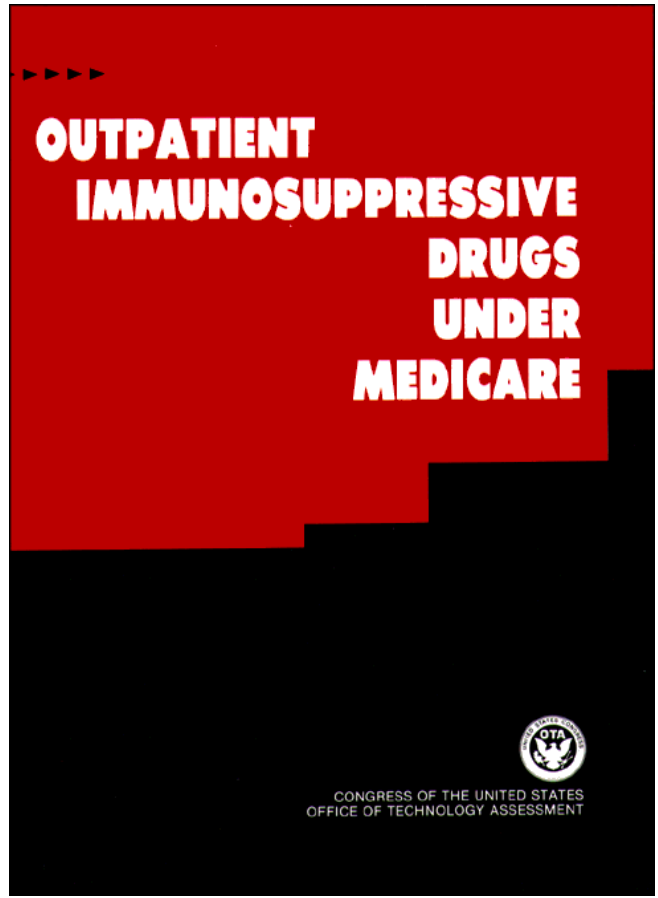
Outpatient Immunosuppressive Drugs Under Medicare

July 1991

OTA-H-452
NTIS order #PB92-117720





Recommended Citation:

U.S. Congress, Office of Technology Assessment, *Outpatient Immunosuppressive Drugs Under Medicare, OTA-H-452* (Washington, DC: U.S. Government Printing Office, September 1991).

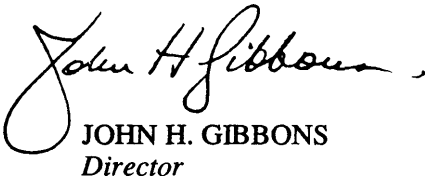
For sale by the U.S. Government Printing Office
Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328"
ISBN **0-16 -035315-7**

Foreword

Of all the astonishing achievements of modern medicine, the ability to successfully transplant a living organ from one human being to another is perhaps one of the most awesome. Immunosuppressive drugs are one of the spectrum of technological advances that have made organ transplants an everyday phenomenon. At the same time, however, transplant recipients' needs for these drugs have presented Medicare with a continuing policy dilemma, because Medicare does not usually pay for outpatient prescription drugs.

In 1984, the year after cyclosporine made its debut onto the health care market, OTA reported to Congress on the likely benefits of the drug for Medicare kidney transplant recipients. The present report, requested by the Senate Committee on Finance in the wake of the repeal of the Medicare Catastrophic Coverage Act, examines Medicare's current immunosuppressive drug coverage dilemma and the policy tradeoffs it entails for the 1990s.

OTA reports would not be possible without the assistance and input of a wide variety of individuals from both the public and the private sectors. OTA staff and contractors gratefully acknowledge the contributions of the many people who provided data, clarified facts, presented views, and reviewed the drafts of this report. The final responsibility for the content of the report rests with OTA.



JOHN H. GIBBONS
Director

Acknowledgments

OTA staff would like to thank the following individuals for their assistance during the preparation of this report. (These individuals do not necessarily agree or disagree with the findings and conclusions of this report.) OTA assumes full responsibility for the report and the accuracy of its contents.

