"How many deaths will it take 'til we know that too many people have died?"

The Failure of U.S. Organ Procurement Policy

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As anyone even vaguely familiar with the organ transplantation industry is keenly aware, there is a severe and longstanding shortage of human organs made available for transplant in both the United States and abroad. Every year for at least the last 30 years, the number of patients in need of organ transplants — primarily kidneys, hearts, livers, and lungs — has exceeded the number of deceased organ donors by a considerable margin. As a result, transplant waiting lists have continued to expand monotonically and expected waiting times have grown apace. The principal (and predictable) upshot of the ongoing shortage is an increasing number of deaths of patients who, because of an insufficient supply of deceased donors, fail to receive the needed organs in time.

Meanwhile, transplant professionals and academic observers have been engaged in a prolonged and often heated debate regarding potential policy actions that might be adopted to resolve the shortage. There has been a series of largely ineffective policy responses ranging from increased educational spending, to donor cards, to the latest strategy involving diffusion of so-called "best practice" procurement techniques. Notably absent from this parade of remedies is the one policy that is likely to end the organ shortage: the adoption of financial incentives for cadaveric organ donors.

While proposals for the use of such incentives have been advanced for almost as long as the shortage has existed, opposition to this option has remained both highly vocal and adamant. Such opposition is ostensibly based upon a set of ethical concerns, although no one has yet articulated a sensible, ethical reason for why we should continue to allow thousands of patients to die each year instead of paying surviving families a few thousand dollars to motivate an increased rate of consent for organ removal.

In this article, we calculate how many lives will be lost if the United States continues in its current policy course. We do this to motivate policymakers to stop implementing one ineffectual policy action after another and attack the organ shortage with more effective weaponry in the form of financial incentives.

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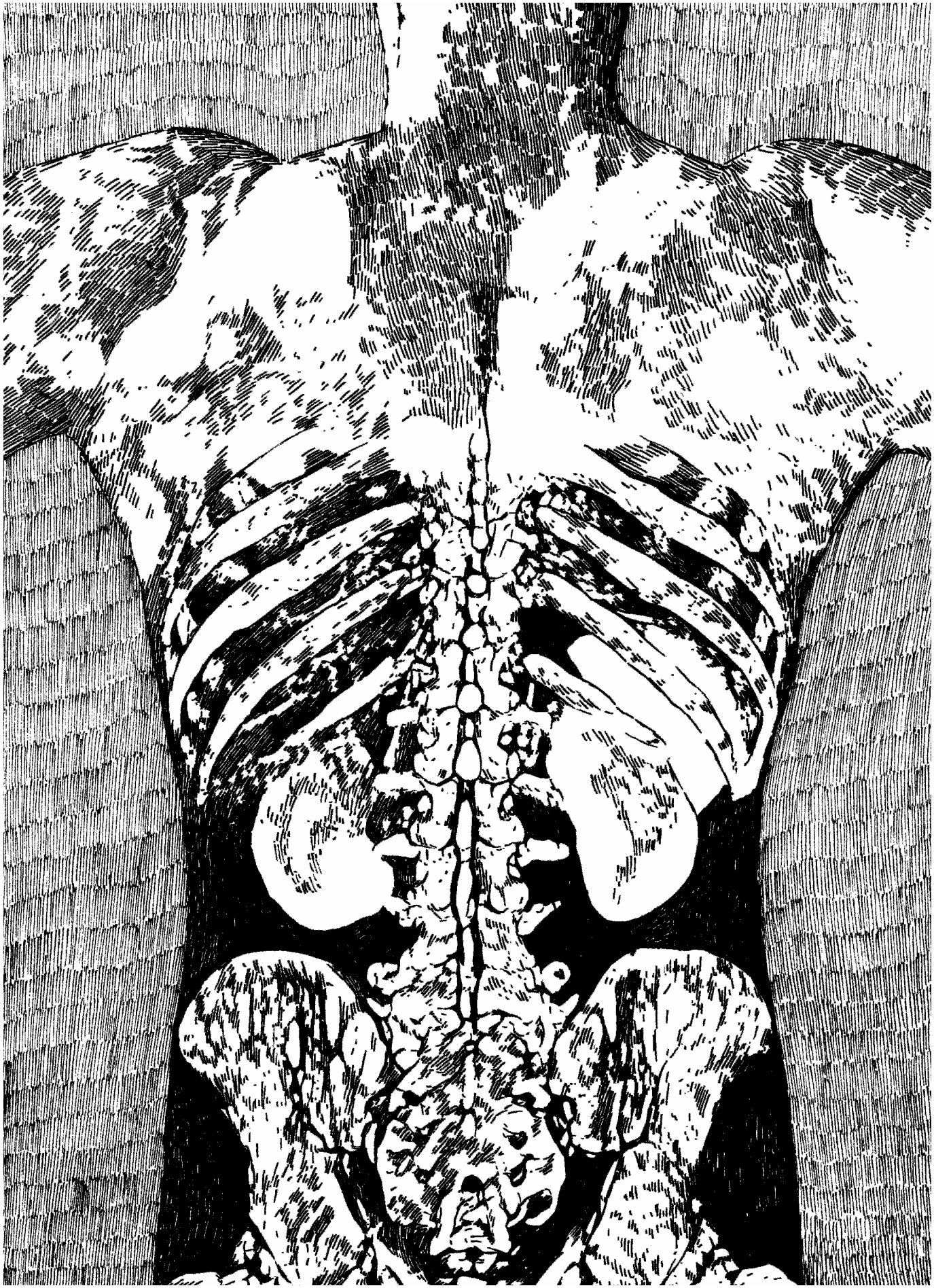
THE ORGAN SHORTAGE

