

# INCENTIVIZING ORGAN DONOR REGISTRATIONS WITH ORGAN ALLOCATION PRIORITY

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## ABSTRACT

How donor organs are allocated for transplant can affect their scarcity. In 2008, Israel's Parliament passed an Organ Transplantation Law granting priority on organ donor waiting lists to individuals who had previously registered as organ donors. Beginning in November 2010, public awareness campaigns advertised the priority policy to the public. Since April 2012, priority has been added to the routine medical criteria in organ allocation decisions. We evaluate the introduction of priority for registered organ donors using Israeli data on organ donor registration from 1992 to 2013. We find that registrations increased when information about the priority law was made widely available. We find an even larger increase in registration rates in the 2 months leading up to a program deadline, after which priority would only be granted with a 3-year delay. We also find that the registration rate responds positively to public awareness campaigns, to the ease of registration (i.e. allowing for registering online and by phone) and to an election drive that included placing registration opportunities in central voting locations. Copyright © 2016 John Wiley & Sons, Ltd.

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## 1. INTRODUCTION

Across the globe, countries face a shortage of human organs for transplant. Waiting lists for deceased donor organs—organs from individuals who have died in a manner that leaves their organs viable for transplant—have grown drastically over the past decade. Between 2002 and 2015, the number of candidates on the US waiting list for kidneys has more than doubled (from 50,301 to 101,674 patients).<sup>1</sup>

As the need for organs grows over time, policy makers have considered a number of new strategies to increase the supply of transplantable organs.<sup>2</sup> A policy aimed at incentivizing organ donation was passed in Israel

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<sup>1</sup>Organ Procurement and Transplantation Network (OPTN, 2015). <http://optn.transplant.hrsa.gov/data/> (accessed April 5, 2015).

<sup>2</sup>One approach is to use opt out (or presumed consent), in which people are considered organ donors unless they actively remove themselves from the registry. Refer to, for examples, Horvat *et al.* (2010), Saunders (2012), Boyarsky *et al.* (2012), Wispelaere (2012), Beloucif (2012), and Rosenblum *et al.* (2012). Another approach is to offer financial compensation for living organ donors or next of kin of deceased organ donors. Recent debates about financial compensation for donors express points of view from encouraging pilot studies to opposing them as morally flawed, but there is growing consensus on removing financial disincentives to donate: refer to, for examples, Fisher *et al.* (2015), Delmonico *et al.* (2015), and Salomon *et al.* (2015). This is part of a long-running debate about financial incentives for organ donation, which are widely regarded as repugnant (Roth, 2007) and are outlawed around the world, with the significant exception of in the Islamic Republic of Iran where there exists a legal market for living kidney donation (Ghods, 2014). Another approach is kidney exchange, which can be viewed as a way to achieve (priority for) a transplant for a loved one, by donating a kidney, refer to Roth *et al.* (2004, 2005, 2007), Rees *et al.* (2009), Ashlagi *et al.* (2011a, 2011b), Ashlagi and Roth (2012, 2014), and Anderson *et al.* (2015).

by the Israeli Parliament in 2008 (Lavee *et al.* 2010) and fully adopted on April 1, 2012. The law grants priority on organ donor waiting lists to individuals who registered as organ donors by signing a donor card. Registration indicates intent to be an organ donor upon death. The law also grants priority to those whose first-degree relatives were previously deceased organ donors and to those who previously donated an organ while alive.<sup>3</sup> The priority policy is rather unique; only Singapore previously had a policy granting priority for organ transplantation based on organ donor registration status.<sup>4</sup> Chile has only recently adopted a similar law (Zúñiga-Fajuria, 2015), while China has recently begun granting priority to family members of deceased organ donors.<sup>5</sup>

Such policies have the potential to increase the availability of donor organs. In work motivated by this Israeli priority law, Kessler and Roth (2012, 2014a, 2014b) find that priority incentives dramatically increase registration rates among experimental subjects playing laboratory games that model the decision to register as an organ donor.<sup>6</sup> These experiments were conducted prior to the availability of evidence from the field and focus on the priority rule in a setting that abstracts away from visceral attitudes toward organ donation, leaving open the empirical question of how such policies affect organ donor registration, and ultimate donation and transplantation, in practice.<sup>7</sup>