James Armitage
North American Autologous Bone Transplant Registry
Lincoln, NE

Remy Aronoff
U.S. Health Resources and Services Administration
Rockville, MD

Robert Block
Blue Cross and Blue Shield Association
Chicago, IL

Carmella Bocchino
Nursing Economics
Washington, DC

Judith Braslow
U.S. Health Resources and Services Administration
Rockville, MD

Bureau of Policy Development
U.S. Health Care Financing Administration
Baltimore, MD

William Comanor
University of California, Santa Barbara
Santa Barbara, CA

Dennis Cotter
Health Technology Association
Washington, DC

Paul Eggers
U.S. Health Care Financing Administration
Baltimore, MD

Denis Grady
Sandoz Pharmaceuticals Corp.
East Hanover, NJ

Philip Held
Urban Institute
Washington, DC

Tom Holohan
Office of Health Technology Assessment
Rockville, MD

Alan Hull
Dallas Nephrology Associates
Dallas, TX

Barry Kahan
The University of Texas Health Science Center
Houston, TX

Joel Kallich
RAND Corp.
Santa Monica, CA

D'Etta Waldoch Koser
International Bone Marrow Transplant Registry
Milwaukee, WI

Susan Laudecina
Intergovernmental Health Policy Project
Washington, DC

James Light
Washington Hospital Center
Washington, DC

Shari McCullough
IMS America
Plymouth Meeting, PA

William McGivney
American Medical Association
Chicago, IL

John Newman
Reston, VA

Julie Ostrowsky
Chicago, IL

Richard Rettig
Institute of Medicine
Washington, DC

Walter Rutemueller
U.S. Health Care Financing Administration
Baltimore, MD

Bernadette Schumaker
U.S. Health Care Financing Administration
Baltimore, MD

Linda Sheaffer
Division of HIV Services
Rockville, MD

Jane Sisk
Dobbs Ferry, NY

Sandy Zachary
U.S. Health Care Financing Administration
Baltimore, MD

OTA Project Staff—Outpatient Immunosuppressive Drugs Under Medicare

Roger C. Herdrnan, *Assistant Director, OTA*
Health and Life Sciences Division

Clyde J. Behney, Health Program Manager

Project Staff

Elaine J. Power, *Project Director*

Diane Burnside Murdock, *Contractor/Principal Analyst*

Other Contributing Staff

Sharon Y. Hamilton, *Research Assistant*

David P. Reeker, *Congressional Fellow*

Administrative Staff

Virginia Cwalina, Office *Administrator*

Carolyn Martin, *Word Processor Specialist*

Eileen Murphy, P.C. Specialist

Contents

Page

Chapter 1: Summary and Options 3

Chapter 2: Overview of the Transplant Population 15

Chapter 3: Immunosuppressive Drug Therapks 23

Chapter 4: The Adequacy of Current Medicare Coverage of Immunosuppressive Therapy 31

Chapter 5: Medicare Expenditures for Immunosuppressive Drug Therapy 39

Appendix A: Method of the Study 47

Appendix B: Medicare Payment Policy for Organ Transplant Procedures 48

Appendix C: Glossary of Abbreviations and Terms 49

References 53

Chapter 1

Summary and Options

Contents

Page

INTRODUCTION ... 3
THE TRANSPLANT RECIPIENT POPULATION ... 3
IMMUNOSUPPRESSIVE DRUGS ... 5
THE ADEQUACY OF CURRENT MEDICARE COVERAGE ... 6
MEDICARE EXPENDITURES FOR IMMUNOSUPPRESSIVE DRUGS ... 8
ISSUES AND OPTIONS ... 9

Figures

Figure — Page

1. Organ Transplants: Distribution by Type of Organ and Medicare Coverage, 1988 ... 4
2. Future Medicare Coverage for Recipients of Medicine-Covered Transplants ... 5

Tables

Table — Page

1. Kidney Transplant Patients' Risk of Out-of-Pocket Liabilities for Outpatient Immunosuppressive Drugs by Insurance Status ... 7
2. Factors Influencing Future Medicare Expenditures for Immunosuppressive Drug Therapy ... 8
3. Medicare Policy Options for Outpatient Immunosuppressive Drugs ... 9
4. Estimated Number of Persons for Whom Medicare Would Have Paid for Immunosuppressive Drug Therapy Based on Selected Coverage Policy Options, 1988-90 ... 11

Chapter 1
Summary and Options

INTRODUCTION

Drugs that act to suppress the body's normal immune reactions are a critical medical therapy for persons who have received organ transplants. Most such individuals must continue imrnunosuppressive drug therapy throughout their lives to prevent organ rejection.

