a net of 96 new donors. This latter result provides suggestive support for attempts to increase organ donor registration by asking for registrations outside of the DMV (e.g., on other government forms) and highlights the value of future work about the impact of asking people to register as organ donors more often.

I. Experiment with Actual Organ Donor Registrations

A. *Design*

In our field-in-the-lab experiment, 514 participants were recruited to the Computer Lab for Experimental Research (CLER) at Harvard University to participate in either wave 1 (372 participants on one of 26 dates between August 2010 and April 2012) or wave 2 (142 participants on one of four dates in August 2016). Recruitment information informed potential participants they needed a Massachusetts driver's license, learner's permit, or state identification card and the last four digits of their social security number to participate in the study, but participants were not informed in advance that the study concerned organ donation. Participants received $15 for participating in the study. Everyone who arrived at the laboratory and had the required Massachusetts credentials was allowed to participate. In addition, 529 participants were recruited through a Qualtrics panel of Massachusetts residents (wave 3) to take an online version of our study that did not require subjects to come into the laboratory. These participants completed the study on one of 40 dates between July and August 2016 (recruitment materials, consent form, and decision screens appear in Supplemental Appendix A).[5] Table 1 provides descriptive statistics on both the in-person (wave 1 and 2) and online (wave 3) samples, based on survey data we collected toward the end of the experiment. The table also shows balance across the choice frame treatments that we randomized (i.e., opt-in and yes/no).[6]

[5] We did not register a pre-analysis plan as our initial experiment began in 2010, before doing so was standard practice. In addition, our subsequent data collection and analysis closely followed the initial experimental work, which served to discipline our analysis.

[6] While observables do not jointly predict treatment assignment, there are some imbalances with respect to gender. Supplemental Appendix Table 5 shows that our main results are robust to controlling for this and other observables.

Table 1—Summary Statistics, Experimental Subjects

	In-person (MA)			Online (MA)		
	Opt-In (1)	Yes/No (2)	Difference (3)	Opt-In (4)	Yes/No (5)	Difference (6)
Female	0.490	0.487	−0.003	0.528	0.434	−0.094
	[0.501]	[0.501]	(0.044)	[0.500]	[0.496]	(0.043)
Age	33.328	32.479	−0.849	41.343	41.229	−0.113
	[14.633]	[14.201]	(1.274)	[12.226]	[12.537]	(1.078)
Non-White	0.344	0.401	0.057	0.168	0.204	0.036
	[0.476]	[0.491]	(0.043)	[0.375]	[0.404]	(0.034)
Some college	0.899	0.918	0.019	0.868	0.896	0.028
	[0.302]	[0.275]	(0.026)	[0.339]	[0.306]	(0.028)
Student	0.478	0.472	−0.006	0.060	0.079	0.019
	[0.501]	[0.500]	(0.044)	[0.238]	[0.270]	(0.022)
Never married	0.794	0.846	0.053	0.304	0.287	−0.017
	[0.406]	[0.361]	(0.034)	[0.461]	[0.453]	(0.040)
Has kid(s)	0.130	0.101	−0.028	0.480	0.448	−0.032
	[0.336]	[0.302]	(0.028)	[0.501]	[0.498]	(0.043)
Religious	0.652	0.625	−0.026	0.608	0.620	0.012
	[0.477]	[0.485]	(0.042)	[0.489]	[0.486]	(0.042)
Republican	0.081	0.060	−0.021	0.084	0.086	0.002
	[0.273]	[0.238]	(0.023)	[0.278]	[0.281]	(0.024)
Socially conservative	0.142	0.105	−0.037	0.140	0.143	0.003
	[0.349]	[0.307]	(0.029)	[0.348]	[0.351]	(0.030)
Registered donor	0.437	0.479	0.042	0.812	0.814	0.002
	[0.497]	[0.501]	(0.044)	[0.391]	[0.390]	(0.034)
Observations	247	267		250	279	
p-value (F-test):			0.700			0.358

Notes: Table 1 provides summary statistics on experimental subjects disaggregated by sample and treatment group. Columns 1–3 show results for subjects in waves 1 and 2 of the field-in-the-lab experiment who completed the study in person and columns 4–6 for subjects in wave 3 who completed the experiment online. Columns 3 (in-person) and 6 (online) report whether differences across the opt-in and yes/no treatment groups are significant within each sample. Standard deviations are in brackets, robust standard errors are in parentheses. We report the p-values from joint tests for significance with the null that observables do not jointly predict treatment assignment. Column 3 shows the p-value from the test estimated on data from waves 1 and 2 and column 6 on data from wave 3. The p-value from the test estimated on waves 1–3 jointly is 0.410. As expected, the population differs slightly across the in-person and online samples on a number of demographic dimensions. Most prominently, the online sample is more likely to begin the study as a registered donor. The variable *Registered donor* indicates the fraction of subjects who were registered as an organ donor at the beginning of the study. We suspect this is due to differences in the recruitment process across the platforms. The in-person subjects were not aware that the study was about organ donation until they reached the lab (and only one person who came to the lab and was eligible to participate chose not to do so, citing concerns about entering the last four digits of her social security number as part of the study), whereas the online sample learned the study was about organ donation before they had invested time or energy to participate in the study, and so individuals who are not registered may have been more likely to choose not to participate at that stage.

Since the software we built interacted with the Massachusetts registry, we were able to see each subject's current donor status, allowing us to investigate changes in registration status in both directions (from unregistered to registered and vice versa). The software also allowed for experimental manipulation of how a subject was asked about organ donor registration.

Of the 514 subjects who participated in waves 1 and 2, 236 participants (45.9 percent) were initially registered donors and 278 participants (54.1 percent) were initially unregistered at the study start. The fraction of subjects who were registered when they entered the lab was close to the fraction of Massachusetts residents who were registered in the relevant years (Donate Life America 2011, 2012, 2013, 2017), suggesting we did not get selection into the study by organ donors in these waves.[7] In wave 3, 430 participants (81.3 percent) were registered donors and 99 participants (18.7 percent) were unregistered when they began the study. This rate of being registered is higher than the rate of Massachusetts residents who were registered in 2016, suggesting the ability to easily choose not to participate in the online study after learning that it was about organ donation may have introduced selection into participation in wave 3.

Subjects were randomly asked about organ donor registration with an opt-in frame or a yes/no frame. In the opt-in frame, subjects were given the opportunity to change their organ donor status by checking a box and clicking "continue." Leaving the box blank and clicking continue kept their organ donor registration status unchanged. In the yes/no frame, subjects were provided with two radio buttons, one that would add them to the organ and tissue donor registry (or leave them on the registry if they were already on it) and one that would leave them off the registry (or remove them from the registry if they were already on it). In the yes/no frame, subjects were required to check one of the buttons and click "continue" before continuing with the rest of the study. Figure 1 shows the organ donor registration question asked of those who were unregistered at the start of the study with an opt-in frame and with a yes/no frame.

As discussed below, in wave 1 we also independently randomized the information provided to subjects on the decision screen. Some subjects were randomly provided with a list of organs that might be donated in the event of deceased donation. Images of screens with the organ lists are shown in Supplemental Appendix A.

