

THE RATIONING OF TRANSPLANTABLE ORGANS: A TROUBLED LINEUP

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On June 6, 1995, baseball legend Mickey Mantle was placed on the transplant waiting list after being diagnosed with end-stage liver disease caused by hepatitis, liver cancer, and years of alcohol abuse. Two days later, he underwent surgery, despite the fact that the average liver transplant patient waits 67 days. His doctors claimed that Mantle received no preferential treatment; rather, his gravely ill status placed him at the top of the list. Yet, because of Mantle's original liver cancer, he died two months later. Given that 804 patients died in 1995 while awaiting a liver transplant, Mantle's case and others like his raise questions about which of the 7,400 liver patients on the waiting list should have received the 3,900 livers that became available that year. Society has to confront this and similar questions because of the severe shortage of transplantable organs.

Organs are not the only goods rationed in the United States—they are just the most controversial. Hunting permits, oil drilling leases, cellular telephone licenses, and radio frequencies are other examples of rationed resources. The distinguishing feature of these goods is that prices alone are not permitted to allocate the commodity; as a result, someone must determine how they will be distributed.

There are many ways that goods can be rationed, such as lotteries, first-come, first-served, and coupons. As a consequence of price controls, gasoline was rationed in the 1970s, largely on a first-come, first-served basis.¹ The result was long lines at the pumps and an effective

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¹Some states developed other rationing schemes based on license plate numbers and birthdays. These were largely ineffective in reducing queuing.

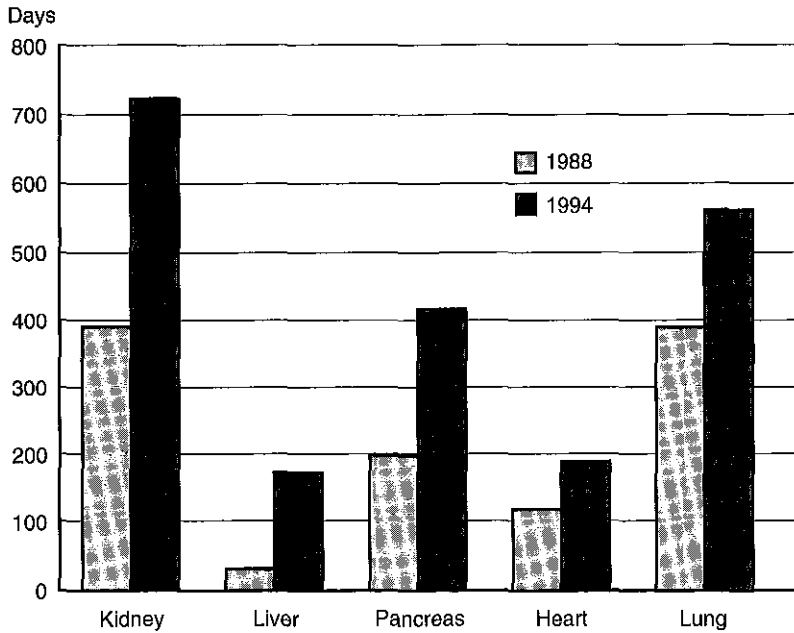
price of gasoline that included both the direct cost of purchasing gas plus the indirect cost of queuing. Although some view such a system as equitable, its inefficiencies are obvious once we factor in the time and even the gas wasted as people waited in line. Rationing also played a role during World War II, when the government issued coupons for purchasing staples such as meat and butter. This solution was also seen as equitable in many quarters, although, like lotteries, it did not ensure that those who most needed or valued a good received it.

This conflict between equity and efficiency arises whenever goods are rationed. Determining the most equitable way to allocate gasoline and food is difficult, but deciding how to allocate transplantable organs is infinitely more complex. The complexity stems from the fact that someone must choose who receives lifesaving transplants—a decision that impacts efficiency through the number of lives lost over time. Since both equity and efficiency are paramount when rationing goods, the market for transplantable organs is an ideal case to illustrate this conflict.