Medicare, the Nation's health insurance program for the elderly and disabled, does not usually cover outpatient prescription drugs. Congress granted a special exception to this rule in 1986[1] to ensure that Medicare transplant recipients had at least initial access to outpatient immunosuppressive therapy. At present, however, Medicare's coverage of this therapy is limited to 1 year, starting upon the patient's discharge from the hospital after a Medicare-covered transplant procedure.

In March 1990, the Senate Committee on Finance asked the Office of Technology Assessment (OTA) to examine Medicare's coverage and payment policies for outpatient immunosuppressive drug therapy.[2] In response to that request, this report addresses two basic questions. First, do Medicare beneficiaries have adequate access to outpatient immunosuppressive drugs under existing coverage and payment rules? Second, how might Medicare coverage and payment for immunosuppressive drugs be changed, and what are the likely implications of those changes?

To provide a framework for discussing possible options for changing Medicare immunosuppressive drug policy, the report presents background on four subjects. Chapter 2 describes the patient population using immunosuppressive drugs-i. e., transplant recipients with a functioning graft (implanted organ). Chapter 3 describes the immunosuppressive drugs used by transplant recipients and the variation that exists in drug protocols and their costs. Chapter 4 examines the adequacy of current coverage policy for immunosuppressive drugs used by Medicare beneficiaries. Chapter 5 discusses national and Medicare expenditures for outpatient immunosuppressive drugs and some factors that might affect future expenditures.

The remainder of this chapter summarizes the report and discusses the advantages and disadvantages of several possible approaches to changing Medicare coverage and payment for immunosuppressive drugs,

THE TRANSPLANT RECIPIENT POPULATION

The demand for outpatient post-transplant immunosuppressive drugs depends heavily on the number of eligible organ transplant recipients with a successful, functioning graft. Medicare restricts its organ transplant coverage to certain organs and certain categories of patients. Presently, Medicare covers heart, kidney, liver, and bone marrow transplants (for beneficiaries with certain medical conditions). Medicare does not cover heart/lung, lung, or pancreas transplants, although these transplants are sometimes covered by other insurers.

In 1988, the most recent year for which comprehensive data are available, nearly 15,000 organ transplants were performed in the United States.[3] Kidney transplants were the most frequently performed, accounting for 62 percent of the U.S. total (figure 1). Medicare covered an overwhelming majority (nearly 90 percent) of those kidney transplants, compared with only 7 percent of heart transplants, 3 percent of allogeneic bone marrow transplants, and less than 1 percent of liver transplants. Nonetheless, because kidneys are the most commonly performed transplants, Medicare covered a majority (57 percent) of the Nation's transplant procedures overall in 1988.