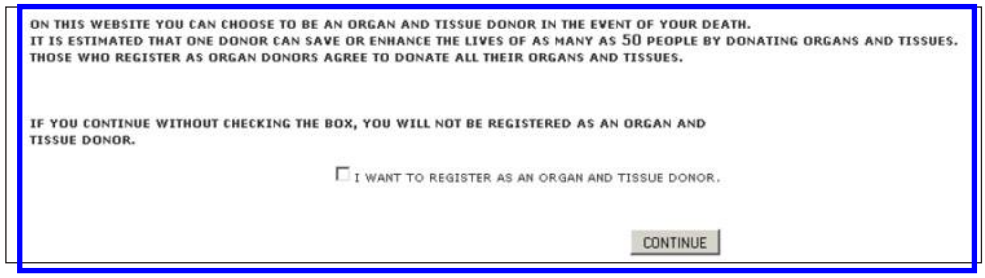
B. *Results on Choice Frame*

Table 2 reports on the impact of choice frame on registration decisions in our study among subjects who were initially unregistered. As discussed below, over 99 percent of subjects who started the experiment as registered donors remained registered. Given that nearly all initially registered donors remained on the registry, Table 2 focuses on the 377 participants who were not registered when they began our study and explores whether the way they are asked to register impacts decisions to join the registry.

Columns 1–3 look at each wave of data separately, and columns 4–5 analyze the pooled data. The opt-in frame is the excluded group. In each wave separately,

[7] The share of subjects who showed up as registered donors in waves 1 and 2 was comparable to the share of Massachusetts residents who were registered in the same years (40 percent versus 44 percent in 2010, $p = 0.29$; 49 percent versus 48 percent in 2011, $p = 0.76$; 40 percent versus 51 percent in 2012, $p = 0.05$; 54 percent versus 57 percent in 2016, $p = 0.50$).

Panel A. Opt-in frame decision screen



Panel B. Yes/no frame decision screen

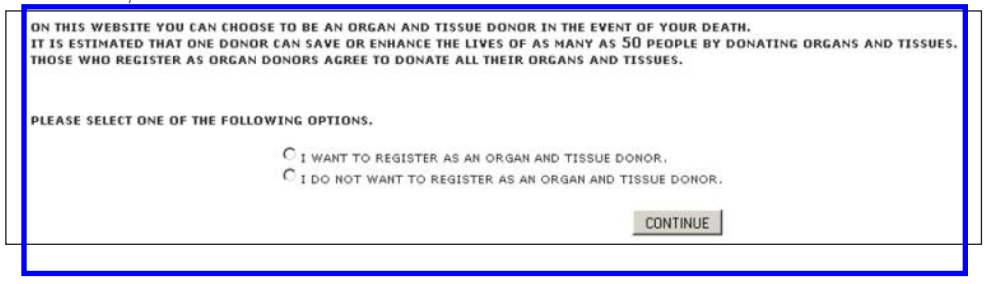


FIGURE 1. REGISTRATION SCREENS FROM THE EXPERIMENT

Notes: Figure 1 shows the decision screens randomly shown to subjects in all three waves of the study if they were unregistered at the start of the study. In the opt-in frame (panel A), subjects who did not want to be added to the registry could leave the box blank and click "continue" while those who wanted to be added could check the box and click "continue." In the yes/no frame (panel B), all subjects were required to select one of the two radio buttons and click continue to advance to the next page. Subjects who were registered at the start of the study saw a sentence that stated: "You are currently registered as an organ and tissue donor." In the opt-in frame, the text shown to these subjects before the checkbox read: "If you continue without checking the box, you will remain registered as an organ and tissue donor." The text next to the checkbox read: "I no longer want to be registered as an organ and tissue donor." In this case, checking the box before clicking continue removed the subject from the registry. In the yes/no frame, subjects who were registered were asked to choose between "I want to remain registered as an organ and tissue donor" and "I no longer want to be registered as an organ and tissue donor."

and in all waves jointly, the use of a yes/no frame has no impact on registration rates. Wave 1 finds a directionally negative impact of yes/no on registration rates while waves 2 and 3 find small, directionally positive impacts of the yes/no frame. Pooled together in columns 4 and 5, yes/no is associated with a registration rate that is 2–4 percentage points lower than opt-in, but this directional reduction is far from statistically significant ($p = 0.42$ in column 4, where we include dummies for wave, and $p = 0.64$ in column 5, where we include both dummies for wave and dummies for the calendar day on which the subject participated).

These results are robust to different regression specifications. Results look similar in Supplemental Appendix Table 5 when we include demographic controls to account for any chance imbalance in the demographics reported in Table 1, and results look similar in Supplemental Appendix Table 6 when we include all subjects, including those who were initially registered at the start of the study.

We find a null effect of choice frame on organ donor registration decisions. Given our null result, one might be worried that our study was underpowered to detect a reasonably sized treatment effect. We note that our ex ante minimum detectable

Table 2—Organ Donor Registration by Treatment (Initially Unregistered)

	Wave 1	Wave 2	Wave 3	All waves	
Study wave:	(1)	(2)	(3)	(4)	(5)
Yes/no frame	−0.085	0.015	0.033	−0.037	−0.023
	(0.062)	(0.104)	(0.090)	(0.046)	(0.049)
Organ list	0.120			0.120	0.162
	(0.062)			(0.061)	(0.067)
Constant	0.267	0.207	0.255		
	(0.053)	(0.078)	(0.066)		
Observations	213	65	99	377	377
R^2	0.026	0.000	0.001	0.015	0.127
Wave FE	NO	NO	NO	YES	YES
Date FE	NO	NO	NO	NO	YES

Notes: Analysis includes 377 participants who were unregistered at the beginning of our study. Results are shown for each study wave separately in columns 1–3 and across all waves jointly in columns 4–5. *Yes/no frame* is an indicator for whether a participant was exposed to the yes/no frame; *Organ list* is an indicator for whether a participant saw a list of organs. Analysis in column 4 includes fixed effects for study wave. Analysis in column 5 includes fixed effects for study wave and for the date on which a subject participated in the study. Standard errors are in parentheses.

effect (MDE), using data across all three waves of our study, was roughly 7 percentage points. We see this as reasonable compared to the prior work on how choice frame impacts organ donation. In particular, the MDE is less than one-fifth of the 37 percentage point treatment effect observed in Johnson and Goldstein (2003, 2004). The MDE is 14 percentage points if we focus on the individuals who are initially unregistered, as we do in Table 2, but this is still less than two-fifths of the effect observed in Johnson and Goldstein (2003, 2004).

The MDE in the field-in-the-lab experiment is constrained by our ability to recruit subjects to participate in our experiment. Identifying subjects was more difficult than in a typical study, since subjects need to have a Massachusetts license, learner's permit, or state ID, as well as the last four digits of their social security number to participate in the study. This difficulty was part of the reason why the study was run over multiple years, which allowed the subject pool at Harvard, where waves 1 and 2 were run, to recruit more potential subjects. In part, due to the relatively high MDE in the field-in-the-lab experiment, in Section II, we complement this controlled experiment with state-level natural experiments that leverage much larger sample sizes. The MDE in each of our three natural experiments discussed below are on the order of 2.5 percentage points (see Supplemental Appendix Figure 17).