Ten Americans die each day while awaiting an organ transplant, and the problem is becoming more severe. Between 1988 and 1994, the median waiting time nearly doubled (see Figure 1). It is imperative, then, that society find ways to increase the supply of organs, even through buying and selling. For most goods, prices are allowed to adjust to provide incentives, thus ensuring their most efficient allocation. While some people would understandably have qualms about the buying and selling of organs, the cost of our current approach is that shortages will remain endemic, and ultimately, *more* lives will be lost. Allowing monetary payments may not completely eliminate this shortage, but it will undoubtedly increase the number of organs available.

This paper examines the inherent difficulties of rationing by analyzing the market for transplantable organs. We look at the current procurement and allocation system and discuss various proposals to increase the efficiency of the market. Although the particulars of this market are unique to organ transplantation, society faces similar choices whenever prices are regulated and shortages occur. As Dr. Arthur L. Caplan, director of the Center for Bioethics at the University of Pennsylvania, notes, "It [organ transplantation] is a case study of rationing. It is of fundamental interest to every American. All of us will have to confront the decision of what is fair in the allocation of scarce resources. This is a canary in a mine that all of us will have to enter" (Kolata 1996: A1).

FIGURE 1
 MEDIAN WAITING TIMES, 1988-94



SOURCE: UNOS (1995).

Rationing of Organs: The Current System

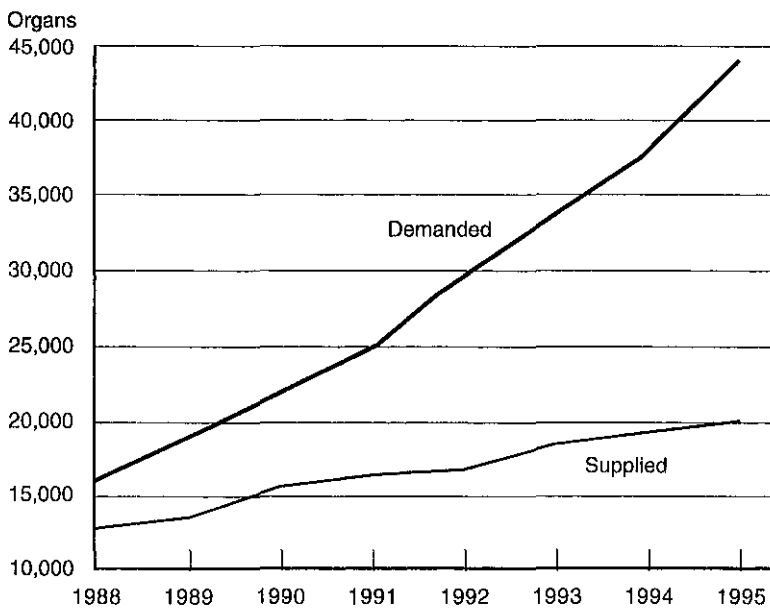
In 1984, Congress passed the National Organ Transplant Act, which outlawed the buying and selling of internal organs.² The National Task Force on Organ Transplantation recommended to Congress in 1986 that organ donation remain purely voluntary, governed by the altruism of the donor or the donor's family. Additionally, it suggested that the "selection of patients for transplant not be subject to favoritism, discrimination on the basis of race or sex, or ability to pay" (U.S. House of Representatives 1991: 44). This nondiscriminatory clause is crucial, because when prices are regulated and shortages occur, goods must be rationed. Since discrimination is one form of rationing, it is

²Specifically, the law prohibits the selling of organs if the transfer affects interstate commerce. Therefore, states may allow payments for organs, as long as the organs stay within state boundaries. However, given the current distribution system, states find it problematic to allow the selling of organs. Thus, the 1984 law has effectively prohibited a market in transplantable organs.

costless when markets are not allowed to operate freely.³ In contrast, in an unregulated market, individuals and firms must forgo profits if they wish to discriminate—that is, engage in nonprice rationing.