A recent preliminary analysis (Lavee *et al.*, 2013) reported an increase in both living and deceased donations as a result of the law that we analyze here. However, because of data limitations (i.e. data aggregated up to an annual level through 2011) that previous paper simply argued that more organ donor registrations were collected in 2011 as compared with 1998–2010 using just one data point for 2011 and a prediction confidence interval. Our richer, daily data and longer panel allow us to perform a complete analysis of the effect of priority on organ donor registrations. Understanding how potential organ donors respond to the incentives of priority for organ donor registration is valuable for any country considering similar legislation.

In this paper, we investigate the effect of allocation rules on deceased organ donation by analyzing how adoption of, and awareness about, a policy granting priority to registered organ donors affected registrations. We measure the effects of the priority incentive in two ways. First, we estimate whether there was a change in the number of daily registrations after the legislation became widely known in November 2010.<sup>8</sup> In addition, we take advantage of a special program deadline on April 1, 2012. Everyone who registered as an organ donor before that date was immediately granted priority, while those who registered after that date faced a waiting period of 3 years before receiving priority. This 3-year waiting period is part of the program design to avoid people choosing to register only after they have gotten sick and need an organ. However, it allows us to directly check whether the deadline in the priority policy generates additional registrations. To do this, we measure whether there was a further increase in the rate of registration in 2 or 3 months before the April 1, 2012 deadline, above and beyond the increase already observed for the period starting in November 2010.<sup>9</sup>

<sup>3</sup>Granting priority to living donors is a policy currently also in place in the USA (Potluri *et al.*, 2014).

<sup>4</sup>It should be noted that while Israel implements the opt-in policy of registration, Singapore has a presumed consent (or opt out) policy for organ donor registration, and so, those who have remained on the registry are prioritized in organ allocation over candidates who have opted out. <http://statutes.agc.gov.sg/aol/search/display/view.w3p;query=DocId%3Adb05e985-f8a0-4d61-a906-9fd39f3b5ac9%20Depth%3A0%20Status%3Ainforce;rec=0;whole=yes> (accessed February 28, 2015).

<sup>5</sup>The policy in China appears to be a very recent innovation, refer to Jiang *et al.* (2015).

<sup>6</sup>Although next of kin are allowed to overrule the registration decision in Israel, the next of kin consent rate to organ donation is more than twice as high (and nearly 100%) when a deceased is registered as an organ donor rather than unregistered.

<sup>7</sup>Because next of kin can overrule the registration decision in Israel, we have closely monitored the consent rate of next of kin of registered donors to see whether different self-selection behaviors introduced by the priority law have caused a decrease in the next of kin consent rate (which might arise if people register to get priority but instruct their relatives to refuse donation). To date, we have found no evidence of such a decrease.

<sup>8</sup>The priority clause in the Organ Transplant Law, which was passed in March 2008, was not publicized or advertised by the Israel National Transplant Center (INTC) in any form until the November 2010 campaign, which was the first campaign directly dedicated to advertising it, which it did intensively. The aim of this campaign, and of those that followed it, was to mitigate the risk that Israelis who subsequently needed organs would claim ignorance of the priority policy. Moreover, even transplant candidates, who have a lot at stake, were not notified about the priority program by INTC staff prior to November 2010. It is therefore reasonable to assume that there should have been an effect of the priority program starting only in November 2010. Additional discussion is provided in the paper's Online Supplementary Material.

<sup>9</sup>We describe the difficulty of evaluating national policy changes and present additional robustness checks (i.e. event windows of 1 and 4 months) in the Online Supplementary Material.

We also study whether other policy changes that took effect during the study period affected registrations. Namely, we investigate the effect of the following on the number of daily registrations: public awareness campaigns (allowing public awareness campaigns to be differentially successful after the public became aware of the priority rule), ease of registration (i.e. the introduction of online and phone registrations), allowing registrations to be conditional on the discretion of a clergyman chosen by the next of kin, and an election drive on January 22, 2013 that facilitated registration by allowing Israelis to register while at the polls.<sup>10</sup>

We find that the rate of organ donor registration increased after the legislation became widely known. We also find that it increased further (and substantially) during the last few months before the program deadline. Public awareness campaigns increase registrations. The introduction of online and phone registrations also increased registrations. Finally, the election drive dramatically increased registrations, with approximately 27,000 registrations collected in 1 day. The introduction of the clergy option is found to not have any statistically significant effect, although it is directionally positive.