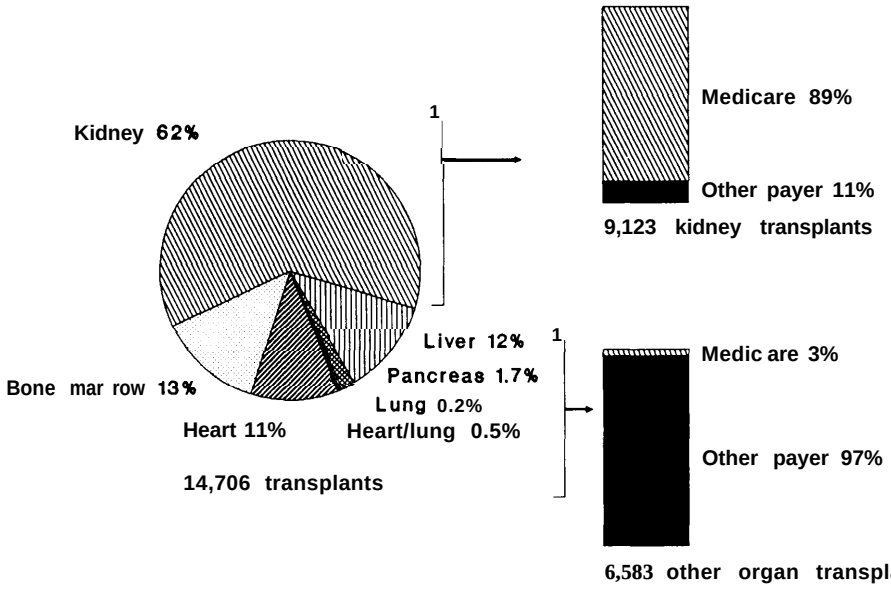
The percentage of transplant recipients covered by Medicare is high because of Medicare's End-Stage Renal Disease (ESRD) entitlement program, which covers nearly all of the U.S. kidney transplant recipients for 3 years following the day of surgery

1 The statutory exception permitting short-term coverage of these drugs took effect on Jan.. 1, 1987 (Public *Law 99-509).*

2The committee requested an examination of coverage and payment for home intravenous drug therapy in the same letter. The OTA report on that topic will be published separately.

3 Includes all organ transplants and all allogeneic bone marrow transplants.

Figure l—Organ Transplants: Distribution by Type of Organ and Medicare Coverage, 1988



SOURCE: Office of Technology Assessment, 1991. Based on information provided by U.S. Department of Health and Human Services, Public Health Service, Health Resources and Services Administration, Division of Organ Transplantation; and the Prospective Payment Assessment Commission.

(figure 2).[4] Whereas other persons must already be entitled to Medicare (by being elderly or disabled) in order to receive a Medicare-covered transplant, any patient diagnosed with end-stage renal failure who requires dialysis or a kidney transplant may be entitled to Medicare as a result of this medical need. Although about half of kidney transplant recipients with a functioning graft lose Medicare eligibility after 3 years, the remaining 50 percent continue to receive Medicare benefits past the 3-year limit due to their age or continuing disability (17).[5]

The total number of organ transplants performed per year has been increasing. The average annual rate of increase in kidney transplants has been only 5 percent in recent years[6] due to the limited supply of kidney organs available for transplant. The average annual growth rates for other organ transplants have been much higher. The number of liver transplants, for example, has been increasing by nearly 50 percent per year. The supply of donated organs is still not sufficient to meet the needs of those waiting for these transplants, however. Even the waiting lists may understate actual medical need; some physicians believe that the number of qualified patients who are not represented on the waiting lists is as large as the number who are (25).

The number and success of transplant procedures have increased over the past decade, although graft survival rates vary markedly by the type of organ. For lung and heart/lung transplants, l-year graft survival rates are still less than 60 percent (5).[7] Kidney graft survival rates are much higher, with l-and 5-year cadaveric kidney survival rates of 78 and 52 percent, respectively. Living-donor kidney transplants are even more successful (5). Overall, of the nearly 15,000 individuals who received organ transplants in 1988, OTA estimates that approximately 11,000 (73 percent) were living in 1989 with a functioning graft. Almost all of these patients would have been on immunosuppressive drug therapy.

