

# Incentivizing Authorization for Deceased Organ Donation With Organ Allocation Priority: The First 5 Years

A. Stoler<sup>1,2,\*</sup>, J. B. Kessler<sup>3</sup>, T. Ashkenazi<sup>4</sup>,  
A. E. Roth<sup>5</sup> and J. Lavee<sup>6,7</sup>

<sup>1</sup>Department of Economics, DePaul University, Chicago, IL

<sup>2</sup>Coherent Economics, Highland Park, IL

<sup>3</sup>Department of Business Economics and Public Policy, The Wharton School at the University of Pennsylvania, Philadelphia, PA

<sup>4</sup>Israel National Transplant Center, State Ministry of Health, Tel-Aviv, Israel

<sup>5</sup>Department of Economics, Stanford University, Stanford, CA

<sup>6</sup>Heart Transplantation Unit, Department of Cardiac Surgery, Leivie Heart Center, Sheba Medical Center, Tel Hashomer, Israel

<sup>7</sup>Sackler Faculty of Medicine, Tel-Aviv University, Tel Aviv, Israel

\*Corresponding author: Avraham Stoler, astoler@gmail.com

**Abbreviations:** DRPM, donation rate per 1 million population; INTC, Israel National Transplant Center; OR, odds ratio

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## Introduction

Across the globe, countries face shortages of human organs for transplant. Waiting lists for deceased donor organs have grown drastically over the past decade. Between 2002 and 2015, the number of candidates on the U.S. waiting list for kidneys has more than doubled, from 50 301 to 101 015 patients. Overall, there are currently 122 042 patients on the U.S. waiting lists for transplantation (1).

Priority rules that give better access to deceased donor organs to persons who previously contributed to the pool of organs (e.g. by registering as an organ donor, authorizing organ donation as next of kin or donating as a living organ donor) have been shown experimentally to have the potential to provide an incentive for organ donation and to increase the pool of donor organs (2–4).

A law aimed at providing incentive for organ donation was passed in Israel (5) in 2008, publicized toward the end of 2010 and fully adopted in 2012. The law grants priority on organ donor waiting lists to persons who previously registered as organ donors, to persons whose first-degree relatives were previously deceased organ donors and to those who donated an organ while alive. Some aspects of the Israeli priority policy are unique; only Singapore (6) preceded Israel in implementing a priority policy, but Singapore's policy does not offer priority to next of kin for authorizing donation and gives priority only to candidates for transplant who have not opted out from being considered as potential organ donors (unlike Israel, Singapore has an opt-out rule for organ donation). Chile recently followed Israel in implementing a priority policy for candidates for transplant; however, like Singapore, Chile has an opt-out rule for organ donation, and priority is given to candidates for transplant who have not opted out (7).

**The allocation system of donor organs for transplantation may affect their scarcity. In 2008, Israel's Parliament passed the Organ Transplantation Law, which grants priority on waiting lists for transplants to candidates who are first-degree relatives of deceased organ donors or who previously registered as organ donors themselves. Several public campaigns have advertised the existence of the law since November 2010. We evaluated the effect of the law using all deceased donation requests made in Israel during the period 1998–2015. We use logistic regression to compare the authorization rates of the donors' next of kin in the periods before (1998–2010) and after (2011–2015) the public was made aware of the law. The authorization rate for donation in the period after awareness was substantially higher (55.1% vs. 45.0%, odds ratio [OR] 1.43,  $p = 0.0003$ ) and reached an all-time high rate of 60.2% in 2015. This increase was mainly due to an increase in the authorization rate of next of kin of unregistered donors (51.1% vs. 42.2%). We also found that the likelihood of next-of-kin authorization for donation was approximately twice as high when the deceased relative was a registered donor rather than unregistered (89.4% vs. 44.6%, OR 14.27,  $p < 0.0001$ ). We concluded that the priority law is associated with an increased authorization rate for organ donation.**

There have been only two preliminary reports to date on the results of the Israeli Organ Transplantation Law. Boas et al (9) focused on live donation. Lavee et al (8) provided initial evidence that the policy seemed to be positively affecting organ donor registrations, next-of-kin authorization rates and live kidney donations; however, because the study was conducted only 1 year after the policy went into effect, it did not provide a complete analysis of how the priority policy affected deceased donation. The current paper shows concretely the longer term effects of the priority policy and quantifies the sources of the change in the authorization rate.