The first successful human organ transplant in the United States was performed on December 23, 1954. On that date, a kidney was transplanted from a living donor who was an identical twin of the recipient. The body's immune system will attack what it perceives to be a foreign organism and, in the early days of organ transplantation, there were no advanced immunosuppressive drugs that would prevent the rejection of "foreign" organs. As a result, the only organ for which transplantation was feasible was the kidney and the only donors who were technologically suitable were living, closely related biological relatives of the recipient. As a direct consequence of that technological constraint, there were no transplant waiting lists and no obvious organ shortage in the late 1950s and early 1960s. In effect, organ transplant candidates brought the necessary donor with them when they checked into the hospital for the transplant operation. If there was no acceptable



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(and willing) donor, no transplant could be performed.

Importantly, given the constraints, there was no obvious need for either an independent organ procurement agency or any explicit payment to motivate donor cooperation. The transplant candidates themselves or their families were responsible for locating donors. The close personal affection between the donor and recipient was generally thought to be sufficient to motivate the donor to supply the needed organ. Where it was not sufficient, additional motivation could be provided by emotional pressure, direct (but clandestine) payments, or both.

Those intra-family arrangements remained largely out of sight of the transplant centers and physicians. Consequently, a system of so-called "altruistic" supply seemed to make sense, and reliance on such a system initially did not seriously impede the use of the emerging medical technology.

GROWING DEMAND This situation changed as transplant technology began to advance. Improvements were made gradually in both surgical techniques and immunosuppressive pharmaceuticals. It is difficult to pinpoint precisely when organ shortages first appeared because of the absence of the earlier data. Projecting backward from more recent figures and surveying the prior literature, however, it appears that transplant patient waiting lists probably began to form in the early to mid 1970s.

The growth of these lists was accelerated greatly by the introduction of the first modern immunosuppressive drug, cyclosporine, which was adopted in the United States in 1983. Its introduction, along with a series of subsequent pharmaceutical discoveries, had two important impacts on the transplant industry. First, because of the improved ability to suppress the transplant recipient's immune system, graft survival rates increased dramatically as rejection problems began to be brought under control. Rising success rates, in turn, stimulated transplant demand as patients faced improved prospects for an effective cure. Second and importantly, as a direct consequence of the new drugs, it became increasingly feasible to employ organs from deceased (and anonymous to recipients) donors. This development allowed transplant technology to be expanded to vital organs other than kidneys. Thus, patients suffering heart, liver, or lung failure were presented new hope as cadaveric organs began to be transplanted successfully.

This technologically driven expansion from living to deceased donors, along with rising success rates, broke the prior necessity of a biological relationship between the organ donor and the recipient. As a result, patients were no longer responsible for locating their own donors. Waiting lists began to expand as the number of potential transplant recipients rapidly grew.