Another concern was that political clout would influence the allocation process; hence, an independent nonprofit organization was selected to operate the Transplantation Network under the auspices of the Department of Health and Human Services. In October 1986, the United Network for Organ Sharing (UNOS) was awarded this federal contract. The group's task is twofold: establish criteria that match donors with waiting recipients, and develop policies that facilitate the procurement of organs. Figure 2 illustrates that within the current voluntary system, UNOS has been largely unsuccessful in increasing donations; supply increases have been minimal compared to demand. The major difficulties in devising an equitable organ distribution system are summarized in Table 1.

FIGURE 2
ORGANS SUPPLIED AND DEMANDED, 1988–95



SOURCE: UNOS (1996).

³There may be social costs associated with discrimination, but it is costless for the individual firm.

TABLE 1
ORGAN RATIONING SCHEMES

Allocation Methods	Benefits	Costs
Waiting time	Equitable	Inappropriate matching; organ wastage; no consideration of urgency
Priority to sickest first	Equitable	Higher retransplantation and death rates; less benefit overall
Priority to sickest last	Higher overall survival; less retransplantation	Sickest patients die
Best biological match	Higher overall survival; less retransplantation	Fewer transplants for certain groups, including highly sensitized patients and some minorities

SOURCE: UNOS (1977a: Appendix D).

The Sickest-First Policy

Many contend that in a fair system, organs would be given to those who “need” them the most—the so-called sickest-first policy. UNOS uses this strategy in ranking liver and heart patients as part of its policy of minimizing patient deaths. The approach is myopic, however, since it ignores the impact that today’s decisions have on the number of deaths over time.⁴ The Mickey Mantle case is a stark example because Mantle, and hence his liver, died two months after surgery. Indeed, the two-year graft (organ) survival rate for patients who are in intensive care prior to their liver transplant is approximately 50

⁴A similar tradeoff exists during wartime with the triage of combat victims. This system maximizes overall survival by allowing the most critically ill soldiers to die.

percent, compared to 75 percent for those who are still relatively healthy. These groups' individual two-year survival rates differ by 10 to 15 percentage points (UNOS 1997a).

Given the differences in two-year survival rates, the cost of transplanting 100 fewer livers into intensive-care patients today would be a loss of 85 to 90 lives versus 100 over a two-year period.⁵ Since graft survival rates are higher for healthier patients, the number needing retransplantation would decline. Thus, another benefit of this one-time policy change would be to free organs for others. Another advantage is that by transplanting livers into healthier individuals, the number of critically ill patients would decrease, thereby saving additional lives. On net, this policy change would be more efficient because it would save more lives.

The Best Biological Match

Another allocation method (the one emphasized for kidneys) is biological matching, which is measured by the quality of the antigen match between donor and patient.⁶ Once a kidney becomes available, UNOS searches among waiting-list patients and ranks them according to their biological match with that organ. When four of the six most critical antigens match, the one-year graft survival rate is 13 percentage points higher than for a total antigen mismatch. Four years later, that difference increases to 20 percent (Opelz 1988).

Instead of biological matching, waiting time alone could be emphasized—the first-come, first-served approach.⁷ While this may seem more equitable, the cost of such a policy change would be enormous. In the first year alone, the average biological match would decrease by nearly three antigens, and graft survival rates would fall by about 6 percentage points. Even discounting subsequent declines in graft survival rates, the number of kidney transplant candidates eventually would increase by nearly 5,600, translating into approximately 202 more waiting-list deaths each year.⁸ The importance of graft survival is obvious, given that nearly one-quarter of those on the kidney waiting list have received a transplant previously.

Despite their emphasis on biological matching, UNOS distributes kidneys on a regional basis, mandating that kidneys procured within

⁵This assumes that all intensive-care patients would die within two years without a transplant.

⁶Biological matching is not considered for livers and hearts because of time constraints. Ordinarily, when transplanting kidneys, a patient's health status is not considered given the alternative of dialysis.

⁷Currently, UNOS gives only slight priority to waiting time.