Nevertheless, to show how the null result from our field-in-the-lab experiment compares to the prior results based on hypothetical choice data that inspired our work, Figure 2 shows the fraction of subjects who ended our study as registered donors across the opt-in frame and the yes/no frame and compares our results to the results from Johnson and Goldstein (2003, 2004). The first two bars show results from everyone in our full sample. The next two bars show results from our in-person sample (i.e., waves 1 and 2 only). In comparing levels between Johnson

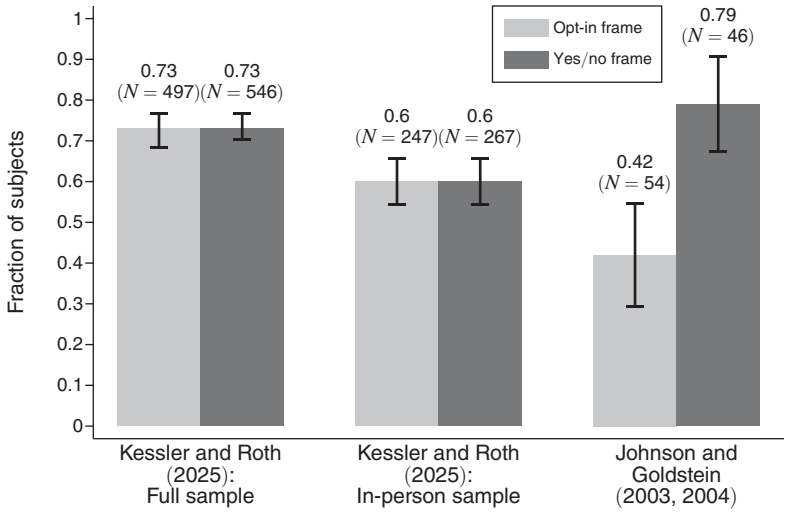


FIGURE 2. COMPARISON WITH JOHNSON AND GOLDSTEIN (2003, 2004)

Notes: Figure 2 shows the fraction of subjects who ended the study as organ donors in the field-in-the-lab experiment across all our data, for our in-person sample (waves 1 and 2) only, and for those who indicated they would register as organ donors in Johnson and Goldstein (2003, 2004), split by treatment group. We include 95 percent confidence intervals around each of our means. For Johnson and Goldstein, we calculate 95 percent confidence intervals based on the number of subjects in each treatment arm as provided by the authors.

and Goldstein and our studies, the in-person sample is most relevant since these subjects showed up to participate without knowing the study was about organ donation, as in Johnson and Goldstein's experiment. The figure clearly shows that our null results are very different from the results in Johnson and Goldstein (2003, 2004) and that our 95 percent confidence intervals can easily rule out effect sizes similar to those in prior work.

When comparing our null results to prior work, one might wonder whether registration rates in our opt-in frame might be artificially high due to subjects in our study mindlessly checking the opt-in box (e.g., because they are in the habit of checking opt-in boxes in online interfaces without carefully reading the surrounding text). Two pieces of evidence work against this hypothesis. First, subjects who enter the study as registered donors and are in the opt-in treatment are also shown a checkbox, but checking the box removes the subject from the registry. Hardly anyone removes themselves from the registry, and registry removal is not more likely in the opt-in treatment $(4/311)$ than in the yes/no treatment $(2/355)$. The difference of 0.72 percentage points is not statistically significant ($p = 0.325$). Second, in waves 2 and 3, we added an additional question to our study to test whether subjects mindlessly check an opt-in box. Toward the end of the experiment, we asked subjects to indicate whether or not they are 100 years old (we separately asked subjects to report their age, and everyone reported being younger than 100). We randomized whether subjects were asked about being 100 years old with an opt-in frame or a yes/no frame. Rates of affirming subjects were 100 years old were not statistically different for the opt-in version $(2/308)$ and the yes/no version $(0/314)$. The difference of 0.65 percentage points

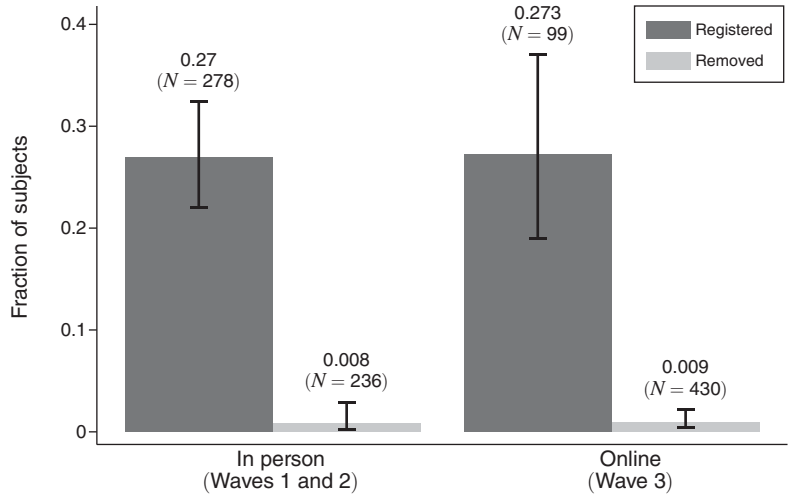


FIGURE 3. CHANGES IN REGISTRATION STATUS BY STUDY WAVE

Notes: Figure 3 shows changes in donor registration status by study wave. *Registered* is the fraction of participants who registered to be an organ donor conditional on being unregistered at the beginning of our experiment. *Removed* is the fraction of participants who were registered organ donors at the beginning of our experiment and subsequently removed themselves from the organ donor registry. We include 95 percent confidence intervals for each mean.

is not statistically significant ($p = 0.153$). While the rates of removing oneself from the registry and incorrectly affirming being 100 years old are both directionally higher in the opt-in version, the small magnitudes confirm that subjects do not mindlessly check boxes at high rates when asked opt-in questions. Indeed, even if we were to assume that 0.65 percent or 0.72 percent of subjects in our opt-in treatment registered as organ donors by mindlessly checking the box, this would not meaningfully impact our results.

C. *Additional Results*

Our field-in-the-lab experiment shows that whether the question has an opt-in frame or a yes/no frame has little-to-no impact on organ donor registration rates, but results from our study provide two additional insights into how one might successfully encourage organ donor registrations.

First, we explore the impact of simply asking individuals to change their donor status. Across all waves, we find that subjects are substantially more likely to join the registry than to remove themselves from the registry. Figure 3 shows that across all three waves, 27.0 percent (or $75/278$ subjects who participated in person in waves 1 and 2) and 27.3 percent (or $27/99$ subjects who participated online in wave 3) of those who were previously unregistered choose to join the registry, whereas fewer than 1 percent ($2/236$ in waves 1 and 2 and $4/430$ in wave 3) of those who were previously registered choose to remove themselves. That is, across all three waves, participants were more than 30 times more likely to add themselves to the registry than remove themselves ($p < 0.01$ for each wave independently and

all waves together). Across the three waves of the study, we observed a net increase of 96 registered donors. This pattern arises even though everyone in our study has a Massachusetts license, permit, or ID, which means they were previously given the opportunity to register as organ donors, so those entering the study unregistered had previously declined.[8]

Second, in wave 1, we also independently varied whether the registration question provided other information about organ donation (see Supplemental Appendix Table 4 and Supplemental Appendix Figure 13). As shown in Table 2, we find that subjects are statistically significantly more likely to register as donors when shown the list of organs. The list makes subjects roughly 12 percentage points more likely to register as donors ($p < 0.10$). This is a promising result for policy interventions aimed to educate potential donors of the value of organ donation (see, e.g., Quinn et al. 2006; Thornton et al. 2012).[9]

These two sets of results suggest the possible value of asking about organ donor registration more often and providing more information when asking individuals to register, topics we return to in Section IV. When considering how these additional results speak to policy, however, it is worth considering the possible role of experimenter demand in our study. Namely, subjects might respond differently to our organ donor registration question as part of a study than they would in a natural field setting. While we tried to remain neutral in asking individuals to review and possibly change their organ donor registration status (e.g., we gave registered donors the chance to remove themselves from the registry and neither our instructions nor our consent form pushed aggressively for donation), subjects might reasonably believe that we would prefer they end up registered rather than not registered given the positive externalities of organ donation.