Initially, the queues and the early attempts to collect organs from deceased donors' families were managed by the organ transplant centers that also performed the surgical operations. Given their now two-decade experience with the altruistic system, the centers' organ procurement activities continued to rely solely upon the zero-price policy that seemed to have performed well in the past. Thus, a procurement policy inherited from the earlier period of living, related donors was carried over to the new and fundamentally different technological environment with little or no discussion or evaluation.

A procurement policy inherited from the earlier period of living, related donors was carried over to the different environment of cadaveric organ transplant.

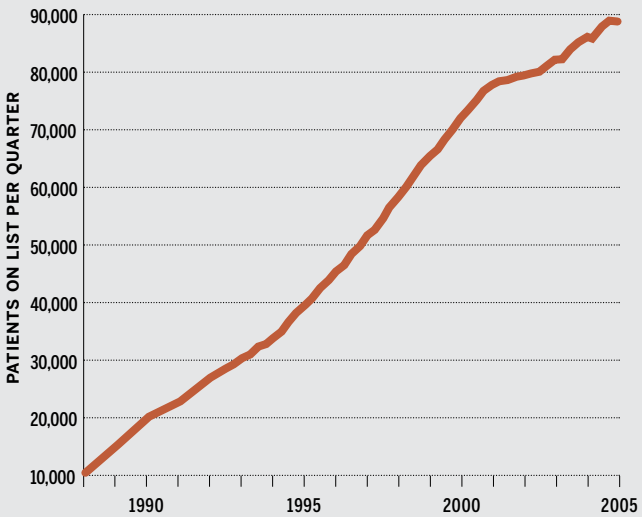
In 1984, the policy was codified into law through passage of the National Organ Transplant Act, which expressly proscribes payment to organ donors or their surviving family members. As a result, the altruistic system was firmly locked into place without any serious inquiry regarding its effectiveness in the new environment of deceased organ donors.

The logical and predictable consequences of the 1984 law are shown in Figures 1 and 2. Figure 1 depicts the number of

Figure 1

Number of Patients on Organ Waiting List

Quarterly data, 1988–2005

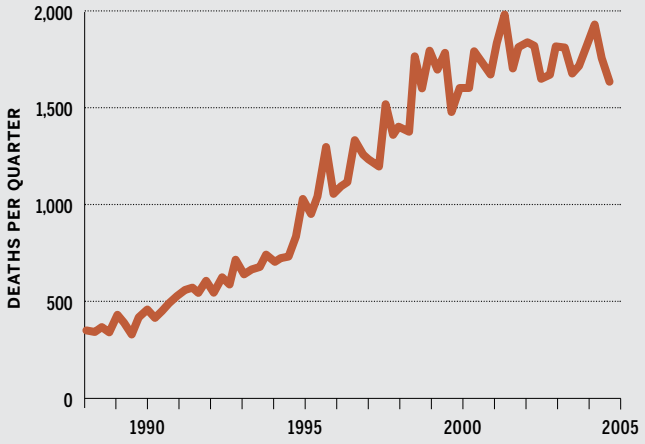


SOURCE: *Organ Procurement and Transplantation Network data*

Figure 2

Deaths While on Waiting List

Quarterly data, 1988–2005



SOURCE: *Organ Procurement and Transplantation Network data*

patients on the United Network for Organ Sharing (UNOS) waiting list quarterly for each year since the late 1980s. Figure 2 depicts the number of patients each quarter who died while on the list or were removed from the list because they became too ill to receive a transplant. The two figures provide the historical base from which our later forecasts will be derived.

At this point, we merely draw the most obvious inference: Because the waiting list has grown every year for which data are available, it is obvious that the altruistic organ procurement system has never once cleared the market during this period. That is, the demand for transplantable organs has exceeded the supply every year since at least 1988. We can see no clearer indication that this atavistic policy has failed to serve the patients it was ostensibly intended to help.

APPEAR TO DO SOMETHING

Aware of the increasingly dire consequences of continued reliance on the existing approach to cadaveric organ procurement and alarmed at the figures shown above, the transplant industry has examined and adopted a series of policy options ostensibly designed to improve the system's performance. All of these, however, continue to maintain the basic zero-price property of the altruistic system. As a result, the likelihood that any of them, even in combination, will resolve the organ shortage is remote.