⁸Estimate is based on authors' calculations.

a region stay local.⁹ If, on the other hand, kidneys were distributed nationally, the pool of potential recipients would increase, thereby increasing the likelihood of finding a patient with a good antigen match. Thus, distributing kidneys nationally would expand the average biological match. This policy change not only would save lives, but also would eliminate inequities caused by regional variations in waiting times.¹⁰

Discrimination in Kidney Allocation

Certain groups of patients wait longer than others for kidney transplants and, because of equity concerns, are given special consideration. For example, highly sensitized patients are much more likely to reject an organ transplant because of antibodies acquired from multiple blood transfusions or from rejecting a previous transplant. UNOS gives them preference when a kidney is found that will not necessarily be rejected; otherwise, they may never be transplanted. Giving highly sensitized patients preference can be extremely costly, however, because it reduces the size of the waiting-recipient pool searched. In effect, UNOS limits its search to the prioritized group unless a match outside the group is considerably higher. Thus, the likelihood of finding a well-matched kidney decreases, along with patient and graft survival rates. Since highly sensitized patients make up less than 3 percent of all kidney patients awaiting transplants, discriminating for them is likely to cost more than if the group receiving preference were larger.

An even greater preference is given to patients with type-O blood. Although organs from donors with type-O blood can potentially be transplanted into patients with any blood type, transplant candidates with O blood can receive only an organ of the same type. Thus, to ensure that these patients' waits are not substantially longer, UNOS mandates that kidneys from O donors will go only to O patients, with the exception of perfectly matched kidneys. The cost of this policy is that potentially good matches are forgone.

Other groups, such as blacks, also spend a disproportionate amount of time awaiting transplants. The median waiting time for black kidney patients is twice as long as it is for whites. This has led many to conclude that UNOS's policies are inherently racist and that blacks should receive preference similar to that given to highly sensitized patients. The longer waiting time, however, is not due to discrimination

⁹The exception is if an individual with a perfect match is identified in another region. For a review of public policies to procure and allocate kidneys, see Singer (1990).

¹⁰There are costs involved in distributing organs nationally, because of increases in ischemic (preservation) time. These costs are small for kidneys (Opelz 1988), but large for other organs such as hearts. The feasibility of distributing livers nationally is currently being debated.

but to a disproportionate number of blacks who suffer from hypertension and diabetes—the two major causes of kidney failure.

Blacks represent 29 percent of all patients with end-stage renal disease, while they make up only 12 percent of the population and donate less than 12 percent of all kidneys. These numbers are important because the quality of the biological match is usually better when both the donor and the recipient are of the same race. The fact that blacks demand more kidney transplants as a share of their population and that the supply of kidneys from blacks is, if anything, slightly less than this figure explains the wide discrepancy between black and white waiting times.¹¹ Thus, a policy change giving preference to blacks not only would be more inefficient, costing additional lives, but also would violate UNOS's directive not to discriminate.

Encouraged Volunteerism: The Need for Incentives

Changes in the way UNOS rations organs can potentially decrease waiting times and save lives, but major reductions in waiting-list deaths, and thus improvements in efficiency, will require a substantial increase in organ donations. Table 2 shows the gap between the number of available organs and the number of people who need a kidney, liver, pancreas, heart, or lung transplant. Although the shortages vary, most

TABLE 2
U.S. ORGAN WAITING LIST AND TRANSPLANT STATISTICS

Organ	Quantity Demand (as of 12/25/96)	Quantity Supply (January–December 1996)
Total kidney	36,013	11,949
Cadaveric		8,560
Living		3,389
Liver	7,467	4,058
Pancreas	1,786	1,022
Heart	3,935	2,381
Lung	2,546	844

NOTE: Multiple organ transplants are counted as more than one organ.
SOURCE: UNOS (1997b).