We make three additional comments on the possibility of experimenter demand. First, to the extent that individuals feel experimenter demand in our study, they may also feel some pressure to register as an organ donor in other settings (e.g., at a state DMV) where someone is observing them and recording their behavior, although the extent of such demand forces could certainly differ inside and outside of the lab. Second, as shown in Figure 3, our results on asking individuals to register look nearly identical across our in-person and online waves. This comparison suggests a limited impact of being in the physical presence of an experimenter, with the caveat that wave 3 subjects may have been positively selected in attitudes about organ donation given its recruitment process. Third, related to our results in Section IB, we do not see how experimenter demand would interact meaningfully with the choice

[8] The Massachusetts state government website states: "You can register as an organ donor at any time through the Registry of Motor Vehicles (RMV). Many people become organ donors when they apply for or renew their Massachusetts driver's license or ID. Registering as a donor is as simple as checking yes on your license/ID application." See https://www.mass.gov/how-to/register-as-an-organ-donor-at-the-rmv (accessed 7/29/2022).

[9] Answers from a survey conducted after subjects make their registration decisions in wave 1 provide suggestive evidence for why the organ list may have increased registration. Those who see the list believe a single donor can save more lives (12.6 versus 9.6; t-test for unregistered donors, 212 observations, $p = 0.067$), potentially causing them to update on the societal value of donation. They are also more likely to report that a family member has received an organ transplant (4.7 percent versus 0.9 percent; t-test 213 observations, $p = 0.101$), suggesting the list broadens their interpretation of what constitutes an organ transplant and enhances their personal connection to donation.

frame or drive our null results on choice frame, and we complement our experiment on choice frame with an analysis of state-level natural experiments—where experimenter demand is not a concern—as discussed next.

II. Data from US States

To complement the field-in-the-lab study, which found no increase in registration rates due to the yes/no question framing, we collected data on organ donor registration decisions from US states. Each state asks some form of registration question when individuals apply for a driver's license or other identification at that state's DMV (and typically asks the same question when individuals renew their license or state ID card). States sometimes change the way they ask. To the extent that the specific timing of a change is plausibly exogenous to the underlying pattern of organ donor registrations in the state, the change can be treated as an experiment to evaluate how the specific wording of the organ donor question affects individuals' willingness to register as an organ donor.

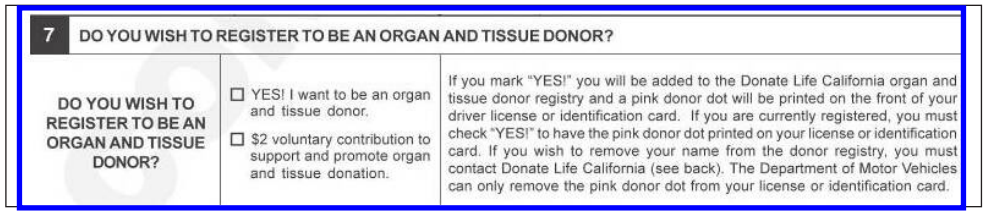
We use changes in question frame to assess the relative efficacy of a yes/no frame and an opt-in frame. Section IIA provides a description of the empirical approach and data. Section IIB presents the results. Additional details and results are shown in Supplemental Appendix C.

A. *Empirical Approach and Data*

To further test whether a yes/no frame generates a higher rate of donor registration than an opt-in frame, we leverage changes to organ donor registration questions at state DMVs. One approach would be to compare organ donor registration rates within a state before and after a framing change, but such a comparison might conflate secular trends in registration rates with the framing change. If organ donor registration rates in other states are subject to the same secular trends, however, those states can serve as a control group in a difference-in-differences identification strategy. In addition, synthetic control approaches (Abadie and Gardeazabal 2003; Abadie, Diamond, and Hainmueller 2010) can reweight the data from those other states to create a tailored control group for a given state.

A key remaining concern with this approach would be if the specific timing of the question rewording responded to state-specific data trends (e.g., if a change in frame was implemented in response to an idiosyncratically low donor registration rate in prior quarters, and so we might conflate mean reversion with the change in question frame; or if a state-wide organ donor awareness campaign was timed to occur alongside the framing change). These concerns are mitigated somewhat by the legislative and administrative process underlying these wording changes, which typically take effect a few years after they are proposed and roughly a year after any relevant legislation is passed. We also find no evidence of contemporaneous state-specific organ donor awareness drives or other policy changes that we would expect to be correlated with organ donor sentiment around the changes we analyze. Nevertheless, our data suggest some possibility of pre-trends in our treatment states, and we aim to account for the possibility of such failures of the parallel trends assumption.

Panel A. Old CA organ donation question (until June 30, 2011)



Panel B. New CA organ donation question (as of July 1, 2011)

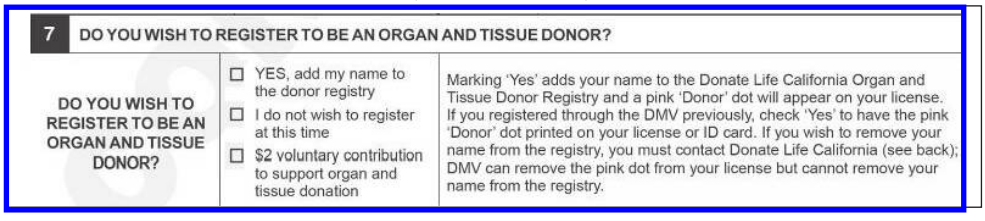


Figure 4. CA Organ Donation Question

Notes: The new CA organ donor registration question in panel B offers a yes/no frame with a yes and no option in place of the old opt-in frame shown in panel A that only offered a yes option. The legislation that proposed this change simultaneously legislated that DMV staff ask whether someone wants to be an organ donor if the question is left blank.

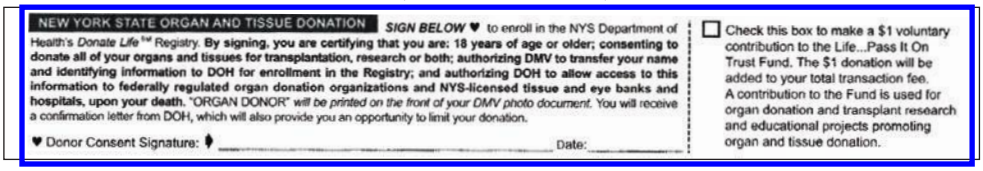
The ideal panel dataset for this analysis includes information on each state's organ donor registration rate (i.e., the fraction of those who are asked to register who respond positively) at a granular level (e.g., quarterly) for a sufficient period before and after a change in question framing.[10] The ideal dataset would also include information on all changes in organ donor question wording to identify potential experiments and to ensure that we are not including a state in a control group during a period in which they also made changes to their organ donor registration question.

From 2017 to 2018, we aimed to construct such a dataset. We contacted each US state's DMV and asked for data on donor registration rates for years 2010–2016. We also asked for copies of relevant forms not available online and information on any changes to the forms with respect to the donor registration question, with dates any changes took effect. If states were not responsive, we submitted freedom of information act (FOIA) requests, which compel states to provide available data. Our process was to send multiple requests until we received any usable data or were confident that the data did not exist or was not going to be made available.[11] Usable data were converted into organ donor registration rates at a quarterly level for as much of 2010–2016 as possible for each state. This led to a panel dataset that had at least some coverage for 42 states and Washington DC. Supplemental Appendix Table C1 shows our registration rate data by state and quarter. We also constructed a dataset of changes in organ

[10] Annual data are less helpful since changes typically take place in the middle of a calendar year.

[11] Many states provided partial data or revealed that they did not collect or store the data that we required. We supplemented the data that was provided by responsive states with a preexisting dataset from Kessler and Roth (2014c).