**Methods**

On March 31, 2008, the Israeli Parliament passed the Organ Transplantation Law, legislation that revamped Israel’s organ donation policies and introduced two new incentives that we studied (10). First, it granted priority in organ allocation to candidates for transplantation who registered as organ donors at least 3 years prior to being listed. Second, it granted even higher priority on organ donor waiting lists to first-degree relatives of persons whose organs were donated at their death or to candidates who previously donated an organ.

Although Israelis can register as organ donors, the potential donor next of kin make the ultimate decision about whether to donate the organs of the deceased relative, so the latter part of the priority policy provides an incentive for the very people authorizing organ donation.

Although 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 those years formulating precise new allocation policies and rules for each organ that included the new priority categories (5). The INTC maintains lists of transplant candidates, coordinates all procurements and organ allocation to all transplant programs, promotes organ donor registration, and maintains the donor registration database. Actual priority was granted on organ waiting lists starting on April 1, 2012, following two countrywide multimedia and multilingual campaigns that took place in November 2010 and November and December 2011 and that aimed at familiarizing the public with the new policy. Any donor registration or authorization for donation made before 2012 was eligible for priority once the priority policy was implemented (i.e. next of kin of authorizations made before the implementation of the law were also eligible for priority).

We analyzed the universe of patients with brain death who were medically eligible for deceased organ donation in Israel from January 1, 1998, to December 31, 2015, provided by the INTC, following institutional review board approval (Table 1). In total, we observed data for 2663 deceased patients. Excluded from our analysis were 419 child and non-Israeli resident potential donors; children are not eligible to register as organ donors and thus are exempt from the priority policy rules, and nonresidents are ineligible to be transplant recipients in Israel and thus cannot be motivated by the priority policy. Consequently, we based our analysis on 2244 deceased adult Israeli residents and observed whether the deceased patients had previously registered as organ donors, whether the deceased patient’s next of kin ultimately authorized donation and the year in which the request for donation was made.

**Table 1:** Registration status of potential donors and actual donors and authorization rates by year

	Registration status								
	Potential donors			Actual donors			Authorization rates, %		
	Both	Yes	No	Both	Yes	No	Both	Yes	No
1998	178	3	175	80	3	77	44.9	100.0	44.0
1999	135	3	132	55	3	52	40.7	100.0	39.4
2000	155	1	154	67	1	66	43.2	100.0	42.9
2001	104	2	102	47	2	45	45.2	100.0	44.1
2002	117	14	103	56	12	44	47.9	85.7	42.7
2003	98	9	89	42	6	36	42.9	66.7	40.5
2004	120	7	113	51	5	46	42.5	71.4	40.7
2005	127	7	120	54	7	47	42.5	100.0	39.2
2006	129	10	119	63	10	53	48.8	100.0	44.5
2007	127	10	117	57	10	47	44.9	100.0	40.2
2008	122	6	116	52	6	46	42.6	100.0	39.7
2009	109	5	104	58	5	53	53.2	100.0	51.0
2010	106	15	91	50	14	36	47.2	93.3	39.6
2011	155	14	141	85	13	72	54.8	92.9	51.1
2012	112	6	106	56	5	51	50.0	83.3	48.1
2013	126	19	107	71	17	54	56.4	89.5	50.5
2014	111	13	98	60	10	50	54.1	76.9	51.0
2015	113	17	96	68	15	53	60.2	88.2	55.2
1998–2010 Total	1627	92	1535	732	84	648	–	–	–
2006–2010 Total	593	46	547	280	45	235	–	–	–
2011–2015 Total	617	69	548	340	60	280	–	–	–
1998–2010 Average	125.2	7.1	118.1	56.3	6.5	49.8	45.0	91.3	42.2
2006–2010 Average	118.6	9.2	109.4	56	9	47	47.2	97.8	43.0
2011–2015 Average	123.4	13.8	109.6	68	12	56	55.1	87.0	51.1

Yes = registered; No = unregistered.