The rest of this paper proceeds as follows. In Section 2, we provide background on the priority policy. In Section 3, we explain our data and methods. In Section 4, we present and discuss our results. Section 5 concludes.

## 2. HISTORICAL AND LEGAL BACKGROUND

On March 31, 2008, the Israeli Parliament passed the ‘Organ Transplantation Law’, legislation that revamped Israel’s organ donation policies by introducing a new priority incentive for organ donor registration.<sup>11</sup> In particular, it granted priority on organ donor waiting lists to individuals who registered as organ donors at least 3 years prior to being added to the organ waiting list, with the 3-year waiting period waived for registrations made prior to April 1, 2012.<sup>12</sup>

While the law was passed in early 2008, it took 4 years for the priority allocation to become operative. The Israel National Transplant Center (INTC), which coordinates organ procurement and allocation in Israel, spent these years formulating the precise new allocation policies and rules for each organ, which included the new priority categories (Lavee *et al.*, 2010).<sup>13</sup> The actual priority was granted on organ waiting lists starting on April 1, 2012, following two countrywide multi-media and multi-lingual campaigns aimed at familiarizing the public with the new policy, which took place in November 2010 and in November and December 2011.

Actions taken before priority implementation were eligible for priority once implemented, and healthy individuals do not usually expect to need an organ transplant in the very near future. Consequently, we expect the incentive effects of priority policy to begin when the policy becomes widely known and before it was actually implemented, as forward-looking individuals took actions to ensure that they would have priority after implementation.

Table I shows a timeline of the events that might have affected the number of organ donor registrations on any given day in Israel from 1992 through 2013. Some events involve permanent changes in registration policy,

<sup>10</sup>The election drive took place during a day of general elections in Israel when, for the first time, 700 organ donor registration stewards working for INTC were placed next to election ballot stations countrywide and invited voters to register as donors by signing a registration form either before or after voting.

<sup>11</sup>The complete English translation of the law may be found here: [http://www.declarationofistanbul.org/index.php?option=com\\_content&view=article&id=267:israel-transplantlaw-organ-transplant-act-2008&catid=83:legislation&Itemid=130](http://www.declarationofistanbul.org/index.php?option=com_content&view=article&id=267:israel-transplantlaw-organ-transplant-act-2008&catid=83:legislation&Itemid=130).

<sup>12</sup>While the focus of this paper is on priority incentives for organ donor registration, the law had a number of additional provisions: granting priority on organ donor waiting lists to candidates whose first-degree relatives were deceased donors, providing reimbursement of a number of expenses of living organ donors, establishing the definition of organ trade and trafficking and associated penalties and banning Israeli citizens from receiving organs while outside of Israel if those organs were procured in a way that contrasted with Israeli law or local law and banning the reimbursement of any such operations. This ban on illegal transplant tourism went into effect in 2008, shortly after the new law was passed. A complementary law, the Brain-Respiratory Death Law, was passed on the same day and defines the circumstances and mechanisms for determining brain death.

<sup>13</sup>The INTC maintains lists of transplant candidates, coordinates all procurements and organ allocation to all transplant programs, promotes organ donor registration, and maintains the registration database.