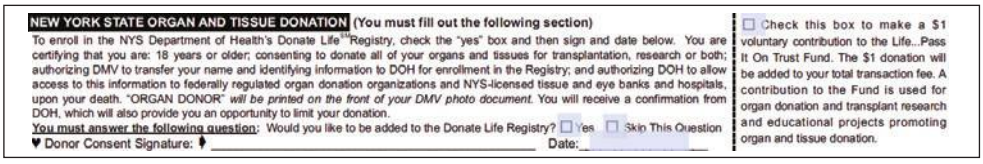
Panel A. Old NY organ donation question (until October 2, 2013)


NEW YORK STATE ORGAN AND TISSUE DONATION **SIGN BELOW** ♥ to enroll in the NYS Department of Health's *Donate Life* [tm] Registry. **By signing, you are certifying that you are: 18 years of age or older; consenting to donate all of your organs and tissues for transplantation, research or both; authorizing DMV to transfer your name and identifying information to DOH for enrollment in the Registry; and authorizing DOH to allow access to this information to federally regulated organ donation organizations and NYS-licensed tissue and eye banks and hospitals, upon your death.** "ORGAN DONOR" *will be printed on the front of your DMV photo document.* You will receive a confirmation letter from DOH, which will also provide you an opportunity to limit your donation.

♥ Donor Consent Signature: _____ Date: _____

☐ Check this box to make a $1 voluntary contribution to the Life...Pass It On Trust Fund. The $1 donation will be added to your total transaction fee. A contribution to the Fund is used for organ donation and transplant research and educational projects promoting organ and tissue donation.

Panel B. New NY organ donation question (as of October 3, 2013)


NEW YORK STATE ORGAN AND TISSUE DONATION **(You must fill out the following section)**

To enroll in the NYS Department of Health's Donate Life [tm] Registry, check the "yes" box and then sign and date below. You are certifying that you are: 18 years or older; consenting to donate all of your organs and tissues for transplantation, research or both; authorizing DMV to transfer your name and identifying information to DOH for enrollment in the Registry; and authorizing DOH to allow access to this information to federally regulated organ donation organizations and NYS-licensed tissue and eye banks and hospitals, upon your death. "ORGAN DONOR" *will be printed on the front of your DMV photo document.* You will receive a confirmation from DOH, which will also provide you an opportunity to limit your donation.

You must answer the following question: Would you like to be added to the Donate Life Registry? ☐ Yes ☐ Skip This Question

♥ Donor Consent Signature: _____ Date: _____

☐ Check this box to make a $1 voluntary contribution to the Life...Pass It On Trust Fund. The $1 donation will be added to your total transaction fee. A contribution to the Fund is used for organ donation and transplant research and educational projects promoting organ and tissue donation.

FIGURE 5. NY ORGAN DONATION QUESTION

Notes: The new NY organ donor registration question in panel B offers a yes/no frame with a yes and "skip this question" in place of the old opt-in frame shown in panel A that only offered the individual an opportunity to sign. The legislation that proposed this change simultaneously legislated that DMV staff ask whether someone wants to be an organ donor if the question is left blank.

donor registration forms, shown in Supplemental Appendix Table 8.[12] The majority of changes are minor wording changes that left the question frame unchanged. However, there were three organ donor registration question changes that involved switching from an opt-in to a yes/no frame (or vice versa) for which we had data for at least some number of quarters before and after the change.[13]

California.—On July 1, 2011, the California DMV changed the organ donation question on its forms, switching from an opt-in frame to a yes/no frame (see Figure 4). Starting on July 1, 2011, those who left the question blank were supposed to be asked by DMV staff to complete it. In addition to changing the choice architecture, there were also small changes in wording and punctuation between the forms.

California's registration rates have historically been lower than the rates in other states, but according to Governor Arnold Schwarzenegger, the policy change only occurred because of lobbying by Steve Jobs to change the organ donation choice frame.[14] The change was the result of legislation introduced in February 2010 and approved in September 2010 but not implemented until the following July.[15]

New York.—On October 3, 2013, the New York State DMV switched from an opt-in choice frame to a yes/no choice frame (see Figure 5). Starting October 3, 2013, those

[12] Supplemental Appendix Section C.1 details our empirical data collection process.

[13] In 2014, Tennessee switched from a yes/no frame to an opt-in frame. We do not have data on registration rates in Tennessee in the six quarters before and four quarters after the policy change and are therefore unable to study its effect on the registration rate. Because Tennessee underwent this policy change, we do not include it as a control state in our analyses.

[14] See https://www.forbes.com/sites/velocity/2010/04/20/how-steve-jobs-got-sick-got-better-and-decided-to-save-some-lives/?sh=5ca176063c46 (accessed 8/1/2022).

[15] For legislation and timing, see the bill at http://leginfo.ca.gov/pub/09-10/bill/sen/sb_1351-1400/sb_1395_bill_20100902_chaptered.html (accessed 7/21/2023).

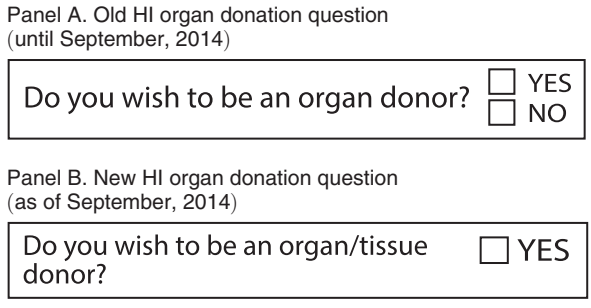


FIGURE 6. HI ORGAN DONATION QUESTION

Note: The new HI organ donor registration question in panel B offers an opt-in choice frame with a yes option only in place of the old yes/no frame shown in panel A that asked for a yes or a no.

who left the question blank were asked by DMV staff to complete it. As with the change in CA, the change in NY also included minor wording changes between the forms.

New York's registration rates have historically been lower than the rates in other states, including CA, but the specific policy change came about due to the passage of "Lauren's Law," signed by Governor Andrew Cuomo on October 4, 2012, a year before the policy took effect.[16]

Hawaii.—In September 2014, the Hawaii DMV switched from a yes/no to an opt-in question frame (see Figure 6).[17] As with the changes in California and New York, there was a small change in wording along with the change in frame.

B. *Results*

Table 3 reports difference-in-differences estimates of the effect of switching from an opt-in to a yes/no frame and vice versa. Columns 1–4 summarize the effect of changing the organ donor question format from an opt-in to a yes/no frame in California (columns 1–2) and New York (columns 3–4). Columns 5–6 estimate the effect of switching from a yes/no to an opt-in frame in Hawaii. The dependent variable is the organ donor registration rate in a state s in year-quarter t. *Post* is an indicator equal to 1 for observations after quarter 2, 2011 in columns 1–2, after quarter 3, 2013 in columns 3–4, and after quarter 2, 2014 in columns 5–6 (i.e., the quarters after the question was changed in each state). *Treated* is an indicator equal to 1 for California, New York, and Hawaii in the relevant columns, respectively.[18]

[16] See https://www.nysenate.gov/legislation/bills/2011/A10039 (accessed 8/1/2022).

[17] In an email correspondence with the Hawaii DMV in July 2017, DMV staff confirmed that the organ donor question frame was changed from a yes/no frame to an opt-in frame in 2014. Our research team further clarified that the switch happened in September 2014 during a phone call with DMV staff, although the DMV was unable to provide additional information on the precise date of the switch. However, the specific date is not required for our analysis, since we analyze all changes in the registration rates at the quarterly level.