At least seven such actions have been implemented over the last two decades or so:

INCREASED EDUCATIONAL EXPENDITURES In the absence of financial incentives, moral suasion becomes the principal avenue through which additional supply may be motivated. Consequently, the organ procurement organizations (OPOs) created under the 1984 Act have launched substantial promotional campaigns. The campaigns have been designed to both educate the general public about the desperate need for donated organs and educate physicians and critical care hospital staff regarding the identification of potential deceased donors. Over the years, a substantial sum has been spent on these types of educational activities. Recent empirical evidence, however, suggests that further spending on these programs is unlikely to increase supply by a significant amount.

ORGAN DONOR CARDS A related activity has been the process of incorporating organ donor cards on states' driver licenses. The cards can be easily completed and witnessed at the time the licenses are issued or renewed. They serve as a pre-mortem statement of the bearer's wish to have his or her organs removed for transplantation purposes at the time of death. Their principal use, in practice, is to facilitate the OPOs' efforts to convince surviving family members to consent to such removal by revealing the decedant's wishes.

The 1968 Uniform Anatomical Gift Act gave all states the authority to issue donor cards and incorporate them in drivers' licenses. Moreover, a few states have recently begun to rely entirely on donor cards to infer consent without requiring the surviving family's permission when such cards are present. Survey evidence indicates that less than 40 percent of U.S. citizens have signed their donor cards.

REQUIRED REQUEST Some survey evidence published in the late 1980s and early 1990s found that in a number of cases families of potential deceased donors were not being asked to donate the organs. As a result, donation was apparently failing to occur in some of those instances simply because the request was not being presented.

In response to this evidence, federal legislation was passed in 1987 requiring all hospitals receiving any federal funding (which, of course, is virtually all hospitals) to request organ donation in all deaths that occur under circumstances that would allow the deceased's organs to be used in transplantation. It appears that this legal obligation is now being met in most, if not all, cases. Yet, the organ shortage has persisted and the waiting list has continued to grow.

REQUIRED REFERRAL While required-request legislation can compel hospitals to approach the families of recently deceased potential organ donors with an appeal for donation, it cannot ensure that the request will be made in a sincere, compassionate manner likely to elicit an agreement. Following implementation of the required-request law, there were a number of anecdotes in which the compulsory organ donation requests were presented in an insincere or even offensive manner that was clearly intended to elicit a negative response. The letter of the law was being met but not the spirit. As a result, additional legislation was passed that requires hospitals to refer potential organ donors to the

regional OPO so that trained procurement personnel can approach the surviving family with the donation request. This policy response has resulted in no perceptible progress in resolving the shortage.

COLLABORATION A fairly recent response to the organ shortage has been the so-called "Organ Donation Breakthrough Collaborative," which was championed by then-secretary of health and human services Tommy Thompson. The program was initiated shortly after Thompson took office in 2001 and is currently continuing. The program's basic motivation is provided by the observation of a considerable degree of variation in performance across the existing OPOs. Specifically, the number of deceased organ donors per thousand hospital deaths has been found to vary by a factor of almost five across the organizations. The presumption, then, is that the relatively successful OPOs employ superior procurement techniques and/or knowledge that, if shared with the relatively unsuccessful organizations, would significantly improve their performance. Thus, diffusion of "best practice" techniques is seen as a promising method through which cadaveric donation rates may be greatly improved.

A thorough and objective evaluation of the Thompson initiative has not, to our knowledge, been conducted. Figure 1, in conjunction with a recent econometric study of observed variations in OPO efficiency, suggests that such an evaluation would yield both good news and bad news. The good news is that the program appears to have had a positive (and potentially significant) impact on the number of donations. In particular, it appears that, after 2002, the growth rate of the waiting list has slowed somewhat. Whether this effect will permanently lower the growth rate of the waiting list or simply cause a temporary intercept shift remains to be seen. The bad news, however, is unequivocal — the initiative is not going to resolve the organ shortage. Even if, contrary to reasonable expectations, all OPO relative inefficiencies were miraculously eliminated (i.e., if all organizations' performance were brought up to the most efficient unit), the increase in donor collection rates would still be insufficient to eliminate the shortage.