¹¹Nevertheless, many argue that steps should be taken to end "discrimination." As a result, the number of black transplant coordinators has been increased in an effort to ensure that blacks have equal access to transplants. Not surprisingly, these efforts have failed. For several good articles investigating the extent to which discrimination is present in kidney allocation, see Eggers (1995), Held (1988), Kasiske (1991), and Kjellstrand (1988).

of them are critical and have shown little response to public awareness programs, professional education efforts, or legislation. "Routine inquiry" laws, for example, require hospital personnel to inform the families of potential donors about their option to donate. In fact, doctors still mention this opportunity only two-thirds of the time.¹²

Trading Organs

The only way to increase the supply of organs is to increase the number of cadaveric organs, with the exception of kidneys, for which there is also the possibility of living donations.¹³ More than one-quarter of the 11,700 kidneys donated each year come from living related individuals—an impressive number considering that kidney removal requires the donor to be hospitalized for five to seven days and to spend two to three months convalescing.¹⁴

What can be done to further increase the supply of kidneys from living donors? Currently, only 7 percent of these donations are from nonrelated individuals (primarily spouses), mainly because kidneys from nonrelated donors are usually poor matches or of the wrong blood type. To increase donations, UNOS could facilitate the trading of kidneys, allowing patients to receive a well-matched kidney in exchange for a kidney from a spouse or close friend. This policy would increase kidney donations from both related and nonrelated sources. For instance, a patient's relative or spouse may be willing to donate a kidney, but because they have the wrong blood type, they are not suitable donors for that individual.¹⁵

Financial Incentives

Although altruism can be a powerful factor in motivating organ donations, it works best within families and cannot be expected to function as efficiently in the market for cadaveric organs. Individuals may sign anatomical donor cards indicating their wishes, but in prac-

¹²One reason for the law's failure is lack of enforcement. There is a remarkable belief that monitoring is unnecessary. One staff member from Oregon's Health Department expresses it this way: "In a small state one does not need to coerce people to comply, especially with a requirement that is perceived as good policy" (Anderson and Fox 1988). For an editorial advocating this legislation, however, see Prottas (1988).

¹³Recently, however, doctors successfully transplanted a segment (lobe) of liver from a living donor.

¹⁴A new laparoscopic procedure could reduce the recovery time from two to three months to two to three weeks ("Laparoscopic" 1996). Doctors and ethicists are divided over the ethics of allowing living kidney donations (Levey 1986, Spital 1988).

¹⁵UNOS's procedures do allow for the trading of cadaveric organs. For example, when one region receives a perfectly matched kidney from outside the area, UNOS requires that the receiving region eventually reimburse the sending region with a payback kidney.

tice, procurement agencies will remove organs only with familial consent. Thus, to increase supply, it is necessary to provide families with additional incentives. This is especially true given the relatively few deaths (10,000 to 12,000 annually) that occur in such a way that the deceased's organs are suitable for transplantation (UNOS 1993).

To increase donations, we need to consider financial incentives mimicking those that prices provide in a market economy. Perhaps the simplest approach is to give tax incentives to families who agree to donation. Donated organs already go to UNOS, a nonprofit organization; therefore, a monetary value would need to be assigned to organs only for tax purposes. To significantly increase the donor pool, society should also reconsider its position against the buying and selling of cadaveric organs. Allowing payments to surviving family members is another way of providing market incentives.¹⁶

To operate efficiently, the structure of this market would still require a centralized agency like UNOS to facilitate the matching process. Donor and recipient information is critical, since an individual's willingness to pay would depend on the quality of the antigen match with the available organ. One possible market structure would be to grant authority to buy and sell organs exclusively to the federal government, an approach suggested by Nobel laureate Gary S. Becker (Becker 1997).

Shifting Rents

A common misperception about situations in which goods are not allowed to be bought and sold is that their market value is zero. An unintended consequence of price restrictions, however, is that the quantity supplied falls and the good becomes extremely valuable. To take advantage of the difference between the regulated price and the market's valuation, black markets tend to develop. Even if the price of the good does not rise, the actual cost may increase because of queuing costs, as in the case of gasoline price controls.