[18] The coefficient on *Post* ranges from 0.022 to 0.046 and represents the average difference in registration rates before and after the change among states in the control group for the relevant analysis. These estimates suggest

Table 3—Effect of Question Frame on Registration Decisions

	California		New York		Hawaii		Stacked DID
	Opt-in to yes/no		Opt-in to yes/no		Yes/no to opt-in		Opt-in to yes/no
Treated state:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post × Treated	−0.054	−0.019	−0.016	0.001	−0.030	−0.017	−0.001
	(0.016)	(0.005)	(0.013)	(0.011)	(0.012)	(0.010)	(0.012)
Post	0.046		0.027		0.022		
	(0.016)		(0.013)		(0.012)		
Treated	−0.166		−0.345		−0.037		
	(0.026)		(0.023)		(0.022)		
Constant	0.438		0.462		0.466		0.345
	(0.026)		(0.023)		(0.022)		(0.006)
Observations	820	820	838	838	832	832	897
R^2	0.051	0.926	0.205	0.938	0.010	0.924	0.980
States	40	40	40	40	40	40	42
State FE	NO	YES	NO	YES	NO	YES	NO
Year-quarter FE	NO	YES	NO	YES	NO	YES	NO
State-cohort FE	NO	NO	NO	NO	NO	NO	YES
Year-quarter-cohort FE	NO	NO	NO	NO	NO	NO	YES

Notes: Columns 1 and 2 summarize the effect of changing the organ donor question format from an opt-in to a yes/no frame in California; columns 3 and 4 summarize the effect of changing the organ donor question format from an opt-in to a yes/no frame in New York; and columns 5 and 6 summarize the effect of changing the organ donor question format from a yes/no to an opt-in frame in Hawaii. Results from the stacked difference-in-differences estimation are included in column 7 and summarize the effect of a yes/no frame in all three treated states. For the purposes of this pooled analysis, the treatment indicator in Hawaii turns on in the period prior to Quarter 3, 2014, before the switch from a yes/no to an opt-in frame. Analysis in column 7 is based on 42 states (California, New York, Hawaii, and 39 control states). Analysis in columns 1–6 is based on 40 states (one treated state and 39 control states). Data in column 7 include state-quarter observations in the 6 quarters before and 4 quarters after each policy change. Standard errors clustered at the state level are in parentheses.

The interaction of *Post* × *Treated* represents the difference-in-differences estimate of interest. The negative and statistically significant coefficient in columns 1 and 2 suggests that by switching from an opt-in frame to a yes/no frame, California's registration rate was (depending on specification) between 1.9 and 5.4 percentage points lower than it would have been otherwise. Results in column 3 suggest a directionally similar, although statistically insignificant, effect on registration rates in New York. Finally, the negative and significant coefficient on *Post* × *Treated* in column 5 indicates that, relative to control states, the registration rate in Hawaii decreased after switching to an opt-in frame. Column 6 shows that this difference is no longer statistically significant when controlling for state and year-quarter fixed effects.

We also implement a "stacked" difference-in-differences specification to estimate the effect of the yes/no frame, pooling across treated states (see Supplemental Appendix Section C.2 for additional details). These results are summarized in column 7. As before, the key coefficient of interest is on *Post* × *Treated*, which is an

a positive secular trend in registration rates in the relevant time periods of our empirical analysis. The coefficient on *Treated* is negative across all three treated states and significant in California and New York, suggesting that the registration rates in California, New York, and Hawaii were lower than the registration rates in their respective control groups in the pre-period.

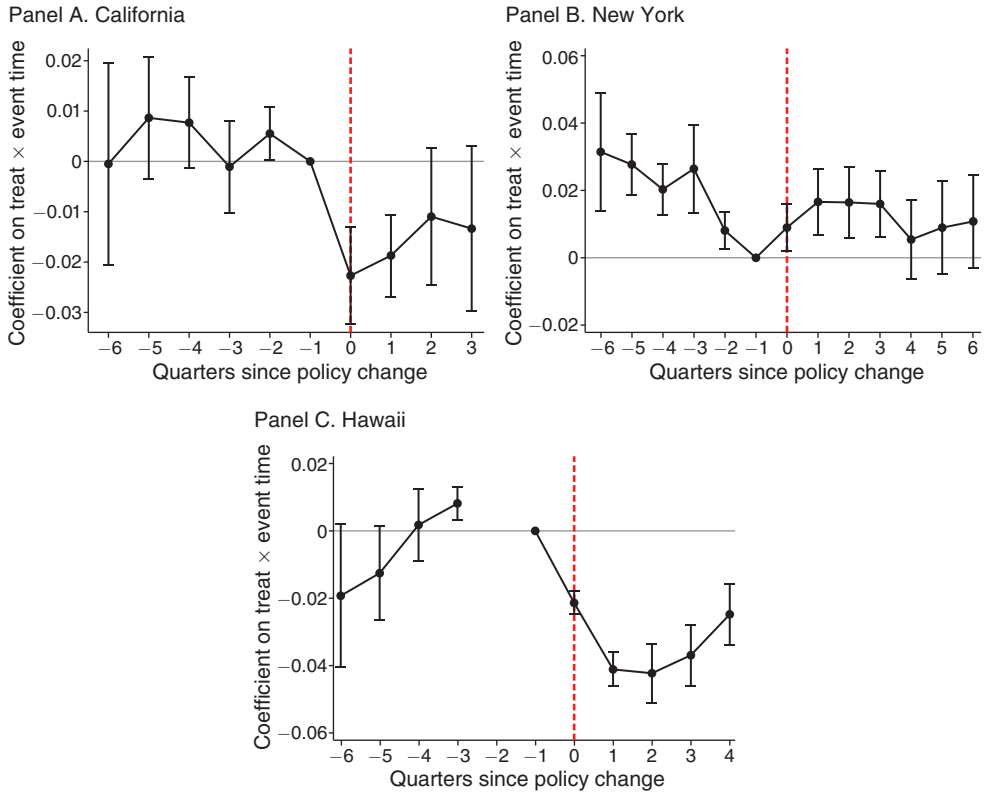


FIGURE 7. QUARTERLY ORGAN DONOR REGISTRATION RATES

Notes: Panel A plots estimates of the effect of switching to a yes/no frame on organ donor registration rates in California. The dashed line indicates the quarter in which California switched from an opt-in to a yes/no frame (Quarter 3, 2011). Panel B plots estimates of the effect of switching to a yes/no frame on organ donor registration rates in New York. The dashed line indicates the quarter in which New York switched from an opt-in to a yes/no frame (Quarter 4, 2013). Panel C plots estimates of the effect of switching to an opt-in frame on organ donor registration rates in Hawaii. The dashed line indicates the quarter in which Hawaii switched from a yes/no to an opt-in frame (Quarter 3, 2014). Data from Hawaii is missing in quarter –2, which prevents us from estimating a coefficient in that period. For all states, the omitted period is $t = -1$, so the coefficient in this period is mechanically set to zero. Regressions include state fixed effects. Standard errors are clustered at the state level.

indicator equal to 1 for year-quarters in which California, Hawaii, and New York have a yes/no frame. The coefficient is directionally negative but statistically insignificant and very close to zero. Taken together, these results suggest a very limited impact of the yes/no frame on organ donor registration rates.

Figure 7 shows event study plots summarizing the effect of the yes/no and opt-in frame in each year-quarter comparing the treated states to the control states, showing the results from columns 2, 4, and 6 in Table 3 graphically and allowing for an evaluation of pre-trends. In each plot, we regress the organ donor registration rate on a treatment indicator, indicators for each year-quarter, and their interactions, controlling for state fixed effects. The treatment indicator is equal to one for California in panel A, New York in panel B, and Hawaii in panel C.

The key assumption underpinning this difference-in-differences analysis is that the registration rate in treated and control states would have evolved similarly in the

absence of the change to the organ donor question frame. While panel A of Figure 7 suggests that the parallel trends assumption is satisfied in California, we are underpowered to detect a difference in trends between treated and control states, even if such a difference were there. Furthermore, panels B and C indicate that there may be pre-trends in New York and Hawaii.