We performed our analysis by investigating whether there was a change in next-of-kin authorization rates starting in January 1, 2011, shortly after priority was first announced as part of a national campaign and when donor coordinators staffed by INTC started mentioning priority to next of kin when asking for authorization. Because actions taken before April 1, 2012 were eligible for priority, the point in time at which the priority could have started to have an effect was during November 2010. Because our data were aggregated yearly, we start our “period after policy change” on January 1, 2011. Consequently, a small number of requests that could have been affected by priority (those from December 2010) are not included in the period after policy change. This may have a very slight effect in the direction of making our estimates more conservative.

We focused on analyzing authorization rates instead of the common donation rate per 1 million population (DRPM) or total number of organ donors. Those latter measures, although useful and informative in most cases, suffer from several disadvantages in the context of our study because they are confounded by factors unrelated to the incentive of the priority policy. Nevertheless, we reported DRPM and the total number of organ donors as secondary metrics in Appendix 1, alongside a detailed explanation of the potential confounds in estimating the effect of the priority incentive.

We investigated authorization rates of next of kin of all adult Israeli resident potential donors and then looked separately at those potential donors who were registered as organ donors and those who were not registered. This approach allowed us to understand whether changes in the overall next-of-kin authorization rates were associated with the registration status of the potential donors or with changes in the relative incidence of registration as organ donors in the population.

**Statistical methods**

We compared next-of-kin authorization rates in the periods before (1998–2010) and after (2011–2015) policy change using logistic regressions. Each observation represents one donation request made to the next of kin of a potential donor after brain death. The dependent variable is equal to 1 if the donation request was authorized and is zero otherwise. In addition to whether we were in the *before* or *after* period, we controlled for whether the potential donor was a registered organ donor because this status can influence the next-of-kin decision. An interaction term between the *after* period and whether the potential donor was a registered organ donor was also used to allow the legislation to differentially affect the authorization rates among registered versus unregistered organ donors. We use two specifications: The first compared the periods 1998–2010 and 2011–2015, and the second compared the periods 1998–2010 to 2011–2015 but also included a linear yearly trend. The linear yearly trend was included to mitigate the potential concern that a positive estimated effect of the law may be a result of very low authorization rates in the very early years and a secular increase in the authorization rates rather than a discontinuous effect of the priority incentive included in the law. This approach is somewhat conservative because a positive effect of the priority incentive in the *after* period would cause the linear trend to become more positive, so the linear trend coefficient would pick up some of the effect of the law.

Finally, we decomposed the change in the overall next-of-kin authorization rate into three components, each of which could affect the overall authorization rate: a change in the authorization rate of next of kin of registered donors, a change in the authorization rate of next of kin of unregistered persons and a change in the proportion of registered donors among potential donors. We computed p-values (using a test of proportions) to help readers compare authorization rates between different time periods and otherwise when we do not have a corresponding logistic

model estimate. We relied on the logistic model to conclude that the priority policy was associated with higher authorization rates.

**Results**

**Actual changes in authorization rates**

There was a significant increase in the average authorization rates for organ donation among next of kin of potential donors from 1998 to 2010, when it was 45.0% (732 of 1627 authorized), to 2011–2015, when it was 55.1% (340 of 617 authorized,  $p < 0.0001$ ) (Table 1). The authorization rate reached an all-time high of 60.2% in 2015. Of the five highest authorization rates during the entire study period, four are recorded during the 2011–2015 period.

For authorization rates of next of kin of deceased persons who were registered as organ donors, we observed an insignificant decrease in the average authorization rate from an average of 91.3% (84 of 92 authorized) in 1998–2010 to 87.0% (60 of 69 authorized,  $p = 0.37$ ) in 2011–2015.

For authorization rates of next of kin of deceased persons who were not registered as organ donors, we observed a significant increase in the average authorization rate, from an average of 42.2% (648 of 1535 authorized) in 1998–2010 to 51.1% (280 of 548 authorized,  $p = 0.0003$ ) in 2011–2015, reaching an all-time-high rate of 55.2% in 2015. Of the five highest authorization rates of unregistered persons during the entire study period, four are recorded during the 2011–2015 period.