KIDNEY EXCHANGES Another approach that has received some attention recently involves the exchange of kidneys between families who have willing but incompatible living donors. Suppose, for example, a person in one family needs a kidney transplant and a sibling has offered to donate the needed organ. Further suppose that the two siblings are not compatible — perhaps their blood types differ. If this family can locate a second, similarly situated family, then it may be possible that the donor in the first family will match the recipient in the second, and vice versa. A relatively small number of such exchanges have recently occurred and a UNOS-based computerized system of matching such interfamily donors has been proposed to facilitate a larger number of these living donor transactions.

Two observations regarding kidney exchanges are worth noting. First, such exchanges obviously constitute a crude type of market in living donor kidneys that is based upon barter rather than currency. Like all such barter markets, this exchange will be considerably less efficient than currency-based trade.

Puzzlingly, some of the staunchest critics of using financial incentives for cadaveric donors have openly supported expanded use of living donor exchanges. Apparently, it is not market exchange per se that offends them but, rather, the use of money to facilitate efficient market exchange. This combination of positions merely highlights the critics' lack of knowledge regarding the operation of market processes.

It is quite apparent that living donor kidney exchanges are not going to resolve the organ shortage. Opportunities for such barter-based exchanges are simply too limited.

REIMBURSEMENT OF DONOR COSTS Finally, in another effort to encourage an increase in the number of living (primarily kidney) donors, several states have passed legislation authorizing reimbursement of any direct (explicit) costs incurred by such donors (e.g., travel expenses, lost wages, and so on). Economically, this policy action raises the price paid to living kidney donors from a negative amount to zero. As such, it should be expected to increase the quantity of organs supplied from this source.

Because the explicit, out-of-pocket expenses associated with live kidney donation are unlikely to be large relative to the longer-term implicit costs of potential health

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risks, however, such reimbursement should not be expected to bring forth a flood of new donors. Moreover, recent empirical evidence suggests that an increase in the number of living donors may have a negative impact on the number of deceased donors because of some degree of supply-side substitutability. Again, this policy is not a solution to the organ shortage.

We must conclude that none of the above-listed policies should be expected to resolve the transplant organ shortage. We say this not because we oppose any of these policies; indeed, each appears sensible in its own right and some have unquestionably succeeded in raising the number of organ donors by some (perhaps nontrivial) amount. Rather, our concern is that every time another one of these marginalist policies is devised, it delays the only real reform that is capable of fully resolving the organ shortage.

A cynical observer might easily conclude that the above string of largely ineffectual actions represents an intentional strategy of what might be termed "illusory responsiveness." That is, the policies were never really intended or expected to resolve or even substantially ameliorate the organ shortage. Rather, they have been undertaken strategically to create the illusion that serious efforts were being made to address the issue while postponing more effective reforms.

As economists, we generally believe that parties more or less consistently pursue public policies that are in their own self-interest, broadly defined. Consequently, we are seriously tempted to draw this somewhat disturbing conclusion from the evidence at hand. Certainly, there are parties directly involved in this policy debate that benefit economically from a continuation of the organ shortage. For example, owners of dialysis clinics, investigators who receive funding for xenograph research, the agencies that manage organ procurement and allocation activities, and even the transplant centers themselves all may experience significant financial gains from shortage conditions. As with any cartel-type arrangement, producers receive increased profits when they are able to restrict supply. And constraining the supply of an essential input (transplantable organs) by imposing a zero-price restraint is guaranteed to restrict the supply of the associated output (transplant operations). In addition, paying a below-equilibrium price for an input creates rents that can be captured by downstream producers. Moreover, the above groups tend to be highly organized and politically influential, particularly in debates relating to organ procurement issues. After all, they are the "experts."

It is not necessary, of course, that the opponents of financial incentives consciously pursue policies that promote their own economic interest at the expense of patients' lives. It is more likely that the underlying economics tends to predispose at least some of these parties to accept arguments (however weak) that yield outcomes that are consistent with their financial well-being. That is, their underlying economic interests mold their receptiveness to otherwise unconvincing arguments against the use of financial incentives in cadaveric organ procurement. But the outcome is the same — the organ shortage continues and thousands of patients continue to die unnecessarily each year.