Table I. Campaigns and policy changes for organ donor registrations in Israel

Date	Event
Jan 2002	Campaign. TV ads; stands in hospitals and malls
Feb 15, 2002	Clergy option becomes available on donor cards
May 2003	Campaign. TV, cinema, radio, and Internet ads; letters to state workers
Feb 2004	Campaign. TV, cinema, and newspaper ads; stands in hospitals
Mar 2006	Campaign. TV ads; stands in hospitals
Sep 2007	Campaign. Radio and bus ads involving famous singer and media personality
Sep 23, 2007	Electronic donor card registrations using the Internet become available
Sep 23, 2007	Direct phone link for phone donor card registrations becomes available
Mar 2008	Prioritization law passes in parliament and is published
Nov 2010	First campaign on prioritization law. Ads on TV, radio, busses, and Internet
Nov–Dec 2011	Campaign highlighting that the deadline for immediate priority is nearing
Mar 31, 2012	Deadline for getting immediate priority for donor card registrations
April 1, 2012	Priority for registered organ donors begins
Dec 2012	Campaign. TV, radio, internet, mobile phone, and street ads
Jan 22, 2013	Stands put near 700 ballot boxes on general election day

while other events involve temporary changes, including a number of campaigns run by the INTC to encourage organ donor registrations. These campaigns generally included advertisements across multiple platforms and stands placed throughout the country where individuals would be asked to register.

### 3. DATA AND METHODS

We analyze the universe of all organ donor *registrations* in Israel between January 1992 and December 2013.<sup>14</sup> We observe the calendar date on which each registration was made, allowing us to analyze registrations on a daily basis.<sup>15</sup> We investigate the effect of the priority rule for organ donor registration<sup>16</sup> on the flow of registrations in two ways. First, we examine whether the flow of registrations increased after the legislation became widely known using a binary variable (‘Aware’) that is set to 1 for November 2010 (when the campaign began) to the end of our data.

To provide additional evidence that priority is affecting registrations, we also look for evidence of a further increase in the number of registrations in the months before April 1, 2012. As a motivation for this analysis, Figure 1

<sup>14</sup>The INTC began collecting Organ Donor Registrations in June of 1990, but until 1992, registrations were only recorded when enough registration forms accumulated, and the date of the registration was marked as the day the registration was entered into the database rather than the day the donor card was signed. Because of this limitation, the 1990–1991 registration data is full of gaps that make it difficult to reliably estimate a model of daily registrations. Consequently, we exclude it from the empirical analysis. Results are nearly identical when these years are included.

<sup>15</sup>The new law grants priority as a function of when the donor registration occurs, making the timing of the registrations important to track. Before the passage of the law, the specific date of registration was less important, and so, the data is likely measured with more noise before the law was passed than after. In particular, before the law, registration date may have sometimes been recorded as the date the donor card information was entered into the INTC database rather than the date the card was signed. We address this in our econometric analysis (e.g. by defining variables like when a INTC campaign is run to allow for registrations entered after the campaign ends to be included as part of the campaign).

<sup>16</sup>Since the law also provided incentives for the next of kin of deceased donors, an altruistic family member might register knowing that it may potentially benefit their next of kin. Unfortunately, we cannot estimate such effects separately because all parts of the priority policy were legislated, announced, and implemented together. However, we are not worried that the priority for next of kin of donors has a measurable impact on the effect of priority on organ donor registrations for two main reasons. First, even if an individual does not register as an organ donor while alive, their next of kin can still receive priority by consenting to donation of the deceased’s organs after death. This means that altruistic parents need not register as donors while alive if their only concern is that their children get priority from their deceased organ donation. Second, only a small percentage of registered donors are ever in a position to donate the organs of a deceased relative as a next of kin. Indeed, there are only on the order of 100 eligible deaths each year while there are between 100 and 150 organ donor registrations *per day* in Israel. Consequently, the majority of the individuals who receive priority from registration are not going to be eligible to receive priority through the next of kin channel.