We also compared the authorization rates of next of kin of registered potential donors and unregistered potential donors. For the whole study period, the mean authorization rate of next of kin of unregistered persons was 44.6% and that of next of kin of registered donors was 89.4% ( $p < 0.0001$ ). For 1998–2010, the same authorization rates were 42.2% and 91.3%, respectively ( $p < 0.0001$ ), and for 2011–2015, they were 51.1% and 87.0%, respectively ( $p < 0.0001$ ).

**Estimated effect of policy on authorization rates**

Results from the logistic model estimation are reported in Table 2. The term *After 2010* was equal to 1 if the donation request was made during 2011–2015. The term *Registered* was equal to 1 if the potential donor was a registered organ donor. The term *Registered × after 2010* was equal to 1 if the donation request was made during 2011–2015 and the potential donor was a registered organ donor.

As expected, whether the donation request was made after 2010 and whether the potential donor was a registered organ donor were statistically significant in both specifications and were associated with a higher likelihood of authorizing donation. The *Registered* variable

**Table 2:** Logistic regression results

Specification	Predictor	Odds ratio	95% CI	p
No linear yearly trend	After 2010	1.43	1.18–1.74	0.0003
	Registered	14.37	6.91–29.89	<0.0001
	Registered × after 2010	0.88		0.0179
Linear yearly trend	After 2010	1.37	1.01–1.87	0.0414
	Registered	14.27	6.85–29.72	<0.0001
	Registered × after 2010	0.88		0.0336
	Trend	1.00	0.98–1.03	0.7515

Interaction terms were computed using the Ai-Norton correction (30).

**Table 3:** Alternative metrics tracking donations in Israel, 2006–2015

	Next-of-kin authorization rates, %			DRPM	Total donors
	Overall	Registered	Not registered		
2006	48.8	100.0	44.5	10.4	63
2007	44.9	100.0	40.2	8.4	57
2008	42.6	100.0	39.7	9.8	52
2009	53.2	100.0	51.0	8.7	58
2010	47.2	93.3	39.6	7.8	50
2011	54.8	92.9	51.1	11.4	85
2012	50.0	83.3	48.1	7.2	56
2013	56.4	89.5	50.5	9.8	71
2014	54.1	76.9	51.0	7.8	60
2015	60.2	88.2	55.2	9.1	68
Average 2006–2010	47.2	97.8	43.0	9.0	56
Average 2011–2015	55.1	87.0	51.1	9.2	68

DRPM, donation rate per 1 million population.

was statistically significant at  $p < 0.0001$  in both specifications and was very large, suggesting the importance of organ donor registrations in encouraging later donations. The *After 2010* variable was statistically significant at the 1% level ( $p = 0.0003$ ) in our basic specification and was statistically significant at the 5% level ( $p = 0.0414$ ) in the specification with a linear yearly trend. We believe that some of the weakening in significance is due to the trend coefficient picking up some of the effect of the law; the trend term in a logistic model including 2011–2015 data is more positive than a logistic model using only 1998–2010 data. The coefficient on *Registered × after 2010* suggests that the effects of the priority policy on next-of-kin of registered and unregistered persons were statistically significantly different ( $p = 0.0179$ ).

## Discussion

As organ shortages grow more severe, governments are exploring a variety of policies to increase the supply of transplantable donor organs. To increase live organ donation, some nations have removed financial disincentives to live donation by reimbursing donors for expenses, including lost wages (11–13). Offering direct financial incentives to donate is considered by many to be repugnant (14) and is illegal everywhere in the world except in

the Islamic Republic of Iran (15). There are growing programs for kidney exchanges that take place simultaneously (16) or in longer chains initiated by a nondirected donor (17–20). In addition, countries choose their authorization policies, for example, choosing to use a presumed consent policy to opt out rather than opt in (21–26); however, although presumed consent systematically increases registration rates, it does not always generate an increase in actual organ donation (21). The People's Republic of China recently adopted the policy of providing deceased donors' families with significant financial incentives to donate (27), which triggers some of the same issues already noted.