To partially account for this, we take two approaches (additional details can be found in Supplemental Appendix C.3). First, we implement a synthetic control method (Abadie and Gardeazabal 2003), comparing the evolution of the donor registration rate in treated states with the evolution in a weighted combination of control states that do not change the frame of the donor question during the sample period and best resemble registration rates in the treated state of interest in the pre-period. The synthetic control results are consistent with those in Table 3. The yes/no frame has a directionally negative effect on registration rates in California and New York and the opt-in frame has a directionally negative effect on rates in Hawaii (see Supplemental Appendix Figure 22 for the synthetic control results). Second, we implement a sensitivity analysis introduced by Rambachan and Roth (2023). This exercise imposes restrictions on how large the violation of parallel trends in the first post-period can be (relative to the worst violation in the pre-period across two consecutive pre-periods). It allows us to identify the largest violation for which there is still a significant effect of the question frame on organ donor registrations. We find that this "breakdown value," borrowing language from Rambachan and Roth (2023), is roughly 1 in California, 0.1 in New York (where pre-trends are the most severe), and 1.1 in Hawaii (see Supplemental Appendix Figure 23 for confidence intervals of our main difference-in-differences estimate for that state's change for various violations of parallel trends). Intuitively, this means that our ability to conclude a significant effect of question frame on donor registration rates depends on whether the posttreament violation of parallel trends is more than 1, 0.1, and 1.1 times as large, respectively, as the largest pretreatment violation of parallel trends. In other words, if the violations of parallel trends are more than 1, 0.1, and 1.1 times as large as the largest pre-period violation, we are unable to conclude that the question frame has a significant effect on registrations. These results suggest that whether we find statistically significant differences due to the change in question frame depends somewhat on how parallel trends are treated and it emphasizes that results in New York are the most sensitive to these concerns.

That the results are not sensitive to the control group we construct and that the statistical significance that we do find may be sensitive to how possible pre-trends are handled underscores our point that the question frame fails to have a large impact on organ donor registration rates. If effects of choice frame on registration were substantial and robust, we would expect a different pattern in our difference-in-differences analysis than we have seen here.

III. Next of Kin Experiment

The results from the prior two sections show that the way in which the organ donor registration question is asked (i.e., with either an opt-in or yes/no frame) does not have sizable impacts on organ donor registration rates. In this section, we

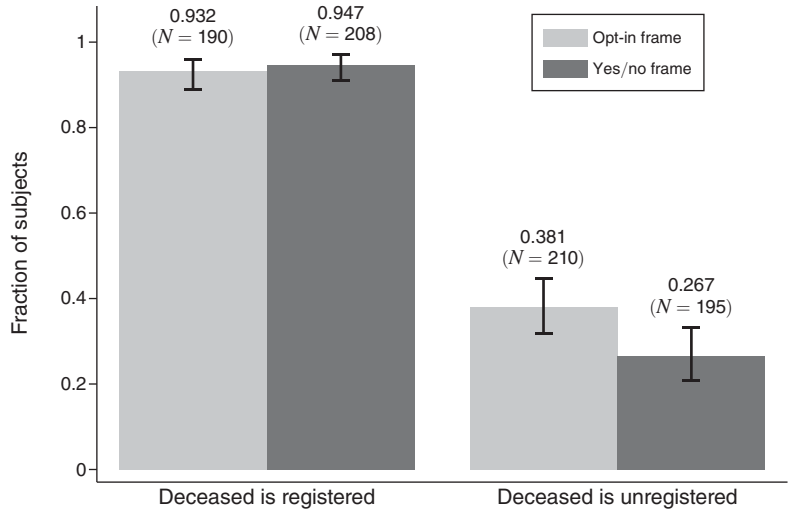


Figure 8. Share Saying Next of Kin Should Donate

Notes: Figure 8 shows the share of subjects saying the next of kin should donate the organs of the deceased by question frame and the deceased's registration status. Data are from the first scenario subjects saw. We include 95 percent confidence intervals for each mean.

highlight that the way in which the organ donation question is asked might have *indirect* effects on the number of deceased donor organs recovered through a separate channel.

In the introduction, we noted that there are two ways an individual might end up as a deceased organ donor. First, they may register as an organ donor themselves (i.e., the focus of the prior two sections). Second, their organs might be donated by their next of kin. To the extent that next of kin have a sense of how an organ donor registration question was asked of the deceased (e.g., if they are aware of how the deceased's state asks people to register at the DMV), the question frame might also impact donation through decisions of next of kin.

In a separate experiment, we asked 803 subjects from Amazon's Mechanical Turk (MTurk) to report what next of kin should do when deciding whether to donate the organs of a deceased relative.[19] Subjects answered questions in four scenarios. In each scenario they saw one of the two decision screens in Figure 1 and were told that a hypothetical deceased had either chosen to join or not join the registry. For the opt-in frame subjects were told the deceased either selected "I want to register as an organ and tissue donor" or did not select "I want to register as an organ and tissue donor." For the yes/no frame, subjects were told the deceased either selected "I want to register as an organ and tissue donor" or selected "I do not want to register as an organ and tissue donor." In each scenario the subject was then asked whether the next of kin should donate the organs of the deceased and how confident they

[19] This study was run in January 2013, before researchers started worrying about bots on the MTurk platform. Subjects were told the survey would take five to ten minutes (on average it was completed in just over five minutes) and were paid $0.50 for completing the survey. Additional experimental details are in Supplemental Appendix D.

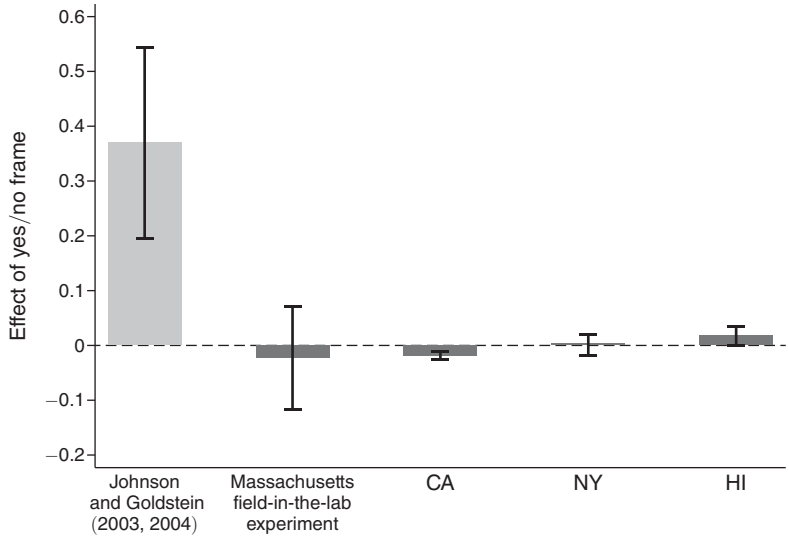


FIGURE 9. EFFECT OF YES/NO FRAME ACROSS STUDIES

Notes: Figure 9 shows the effects of a yes/no frame on organ donor registrations across studies. The light gray bar on the left shows the effect of a yes/no frame on hypothetical organ donor registrations in Johnson and Goldstein (2003, 2004). We calculate 95 percent confidence intervals using the sample size in each treatment arm as provided by the authors. Massachusetts field-in-the-lab experiment shows the effect of the yes/no frame on organ donor registrations in our field-in-the-lab experiment (see Table 2, column 5). CA, NY, and HI show results from the difference-in-differences analysis including state and year-quarter fixed effects (see Table 3, columns 2, 4, and 6, respectively). We include 95 percent confidence intervals for each mean. In Table 3 we report the effect of moving from a yes/no to an opt-in frame in Hawaii; for consistency with the other estimates, here we instead report the effect of moving from an opt-in to a yes/no frame.

were in that answer. The four scenarios were presented one at a time in one of four random orders.