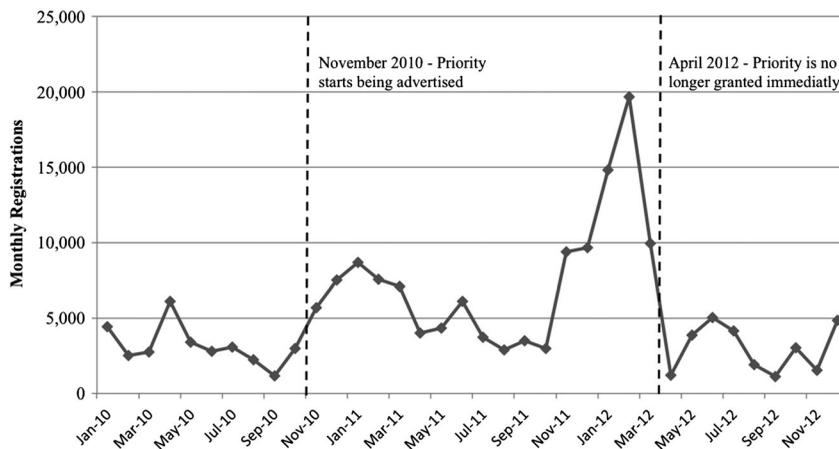


Figure 1. Number of organ donor registrations each month around priority implementation. The first vertical line (November 2010) is when people become aware of the priority policy. The second vertical line (April 2012) indicates when priority became subject to a 3-year delay.

shows registrations per month from 2010 through 2012, including the period during which the law was implemented. One can see a jump in late 2011, likely because of the organ donor registration campaign in November and December of 2011. However, when the campaign is over, registrations keep increasing during January and February 2012. If the priority incentives leading up to the program deadline did not play a role, we would expect a decrease in these months as the effect of the campaign fades. The number of registrations in March is still more than three times higher than the mean number of registrations per month across all the data, which is 2,905.<sup>17</sup>

Because organ donor registrations recorded before April 1, 2012 resulted in immediate priority while registrations after this deadline were subject to a 3-year waiting period, the priority value of registering is potentially smaller after this date. In one specification, we use a binary variable ('Feb and Mar 2012') that is set to 1 during February and March of 2012 to measure the effect in the 2 months before the program deadline. In another specification, we instead use a similar binary variable ('Jan to Mar 2012') to measure the effect in the 3 months before the program deadline.<sup>18</sup> To check whether registrations starting in April 2012 are different from the rest of the aware period, we use the binary variable 'Post April 2012' which is set to 1 starting on April 1, 2012. This allows us to test whether some registrations just before the deadline may be the result of inter-temporal substitution, which could potentially result in lower registration rates after the deadline.

To examine whether other policy changes that took effect during the study period affected registrations, we use the following variables: 'Campaign' is a binary variable set to 1 for months during which public awareness campaigns were run plus one additional month after the campaign ends, to allow a gradual fading of the campaign effect (for example, if physical advertisements are not immediately taken down or if individuals motivated to sign up because of the campaign procrastinate for a few weeks before registering).<sup>19</sup> The

<sup>17</sup>Figure A1 in the Appendix shows the number of registrations collected in each month of our data. There is significant variability in the number of registrations collected across months around the mean of 2,905 per month. As one might expect, and as we explore in our analysis, many of the spikes in Figure A1 are associated with the INTC campaigns and with observed changes in organ donor registration policy.

<sup>18</sup>We restrict attention to 2-month and 3-month windows before April 1, 2012 because limiting ourselves to 1 month discards too many observations that are useful in estimating the effect of the deadline, implicitly imposing a restriction that deadline-related registrations only take place in the last month before the deadline, an assumption we find too restrictive. An event window of 4 months or more overlaps with the November to December campaign so if that campaign was more effective than others, the event window coefficient will pick up the positive effect of that campaign. To be conservative, we do not estimate windows longer than 3 months in the paper, although we show additional specifications in the paper's Online Supplementary Material.

<sup>19</sup>This approach also accommodates any potential misreporting of dates in the early years of the registry. However, it is conservative in that it likely results in a downward bias of the effect of the campaigns as it includes additional days as days treated by a campaign. Indeed, our effects are stronger when we restrict our campaign variables to the exact dates the campaign officially ran.

‘Campaign × Aware’ interaction term measures whether public campaigns became more effective in soliciting registrations after the legislation. The ‘Online and phone’ binary variable is set to 1 after it became possible to register as an organ donor using the Internet or a cellular phone on September 23, 2007. The ‘Election’ binary variable is set to 1 for January 22, 2013, the day of the election drive described in the preceding text. The ‘Clergy option’ binary variable is set to 1 starting when the organ donor registration card gave registrants the option to check a box to instruct physicians to request the approval of a clergyman acceptable to the donor’s family before a final donation decision is made, a policy designed to encourage more religious individuals to register. Finally, we also control for the day of the week, the month of the year (in case seasonality is important), whether the observation represents a ‘National holiday’ in Israel (during which fewer registrations are expected) and include a cubic monthly time trend to account for secular trends in registrations.