We evaluated a novel policy of providing nonfinancial incentives for deceased organ donation by granting priority in organ allocation to registered donors and to next of kin of deceased donors. This approach may be particularly useful in motivating people to donate or register because, in addition to a nonfinancial incentive, it can also be viewed as increasing fairness—it increases the probability that organs are given preferentially to persons who contributed to the pool of available organs and thus may promote reciprocal altruism (5)—while reducing the incentive to engage in “free riding” (28). Priority status has real impact on organ allocation. According to the annual reports of the INTC, in 2014, 30% of the

transplanted patients got their organs because of their priority eligibility; in 2015, this percentage increased to 32%.

Initial results of the effectiveness of the law on deceased donation, at only 1 year after the policy went into effect, were previously reported (8). Although that study provided initial evidence that the policy positively affected next-of-kin authorization rates, organ donor registrations and live kidney donations, it was still preliminary for several reasons. First, it was based on only 1 year of data from after the major public campaigns advertising the law. Second, because of the aggregate nature of the data, it could not control for other variables that affect next-of-kin authorization (e.g. whether the deceased person was registered as an organ donor), which may change from year to year. Not controlling for whether the deceased person was a registered organ donor conflates increases in authorization rate due to the priority policy and increases in authorization rates due to an increased proportion of registered donor in the population. Third, because of the small number of observations, the prediction interval method was used instead of more robust statistical tests. In the current report, we overcame all of these shortcomings and quantified the sources of the change in the authorization rate, tested whether or not next of kin of registered donors were more likely to donate than next of kin of unregistered persons, and tested whether a larger proportion of the potential donor population was registered during the period 2011–2015 compared with the period 1998–2010.

We analyzed the priority policy using the universe of organ donation requests of next of kin in Israel between 1998 and 2015. We found that the priority policy had a substantial effect on authorization rates after campaigns advertised the policy. Authorization rates increased from 45.0% to 55.1% overall and from 42.2% to 51.1% for next of kin of unregistered potential donors. Logistic regression confirmed that the likelihood of authorization was positively affected after 2011 (odds ratio [OR] 1.43,  $p = 0.0003$ ). In addition, four of the 5 years with the highest authorization rates in the data period were during the 2011–2015 period. The sole exception was 2012, which was an outlier year because it incidentally had a relatively low rate of registered potential donors (as can be seen in Table 1).

Three channels explain the change in authorization rate from 1998–2010 to 2011–2015. The first is the change in authorization rate for unregistered potential donors, which increased from 42.2% to 51.1%. The second is a change in authorization rate for registered potential donors, which decreased from 91.3% to 87.0%. The third is a change in the proportion of registered potential donors in the potential donor pool, which increased from 5.7% (92 of 1627 potential donors) during 1998–2010 to 11.2% (69 of 617 potential donors) during 2011–2015.

Our data demonstrate that the higher authorization rate in 2011–2015 compared with 1998–2010 was driven almost exclusively by the increased authorization rate for next of kin of unregistered persons. As noted, the authorization rate for next of kin of registered donors decreased from 1998–2010 to 2011–2015 and so worked against the increase that we found across the whole population. In addition, although the share of registered potential donors increased from 5.7% in 1998–2010 to 11.2% in 2011–2015, this difference is modest. Multiplying this difference by 0.359 (the difference in the authorization rates of registered and unregistered potential donors in the 2011–2015 period, 87.0% and 51.1%), the total effect on authorization rates through this channel amounts to 2.0% of a total observed increase of 10.1% (from 45.0% in 1998–2010 to 55.1% in 2011–2015). Consequently, the majority of the increase across the whole population arises from the increase in authorization rates among unregistered donors.

So far, the premise on which the priority rules were legislated—namely, that organ donor registration constitutes a sort of a genuine written will that next of kin generally respect—is substantiated by our data. Across all years, 89.4% of requests to next of kin of registered potential donors were authorized, but only 44.6% of requests to next of kin of unregistered potential donors were authorized. Logistic regression confirmed that the likelihood of authorization was positively affected if the potential donor was a registered organ donor (OR 14.37,  $p < 0.0001$ ). These results establish the importance of the priority policy as an incentive for registration as organ donors. As shown by our data, more registrations translate into a higher likelihood that authorization for donation will be granted.