Finally, juxtaposed against the politically influential interest groups who benefit economically from the organ shortage are the patients who occupy the transplant waiting lists. Unfortunately, this latter group exhibits several characteristics that tend to render it completely politically impotent. Specifically, there are "only" 100,000 or so of these individuals spread out across the entire country. They are disproportionately minority and low-income individuals. They are also completely unorganized, generally uninformed of the underlying economic cause of their plight (the zero-price organ procurement policy), and they are sick. It is difficult to imagine a group less likely to wield significant political influence. Thus, interest group politics appears to go a long way toward explaining the longevity of this tragic and inane public policy.

THE ONLY EFFECTIVE SOLUTION

To an economist, the solution to this problem is both obvious and simple: repeal the National Organ Transplant Act and its progeny and allow the price of cadaveric organs to rise to equilibrium, market-clearing levels. While we cannot be certain exactly what the equilibrium prices would be, at least two economic considerations suggest that they are likely to be relatively low. First, there appears to be a large pool of excess capacity at current collection rates. Estimates suggest that we are presently harvesting only about half of the potential number of cadaveric donors. And second, the opportunity cost of cadaveric organ donation is quite low for most potential donors. Therefore, the price elasticity of supply of organs is likely to be quite large and the market clearing price is correspondingly low.

A related issue pertaining to the supply of cadaveric organs involves the overall adequacy of this source of transplantable organs. Specifically, is there a sufficient number of deaths each

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Table 1

Toll from Shortage of Transplant Organs

Regression results for estimated deaths and severe illnesses

	With 2002–2005 Data		Without 2002–2005 Data	
	Coefficient	t-Statistic	Coefficient	t-Statistic
Intercept	198.88	21.96	103.11	2.39
Waiting list	0.0197	19.17	0.0228	25.90
	n = 72 R^2 = 0.921 F = 820.29		n = 60 R^2 = 0.947 F = 1043.55	

Table 2

Toll Over Time

Regression results for patients on the waiting list for 2006–2015

	With 2002–2005 Data		Without 2002–2005 Data	
	Coefficient	t-Statistic	Coefficient	t-Statistic
Intercept	1556.13	0.74	-1042.68	-0.286
Time	1286.92	30.66	1370.03	16.30
	n = 56 R^2 = 0.985 F = 3615.58		n = 44 R^2 = 0.984 F = 2560.13	

year in the United States that occur under circumstances that would allow organ donation so as to resolve the shortage fully? The answer appears to be yes, given a correct understanding of the economic definition of the term "shortage." In particular, a shortage is the difference between the quantity demanded and the quantity supplied at a given price, both of which are defined as flows (i.e., a number of units per time period). Consequently, the organ shortage is also a flow that presents itself as an increase in the transplant waiting list (a stock) each period — say, a year. Importantly, the shortage is not given by the actual list itself.

Thus, properly defined, there does appear to be a sufficiently large supply of potential cadaveric donors to resolve the shortage fully — that is, to stop adding to the waiting lists. Unfortunately, however, it will take years of surpluses to drain the backlog of excess demands that have accumulated from over 30 years of shortages — i.e., to eliminate the waiting lists. But the sooner we start doing so, the more lives will be saved. To continue to postpone the only effective solution in the unrealistic hope of resolving the shortage at a zero price is to condemn thousands more patients to death as they wait for organs that never arrive.

WAITING LISTS YET TO COME

The consequences of our failure to adapt our cadaveric organ procurement policy to the changed technological realities of the transplant industry have been unconscionable. Figure 2, above, suggests that more than 80,000 lives have now been sacrificed on the altar of our so-called "altruistic" system. In addition, the unnecessary pain and suffering of those who have been forced to wait while undergoing dialysis, unemployment, and declining health must also be reckoned along with the growing despair of family members who must witness all of this.