The model estimated is therefore the following:

$$\begin{aligned} \text{Daily registrations} = & \alpha + \beta_1 \text{Aware} + \beta_2 \text{Post April 2012} + \beta_3 \text{Feb and March 2012} + \\ & \beta_4 \text{Campaign} + \beta_5 \text{Campaign} \times \text{Aware} + \beta_6 \text{Online and phone} + \beta_7 \text{Clergy option} \\ & \beta_8 \text{Election} + \beta_9 \text{Month} + \beta_{10} (\text{Month})^2 + \beta_{11} (\text{Month})^3 + \beta_{12} \text{Tue} + \dots + \beta_{17} \text{Sun} + \\ & \beta_{18} \text{National holiday} + \beta_{19} \text{Feb} + \dots + \beta_{29} \text{Dec} + \varepsilon \end{aligned}$$

#### 4. RESULTS AND DISCUSSION

Table II shows the results of regression analysis that investigates the daily number of organ donor registrations from January 1, 1992 to December 31, 2013. Regression results are consistent with expectations regardless of specification. We discuss results from column (1) and note that results are robust to a different window length in column (2). In column (1), the coefficient on Aware is 36.70 and statistically significant at the 5% level. This suggests that there is a positive effect on registrations because of the priority rule being in effect and individuals being aware of it. To benchmark the size of this effect, we note that the mean daily number of registrations before November 2010 is 93.93. Because the coefficient on Aware is equal to 36.70, we calculate that awareness adds approximately 39% to the number of daily registrations. In addition, if we multiply the coefficient by the number of days for which the Aware variable is equal to 1 (1,157 days), we get that awareness of the priority policy is responsible for 42,462 additional registrations. Given that the total number of registrations collected during 1992–2013 is 767,107 (an average of 34,868 a year), 42,461 is a substantial number.

During February and March 2012, the registration rate increased further by approximately 349.27 registrations per day, as estimated by the Feb and Mar 2012 coefficient. This coefficient is statistically significant at the 1% level and suggests that people strongly respond to the program deadline, signing up at higher rates even relative to the rest of the aware period. Comparing to the mean daily registrations received before November 2010 of 93.93, we see that the nearness of the deadline increased the daily registration rate almost fivefold. This represents  $349.72 \times 60 = 20,956$  additional registrations.<sup>20</sup> It is important to note that we do not claim that all of the extra registrations would not have happened but for the deadline, as some of them may be because of intertemporal substitution (e.g. shifting to register before the program deadline among people who would have registered at some point afterward). However, the existence of the effect and its magnitude suggest that people do indeed respond substantially to the priority incentives.

The Post April 2012 variable coefficient is not statistically significant, suggesting that after the deadline, the registration rate returns to the elevated levels associated with being aware of the priority program. It is somewhat surprising that there is no decrease, because the priority given after the deadline is a bit weaker (i.e. the registrant must wait 3 years before receiving priority).

<sup>20</sup>There were 60 days in February and March 2012 as it was a leap year.

Table II. Effect of policy change and other events on the number of daily registrations

Variable	2-month window	3-month window
Aware	36.70 (17.54)**	45.94 (16.92)***
Post April 2012	26.39 (29.53)	29.76 (25.13)
Feb and Mar 2012	349.27 (118.02)***	
Jan to Mar 2012		275.93 (80.83)***
Campaign	60.29 (9.78)***	60.05 (9.77)***
Campaign × Aware	158.67 (51.60)***	113.36 (52.57)**
Online and phone	77.32 (11.52)***	80.10 (11.35)***
Clergy option	5.47 (7.22)	4.49 (7.17)
Election	26603.91 (65.53)***	26654.46 (66.23)***
National holiday	-98.41 (5.22)***	-98.32 (5.19)***
Constant	121.62 (16.09)***	113.85 (16.12)***
Number of observations	8036	8036
R-squared	0.77	0.77
Mean registrations (pre-Nov 2010)	93.93	93.93

Numbers are rounded to two digits after the decimal point (except for  $p$  values that are rounded to three digits after the decimal point). Robust standard errors are in parentheses. Coefficients for the day of the week, month, and trend terms are suppressed.