Nearly all subjects (94 percent) support next of kin donating the organs if the deceased was a registered donor, and support does not depend on the frame.[20] When the deceased is unregistered, however, subjects respond to the question frame. As shown in Figure 8, which shows results from the first scenario each subject sees, when the deceased is unregistered because they failed to opt in, 38.1 percent of subjects say the next of kin should donate the organs of the deceased; when the deceased in unregistered because they selected "no" in a yes/no frame, only 26.7 percent of subjects say the next of kin should donate the organs (t-test, 405 observations, $p = 0.014$). Results are similar when we analyze responses to all four scenarios (including within-subject variation) and when we analyze subjects' confidence in their responses (see Supplemental Appendix Table 10).

The results presented in prior sections suggest that one might want to be somewhat skeptical of hypothetical choice data in this context. Nevertheless, this experiment suggests a possible channel for question wording to have an indirect effect on

[20] Signing up to the registry is thought to be legally binding (Glazier et al. 2009), but doctors may defer to the next of kin if the next of kin protests to donation upon death, although this type of protest is rare.

organ recovery if next of kin are aware of the choice frame in which their deceased relatives were asked to register. In particular our results suggest that if policymakers want to encourage more donations, the yes/no frame may have an additional downside of discouraging next-of-kin donations.[21]

IV. Summary and Discussion

Across our field-in-the-lab experiment and the natural experiments we analyze, a yes/no frame has a near zero effect on organ donor registrations. This finding stands in stark contrast to the prior results that relied on hypothetical choices. To make this comparison plain, Figure 9 summarizes the treatment effects associated with switching from an opt-in frame to a yes/no frame, estimated in our field-in-the-lab experiment and in each of the three natural experiments. It presents our results alongside estimates of the effect from Johnson and Goldstein (2003, 2004), which relied on hypothetical choice data. Our results involve actual donor registration decisions, which may help to explain the difference from previous work that relies on hypothetical decisions.

That our results contrast with prior studies, which found a much larger impact of choice architecture on decisions, connects our paper to a recent set of work on how nudge-style interventions operate "at scale." DellaVigna and Linos (2022) compare the results of nudge interventions run by the two largest nudge units in the United States to meta analyses of nudges published in academic journals. They find that the average effect in the academic meta analyses is on the order of 8.7 percentage points while the nudge unit effects are dramatically smaller at 1.4 percentage points. We add evidence along similar lines and make a complementary point by suggesting the importance of relying on actual choice data.

In addition to finding that a yes/no decision frame does not increase registration rates above an opt-in frame, we make a number of additional contributions. First, results from wave 1 of our field-in-the-lab study suggest that giving information about the benefits of donation (in our case a list of organs) can increase registration rates, which is promising for interventions aiming to educate potential donors of the value of organ donation (see Quinn et al. 2006; Thornton et al. 2012; Reese et al. 2020). Second, results from our next-of-kin study reported in Section III highlight a possible negative indirect effect on donation from the yes/no frame. Third, our field-in-the-lab study suggest that asking for donor registration regularly in a variety of contexts (e.g., on government forms outside of the DMV) may also increase registration. Asking repeatedly for the same prosocial decision is common (e.g., charities repeatedly ask donors to give during a fundraising campaign, as do political campaigns). An added benefit of asking repeatedly is that it allows individuals to have their most recent wishes reflected on the state registry.

[21] An anonymous referee raises an interesting point and writes: "A yes/no frame increases the concordance between the wishes of the deceased person and the next of kin's decision. Someone who does not wish to join the registry may express their wish unambiguously in a yes/no frame, whereas not opting in in an opt-in frame is open to interpretation (as the mTurk study result suggests)." Indeed, if policymakers want to give the deceased a way to more clearly indicate a desire not to donate, our results suggest they may see an added benefit of the yes/no frame in helping to ensure the deceased's wishes are satisfied.

We also observe that registered donors are unlikely to remove themselves from the registry when given the opportunity to do so (less than 1 percent do so in our experiment). This lack of latent demand to remove oneself from a state registry suggests that an individual being listed on a state registry may reliably reflect their current intent to be a donor. This supports the policy established by the Anatomical Gift Act that being on a registry can be used to reflect the last wishes of a deceased donor (Glazier et al. 2009). This finding may also be helpful to policymakers in considering how to ask already registered organ donors about registration. In some states, including Massachusetts, individuals are repeatedly asked about organ donor registration and are removed from the registry unless they reaffirm their desire to register each time they are asked.[22] Other states, such as Ohio, assume registered donors want to continue to be registered and so do not ask them to reaffirm.[23] Our results suggest that there may not be that many donors who wish to remove themselves at any point in time.[24]

While we explored certain wording changes, there are other ways to change how the organ donor registration question is asked that we did not explore. One could imagine adding an additional option (e.g., of the form "I am not sure" or "Ask me later") to the organ donation question and then following-up with individuals who select that new option (perhaps with additional information about organ donation). Whether such options would encourage or discourage eventual donations is a question for future work. In online registration questions that use a yes/no frame, one could also imagine having a preselected default option to the organ donor registration question (see Jachimowicz et al. (2019) for a meta analysis on the efficacy of defaults). Whether such a default would have a sizable impact in this setting is also a question for future work.

Addressing the worldwide shortage of all transplantable organs requires action on many fronts (Kessler and Roth 2014b). Most organs for transplant can only be obtained from deceased donors.[25] Approaches to increase deceased donation include providing priority on organ donor waiting lists for those who registered as donors or those who have consented as next of kin (Kessler and Roth 2012, 2014a; Stoler et al. 2016, 2017). There is also considerable effort to increase the efficiency with which deceased donor organs are recovered and used.[26] The present paper focuses

[22] From the Massachusetts state government Website: "You must reconfirm your wish to be an organ donor each time you renew your Massachusetts driver's license or ID card, even if you were previously registered as a donor." See: https://www.mass.gov/how-to/register-as-an-organ-donor-at-the-rmv#:~:text=You%20can%20register%20as%20an,on%20your%20license%2FID%20application (accessed 8/1/2022).

[23] The policy in Ohio is described here: https://www.dispatch.com/story/lifestyle/health-fitness/2013/10/09/bmv-won-t-offer-to/23737814007/ (accessed 8/1/2022). Note that individuals may go online and remove themselves from the Ohio registry at any time.

[24] Collecting and exploring data on how an individual's organ donor registration status changes over time (e.g., across driver's license renewals) would be particularly valuable to inform these types of policy questions and is an interesting direction for future work. Our understanding of most DMV data systems, however, is that they have historically stored only point-in-time registration status and so are not likely to have such longitudinal data.

[25] The two notable exceptions are kidneys (which make up the large majority of transplanted organs) and livers, which can both be donated by living as well as deceased donors. Efforts to ease the shortage of living-donor kidneys involve kidney exchange (see Ashlagi and Roth (2021) for a survey). There is a continual discussion of how to ethically and effectively offer incentives to kidney donors (see e.g., Becker and Elias (2007)), although paying donors is legally banned in most of the world (Roth 2007).

[26] Most deceased donor kidneys facilitate a single transplant, but see, for example, Melcher et al. (2016) for a recent proposal to coordinate deceased and living donor kidneys in kidney exchange chains that could facilitate multiple transplants.

on the decision to register as a deceased donor, which is the very beginning of the supply chain for most transplantable organs.

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