Black markets for transplantable organs have not developed in the United States, but it is possible that the price of transplants is higher, because organs cannot be legally sold. The law allows for "reasonable payments" to all who participate in the organ donation process (U.S. Congress 1984). The ambiguity of this term provides an opportunity for

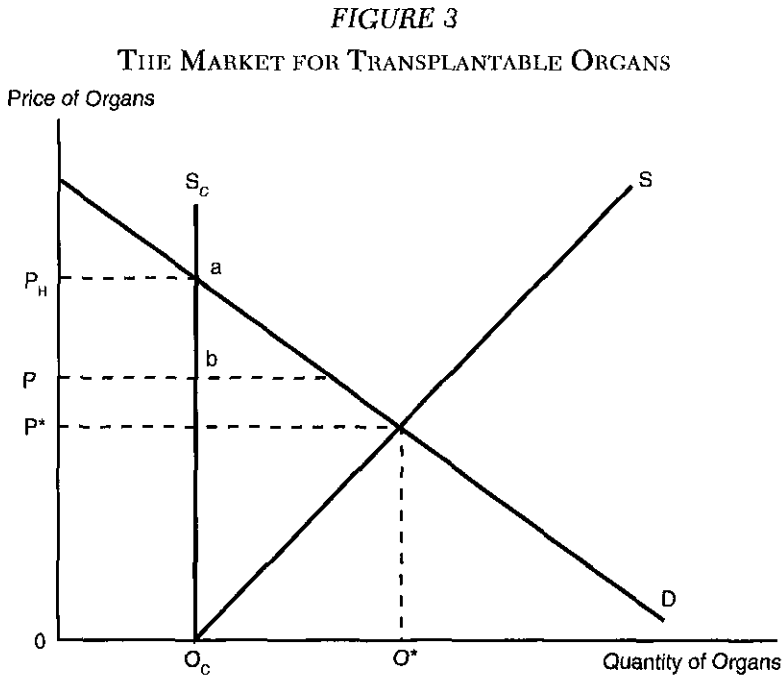
¹⁶The extent to which payments would elicit donations is unclear. The answer will likely come from pilot programs, such as the one recently introduced in Pennsylvania. Residents are offered the opportunity to contribute one dollar to a "Donor Awareness Trust Fund" when they renew their drivers' licenses or complete their state income tax forms. Up to 10 percent of this fund (a maximum of \$3,000) can be redistributed to families of deceased donors for hospital, medical, and funeral costs (Dejong, et al. 1995; Eshleman 1994).

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organ procurement organizations (OPOs) to artificially inflate prices. Currently, they receive approximately \$25,000 for retrieving just the kidneys from a cadaver. An interesting, but as yet unresolved, question is how much of this \$25,000 includes an implicit market price for the organ.

Other medical personnel (transplant surgeons, hospitals, etc.) also benefit financially from the organ procurement process, and are probably collecting some of these profits, also known as rents. Rents accrue whenever the quantity of a good is artificially restricted, thereby giving organizations monopolistic power. In the case of organs, the price, not the quantity per se, is restricted; however, the net effect is the same. Because of this, the shadow price (value) and hence the amount collected are likely to depend on the relative scarcity of the organ. Liver transplants are among the most expensive transplant surgeries—\$300,000 on average—and as Table 2 indicates, livers are in especially short supply.

Figure 3 illustrates this concept in the market for transplantable organs, where S_c represents the supply of organs under the current



system, and P_H represents the price that would clear the market.¹⁷ This is the highest price, over and above normal fees, that a hospital can potentially charge for a transplant. Area OP_HaO_c shows the maximum rents that would be collected.

It is clear, however, that all of these rents are not being collected, given current shortages. Yet, it is equally clear that some rents are being collected. For example, it is particularly telling that OPOs keep procured organs in their local area, even though UNOS's policies sometimes dictate otherwise. This is frequently true when OPOs are affiliated with hospitals' transplant centers (Caplan 1992), in which case the potential profits of keeping organs in-house can be substantial. Thus, there is an implicit market price, P , between zero and P_H that is being charged. At that price, the value of rents would be area $OPbO_c$. If P is above P^* , as shown, then selling organs would actually lower the total price of a transplant (including the equilibrium price of the organ, P^*). Similarly, if P is below the market-clearing price, the total price of a transplant would increase by less than P^* . Thus, allowing organs to be sold would increase their supply, lower their market value, and shift payments from OPOs, hospitals, and surgeons to family members.