\*\* $p=0.05$ . \*\*\* $p=0.01$ .

The Campaign coefficient is quite large at 60.29 and statistically significant at the 1% level. Comparing with the mean daily registrations received before November 2010, we see that campaigns increase the registration rate by approximately two thirds. We have 571 campaign days in the data, suggesting that campaigns accounted for  $571 \times 60.29 = 34,426$  additional registrations.

The Campaign × Aware coefficient is 158.67 and is statistically significant at the 1% level. Comparing with the mean daily registrations received before November 2010, this means that campaigns from the aware period increased the daily registration rate by  $158.67 + 60.29 = 218.96$  registrations per day. Compared with a base of 93.93, campaigns from the aware period more than tripled the daily registration rate. With 215 campaign days during the aware period, this effect accounts to  $215 \times 158.67 = 34,114$  additional registrations, not counting the additional registrations noted in the preceding text.

We must be careful in interpreting what caused this increase in the efficacy of campaigns. While our regression specifications include linear, second-order, and third-order terms for month of our data to control for secular trends, comparing campaigns before and after the policy change is still fraught with two confounding factors: (a) the intensity of the campaigns may differ before and during the aware period, (b) we only observe five campaigns before the aware period (the last one in 2006) and three campaigns during the aware period (the first one in 2010), and there were other changes between 2006 and 2010 beyond priority that could influence the effectiveness of campaigns. In particular, in 2007, individuals became able to register electronically on the Internet and by phone. This enhanced accessibility of registering could also influence the efficacy of campaigns.

Results from Table II also allow us to make some additional observations about what motivates organ donor registrations in Israel. The online and phone coefficient is 77.32 and statistically significant at the 1% level, suggesting that enhancing accessibility of registration by allowing people to register over the phone or the Internet increases registrations. Allowing for online and phone registration almost doubled the daily registration rate compared with before November 2010. Because we have 2,292 days in the data after phone and Internet

registration was introduced, we estimate that this change was responsible for  $2,292 \times 77.32 = 177,217$  registrations. In other words, this change is responsible for approximately 23% of the total registrations collected during 1992–2013. Of course, part of the reason this variable is so important in explaining the stock of registered donors is that this option exists for a long time (since September 2007), but its magnitude is higher than that of the Campaign coefficient (and campaigns are temporary and expensive) and slightly more than double the Aware coefficient.

We find no significant increase in registrations after the option to have a clergyman chosen by the deceased's family approve the donation was introduced. This may not be surprising since secular individuals may not value this option, and ultraorthodox individuals may not register even with this option offered.

Most striking, and likely highly relevant to policy makers in other settings, is the massive positive coefficient on the Election variable, which is 26,603.91 (which compares favorably to the 85,558 registrations collected during all of 2013, the year of the election). We find that this policy, which places the donor card question in front of hundreds of thousands Israelis voters, generated an impressive number of registrations.<sup>21</sup>

Finally, as expected, the coefficient on National holiday is negative and significant, demonstrating that fewer people register on holidays. Additional variables not reported in the table—included in the model as controls—are also significant in expected directions. The day of the week dummy variables show that the number of registrations per day declines as the weekend approaches. Month of the year dummies show a decrease in the number of registrations from July to September, typical vacation months in Israel when many people travel abroad and when many parents may be much busier than usual because children are on vacation from school. Finally, untabulated results show that the estimation is robust to adding a fourth-order as well as a fifth-order monthly trend variable to the estimation.

The results for the regression using a 3-month event window, from January to March 2012, are reported in column (2) of Table II. We see that the results are very similar, and most coefficients change very little. Only two coefficients change significance level—the Aware coefficient is now statistically significant at the 1% level rather than at 5%, and the Campaign  $\times$  Aware coefficient is now somewhat smaller and only statistically significant at the 5% level rather than at 1%.