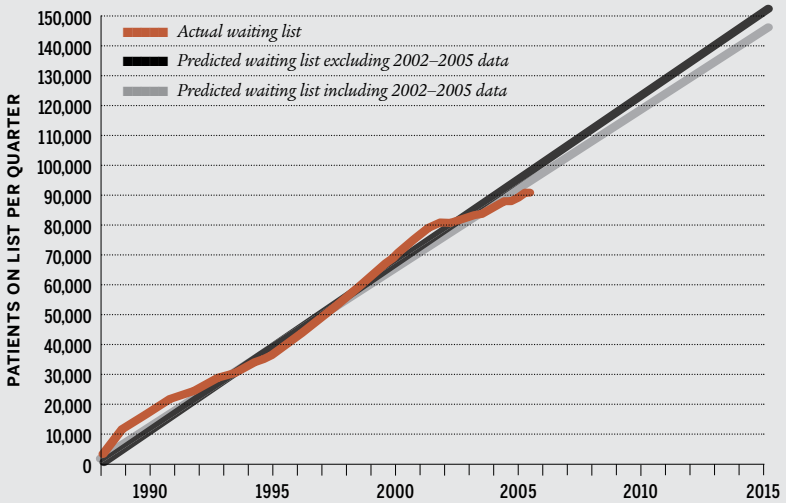
Nonetheless, the pain, suffering, and death imposed on the innocents thus far pales in comparison to what lies ahead if more fundamental change is not forthcoming. In order to illustrate the severe consequences of a continuation of the altruistic system, we use the data presented in Figures 1 and 2 above to generate forecasts of future waiting lists and deaths. The forecasts represent our best guess of what the future holds if fundamental change continues to be postponed. The results should serve as a wake-up call for those who argue that we should continue tinkering with the existing procurement system while further postponing the implementation of financial incentives. The costs of such a "wait and see" approach are rapidly becoming intolerable.

CHANGING VARIABLE To produce reasonable forecasts of future waiting lists and deaths, we must first confront an apparent anomaly in the reported data that could cast doubt on the accuracy of some of the more recent figures. Specifically, the reported number of deaths of patients on the waiting list (plus those too sick to receive a transplant) follows a

Figure 3

The Waiting List Grows

Number of patients on waiting list through 2005 and projections through 2015, per quarter

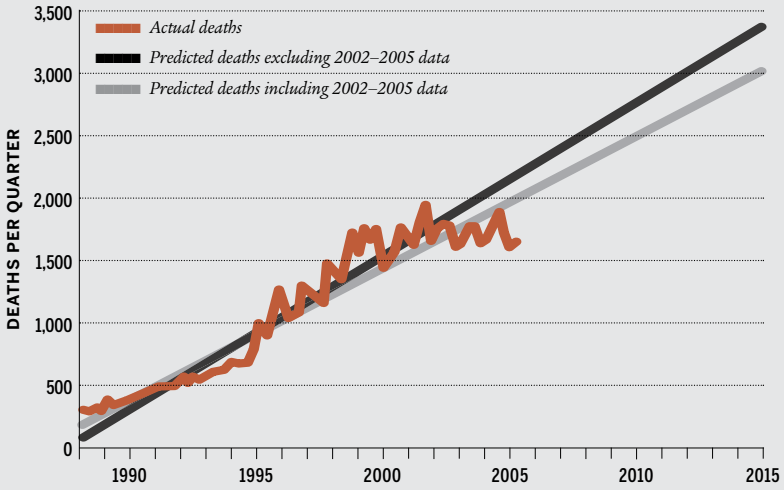


SOURCES: *Organ Procurement and Transplantation Network data, authors' calculations*

Figure 4

The Deaths Mount

Transplant list deaths through 2005 and projected deaths through 2015, per quarter

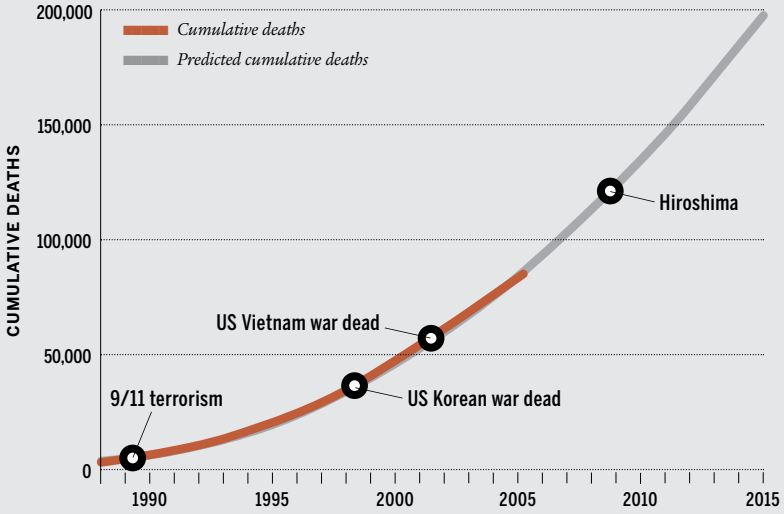


SOURCES: *Organ Procurement and Transplantation Network data, authors' calculations*