We found that the policy was also successful in increasing the percentage of registered potential donors in the potential donor pool, from 5.7% during 1998–2010 to 11.2% during 2011–2015. This change is large and statistically significant. Still, because of the fast increase in registrations over the past several years, the percentage of registered potential donors for 2011–2015 (11.2%) is substantially lower than the current proportion of the population that is registered (14%). This suggests that there is still room for improvement of Israel's authorization rate.

An interesting feature of our data is the directional, yet so far statistically insignificant, decrease in authorization rates of next of kin of registered potential organ donors from 91.3% to 87.0% ( $p = 0.37$ ). This decrease, if a real effect, may reflect “fake” registrations from persons who were unenthusiastic about donation and registered only to take advantage of the priority for registered donors while simultaneously instructing their family not to respect their registration at death (3). Potential changes in the composition of registered donors induced

by such motives might lead to a decrease in authorization rates among next of kin of registered potential donors and should be monitored closely.

Finally, when considering how the effect of the priority policy might generalize to other countries, it is worth considering that before the priority policy was implemented, Israel had a substantially lower authorization rate than most Western countries. The effect of a priority policy in any particular country will likely depend on factors such as culture, religion and the initial authorization rate. The encouraging initial Israeli experience in implementing the priority in organ allocation policy as a non-financial incentive method to increase organ donation should be considered by other nations as a novel model to boost organ donations.

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## Ethics Committee Approval

This research was approved by the Israeli National Transplant Center (INTC) Research Committee, which serves as the institutional review board for any research based on data collected by the INTC.

## Disclosure

The authors of this manuscript have no conflicts of interest to disclose as described by the *American Journal of Transplantation*.

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## Appendix

### Considerations regarding event timing

We decided that the “after” period should start at 2011 based on the following considerations: The priority clause in the Organ Transplant Law, which was passed in March 2008, was not publicized or advertised by the 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 was to mitigate the risk that Israelis who subsequently needed organs would claim ignorance of the priority policy. Moreover, even transplant candidates were not notified about the priority program by INTC staff prior to November 2010.

The campaign in 2010 was extensive—it included substantial TV and radio coverage and an Internet campaign resulting in millions of clicks. People on the waiting list were also notified by the INTC about the priority only starting in late 2010. This is the type of exposure that was needed for a substantial portion of the population to know about the policy.

It is therefore reasonable to assume that there should have been an effect of the priority program starting only after the campaign at the end of 2010, which motivated us to choose 2011 as the first year of the “after” period.

### Alternative metrics

We focus our attention on analyzing authorization rates instead of the donation rate per million population

(DRPM) or total number of organ donors because those latter measures, while useful and informative in some contexts, suffer from numerous disadvantages in the context of this study.

First, both DRPM and total number of organ donors conflate numerous changes over the study period and therefore confound the effect of the priority incentives. For example, during the study period there was a decrease in traffic accident fatalities, as well as annual fluctuations in the incidence of brain death determinations (29), which affect the total number of potential organ donors, as well as DRPM (29).

Second, these alternative metrics include organ donations by children and by non-residents, who are not targeted by the law and who we chose not to include in our data, and therefore represent data that are removed from the goals of our analysis.

Third, these alternative metrics are sensitive to composition effects. For example, if the authorization rate of non-residents is higher, and in a specific year the percent of non-residents increased, these metrics will associate the resulting increase in the authorization rate with the law. Another example is the sensitivity of the alternative metrics to the percent of potential brain-dead donors who were registered organ donors. Organ donor registration dramatically affects authorization rates and so confounds the effect of priority. We control for registration status with our logistic regression.

Because of the common use of these alternative metrics, we report them (for the last 10 years) alongside the authorization rate in Table 3. There was an increase of approximately 20% in total donors per year, but that increase was almost completely negated by increasing population, keeping the DRPM almost identical between 2006–2010 and 2011–2015. Comparing effects on authorization rates to these other measures suggests that the potential confounds associated with DRPM and total organ donors appear to be present. Given our more robust analysis above, our conclusion is that the priority law is associated with higher authorization rate, and that without the law the situation in Israel would have likely worsened on the DRPM measure, instead of staying about the same.