One limitation of the current study is that it is essentially a pre-post study without a comparison group, so the study is susceptible to confounders that are not controlled for in the analysis. Implicitly, we are suggesting that demographic (or other) changes that might affect the number of daily registrations are gradual in nature and that our cubic in months effectively controls for all relevant secular trends.

## 5. CONCLUSION

Using the universe of organ donor registration data in Israel, we are able to make several contributions to the literature. First, we show—for the first time—that a policy that gives registered organ donors priority on organ donor waiting lists has a substantial effect on organ donor registrations. We observe this as an increase in registrations once the priority policy is passed and the public is aware of the law. We also find a substantial increase in registrations just before a program deadline after which priority is subjected to a 3-year delay. Second, we show the importance of other policy variables that influence organ donor registrations. Allowing for easy registration online or by phone, public campaigns, and election drives are all found to be effective means of increasing the registration rate.

Comparing the estimated effects with 93.93, the average number of daily registrations before November 2010, awareness of the priority policy is predicted to have increased the registration rate by 39.1%. Campaigns before the aware period are predicted to have increased the registration rate by 64.2%. The availability of online and phone registration is predicted to have increased the registration rate by 82%. The election drive was found to be highly effective as well, generating approximately 30% of a year's registrants in 1 day.

<sup>21</sup>More than 3.8 million people voted in the Israeli elections in 2013. Not every ballot station was assigned a steward to collect registrations for budgetary reasons, but hundreds of thousands of people were exposed to such option. Because of its success, the INTC chose to have stewards ask for organ donor registrations during the 2015 election as well.

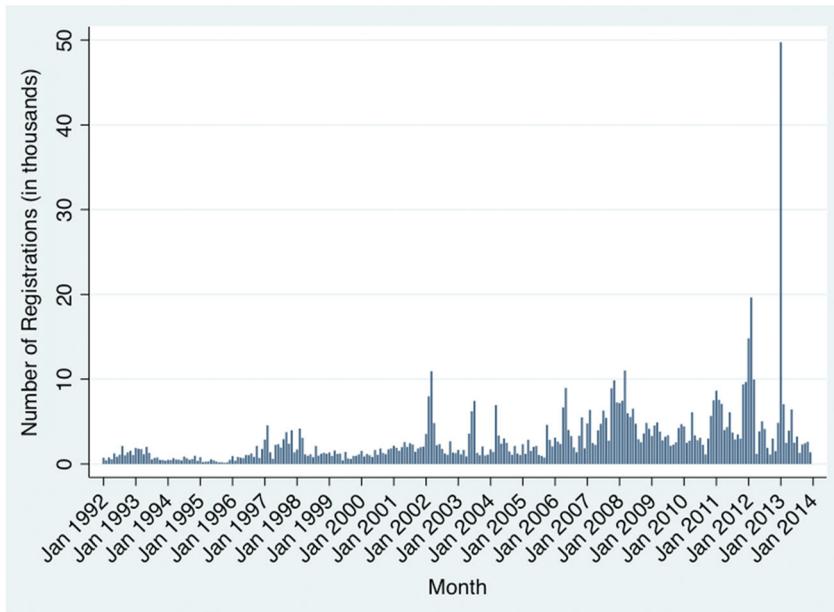
Priority for organ donor registrants is just one component of the full legislation passed in Israel in 2008. The law also provided organ donor waiting list priority incentives for the next of kin of deceased organ donors to encourage next of kin to consent to donation, incentives for living donors (who get a larger priority boost than those registered as organ donors or next of kin), and a ban on transplant tourism. Like the priority for organ donor registrations discussed in this paper, the other components of the law have also been shown to affect behavior. Estimates of the next of kin consent rate suggest that it has increased by 21.1% among the next of kin of non-registered deceased (Stoler *et al.* 2015). There has also been a documented decrease in the extent of transplant tourism and an increase in living kidney donation in Israel since the law (Lavee *et al.* 2013; Ashkenazi *et al.* 2015; Boas *et al.* 2015).

CONFLICT OF INTEREST

All authors declare no conflicts of interest.

APPENDIX

Figure A1. Number of organ donor registrations each month from 1992 through 2013



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## INCENTIVIZING ORGAN DONOR REGISTRATIONS WITH ORGAN ALLOCATION PRIORITY

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