Even if the price of transplantation did rise by the full amount of P^* , the money going to donors' families ("death benefits") would likely pale in comparison to the overall price of the operation. Consider the case where the family benefit is \$5,000 and rent shifting does not occur. When allocated among two kidneys, a heart, liver, and pancreas, the extra cost per organ is probably closer to \$1,000, an insignificant amount compared to the price of a transplant.

Equity Issues

Selling organs would not favor the rich at the expense of the poor, as many argue, since those receiving organ payments would likely have lower average incomes. Organ recipients, both rich and poor, would also benefit from the increased supply of organs. Currently, Medicare pays for kidney transplants, while 90 percent of liver and heart transplants are covered by Medicare, Medicaid, and private

¹⁷Actually, the notion of market-clearing in this market is ambiguous. By convention, an organ shortage is defined to occur when the quantity demanded (as measured by waiting-list patients) exceeds the annual supply. At any point in time, however, the quantity of organs demanded will exceed the available supply, even in a free market. Effectively, the relevant time frame for market-clearing should be organ-specific and should depend on the mortality rate of those awaiting transplants.

insurance.¹⁸ Each additional organ supplied benefits everyone, regardless of wealth.

Repealing the prohibition against the buying and selling of organs could lessen the disparity between black and white waiting times for kidneys. Because the antigen match is usually higher for individuals of the same race, any policy change that increases the percentage of black donors from its present level of 12 percent will decrease their waiting time. Thus, organ payments are more likely to persuade people of lower average income, including blacks, to donate, even if the payment amount is the same across all groups.

Given the higher demand for kidneys from black donors, in the absence of nondiscriminatory laws, payments to individual black families would likely be higher than payments to whites. But even without government assistance, this would not aggravate income inequality, since the extra amount paid by blacks would largely go to blacks. Given that Medicare (and frequently Medicaid) pays for kidney transplants, if anything, income inequality would be reduced by allowing organs to be sold.

Budgetary Concerns

Budgetary concerns are also misplaced. As previously noted, buying and selling organs may not increase transplantation costs at all, and even if it does, this policy change would still save Medicare money. It costs Medicare more than \$40,000 annually to dialyze each kidney patient, while the cost of a transplant and subsequent medication is about \$100,000 the first year and \$12,000 per year thereafter. Because of this, the Health Care Financing Administration estimates that transplantation is considerably more cost effective than continued dialysis (UNOS 1997a).

For example, if the average life of a transplanted kidney were only three years, the budgetary impact of organ payments would be neutral. The median graft survival rate, however, is closer to six years. Therefore, as long as the family benefit is less than \$180,000 (\$90,000 per kidney), the government will save money. Since the vast majority (nearly 70 percent) of all waiting-list patients are waiting for kidneys, each additional dollar spent encouraging families to donate will save taxpayer money.

Conclusion

Rationing is considered anathema to most Americans, yet it is necessary when prices are regulated. Goods are frequently rationed

¹⁸Medicare covers almost all kidney recipients and pays 80 percent of expenses. The remaining 20 percent is picked up by either private insurance or Medicaid.

by simplistic methods such as lotteries or first-come, first-served. These may be more "equitable" approaches, but they are also among the most inefficient and can ultimately harm everyone involved. The inefficiencies are particularly pronounced in the market for transplantable organs, where costs are measured in human lives.

Deciding what is fair and who should be first in line for organ transplants is especially troubling and difficult. Dr. Mark Siegler, who directs the University of Chicago clinical ethics program, has stated that "all alcoholics should go to the bottom of the transplant list . . . yet Dr. Siegler [also] said he would exempt Mickey Mantle from his rule because the baseball legend is 'a real American hero'. . . [W]e have got to take them with all their warts and failures and treat them differently" (Kolata 1995). It is especially important that UNOS resolve these issues given the current prohibition against the buying and selling of organs.

The cost of this prohibition is that lives are being lost. Additional incentives, including monetary, are required if cadaveric organ donations are to increase substantially. Even if these incentives do not eliminate the need for rationing, each additional organ procured will reduce the difficult, and sometimes arbitrary, decisions that UNOS must make. While many feel that the distribution of organs is too important to be left to market forces, ultimately, it is too important not to be.

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