Figure 5

A Growing Tragedy

Deaths from U.S. organ procurement policy as compared to other tragedies



SOURCES: *Organ Procurement and Transplantation Network data, authors' calculations, historical data*

consistently upward trend that is very close to a constant proportion of the size of the waiting list over most of the sample period. Beginning in 2002, however, the number of deaths levels off and even starts to decline, despite continued growth of the waiting list. It is not clear why there is an abrupt change in the observed trend in this variable.

Our investigation of this issue yielded several plausible explanations but no definitive answer. For example, it may be the case that recent advances in medical care, such as the left ventricular assist device, have extended some patients' lives and, thereby, reduced the number of deaths on the list. Alternatively, it may be the case that because of rising criticism of the current system, UNOS has taken steps to remove some of the relatively higher-risk patients from the list before they die. For example, the MELD/PELD program, which was introduced in February 2002, removed a number of liver patients (who have a comparatively high death rate) from the waiting list. Additionally, the increasing use of so-called "extended criteria" donor organs may have a similar effect, getting the most critically ill patients off the list prior to their deaths.

Clearly, the implications of these alternative explanations for reliance on the data are not the same. For example, if patients are, in fact, simply living longer and the data accurately reflect that reality, then our analysis should incorporate the observations. But if the more recent figures are, instead, a manifestation of strategic actions taken by the reporting agency, then they should be excluded. Because we have been unable to identify a single, convincing explanation for the observed phenomenon, we elected to perform our analysis both ways — including and excluding the post-2002 observations on the number of deaths.

ESTIMATES Given the two alternative sample periods, the methodology we employ to generate our forecasts is as follows: First, because the number of deaths appears to be causally driven by the number of patients on the waiting list, we begin by estimating a simple linear regression model of the former as a function of the latter. The results of that estimation are reported in Table 1 for the two sample periods described above. Next, we estimate a second linear model with the number of patients on the waiting list regressed against time, again using the two alternative sample periods. Those results are reported in Table 2.

From the results, we are able to produce forecasts of the expected size of future waiting lists for each of our sample periods. We run the forecasts out 10 years from the end of our longer sample period, to 2015. Given the forecasted waiting list values, we are then able to use the regression results in Table 1 to generate our forecasts of the number of deaths over the same period.

The two alternative sets of forecasts are shown graphically in Figures 3 and 4. Depending upon the sample period chosen, the results show the waiting list reaching 145,691 to 152,400 patients by 2015. Of the patients listed at that time, between 10,547 and 13,642 are expected to die that year. Even more tragically, over the entire period of both actual and

predicted values, a cumulative total of 196,310 patients are conservatively expected to die by 2015 as a consequence of the ongoing shortage. Figure 5 illustrates the results. In that figure, we incorporate several historical reference points in order to put the numbers in perspective.

No one directly involved in the transplant industry is likely to be surprised by our results. Thirty years of experience consistently point to a continuation of the current, long-standing trends. There is nothing on the horizon that should lead anyone to expect a sudden reversal. But our purpose is not to surprise the parties who are already knowledgeable about this increasingly severe problem. Rather, our intent is to awaken the sleeping policymakers whose continuing inaction will inevitably lead to these results. They can no longer continue to postpone meaningful reform of the U.S. organ transplant system in the futile hope that, somehow, things will improve. They will not.

CONCLUSION

Proposals to adopt financial incentives to foster an increased rate of cadaveric organ donation have now been forestalled for at least three decades. Opponents of such incentives have employed two strategies to postpone their use: repeated appeals to a set of alleged ethical concerns that upon closer inspection make no sense, and introduction of a parade of failed policy alternatives ostensibly intended to improve the current system while maintaining the zero-price constraint. Both approaches are wearing thin as the waiting list continues to grow and the number of deaths keeps rising.

The medical community is increasingly confronted with the appalling consequences of a continued reliance on a policy that was originally adopted in a completely different technological environment. As a result, the tide now seems to be turning and the adoption of financial incentives appears inevitable. The future costs of continued inaction are simply too large. R

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