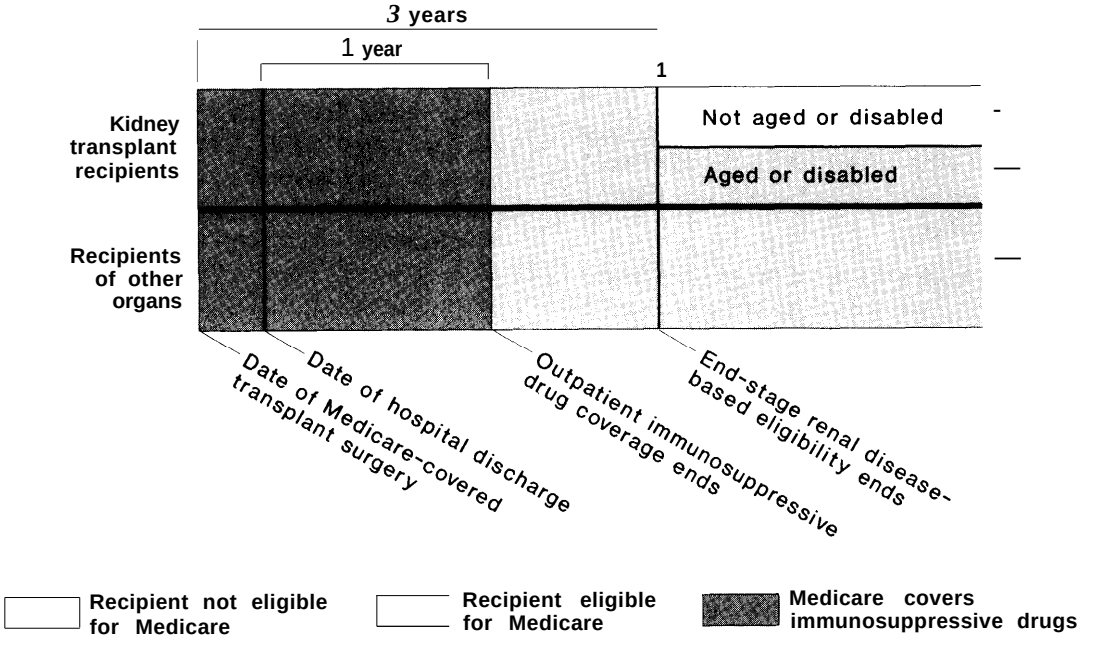
Conversely, Medicare covers only a small percentage of nonrenal transplants because few transplant recipients are elderly (5).

5 In fact, advocates argue that patients strive for continued disability status to assure insurance coverage of ongoing outpatient care (9).

6 Based on 1984--89 data.

7 Survival rates are based on 1989 data.

Figure 2—Future Medicare Coverage for Recipients of Medicare-Covered Transplants



SOURCE: Office of Technology Assessment, 1991.

IMMUNOSUPPRESSIVE DRUGS

Medicare's policy is to cover all drug products for outpatient self-administration that are approved by the U.S. Food and Drug Administration (FDA) and have a label indicating use for immunosuppressive therapy. At present, only four drugs are FDA-approved for post-transplant immunosuppression: azathioprine (Imuran), cyclosporine (Sandimmune), antithymocyte globulin (Atgam), and muromonab CD3 (Orthoclone OKT-3). Each of these drugs is made by only a single manufacturer. In addition, Medicare covers adjunct prescription drugs (e.g., prednisone) when they are used as part of the immunosuppressive therapeutic regimen (56).

Early approaches to chemical immunosuppression relied mainly on a combination of azathioprine and prednisone. With cyclosporine's introduction into widespread use in 1984, however, a variety of new drug protocols followed. At present, nearly all are based on cyclosporine; 90 percent of transplant recipients receive this drug as the primary immunosuppressive agent (5).

Cyclosporine has improved graft survival rates and decreased the number of infection-related complications, the average length of hospital stay, and the number of organ rejection episodes compared with early approaches (7,43). However, the costs of protocols using this drug are dramatically higher than the cost of traditional therapies. For example, the reported cost of outpatient therapy using only prednisone and azathioprine was $2 per day in 1988, compared with reported average costs for cyclosporine therapies ranging from $9 to $23 per day (6,7). The average annual costs of cyclosporine-based protocols range from an estimated $4,000 to $6,000 per year (7).[8] Costs for immunosuppression can vary substantially across recipients, because some recipients still receive the traditional less costly drug protocols, and because the cost of therapy for patients on cyclosporine-based protocols often decreases as drug dosages are reduced over time (7,28). Future per-patient costs may increase or decrease as new drugs (e.g., FK-506) enter the market. Costs may also change when Sandoz's patent for cyclosporine expires in 1995.

8 These costs include he costs of other drugs used in the protocols.

THE ADEQUACY OF CURRENT MEDICARE COVERAGE

Since January 1, 1987, Medicare has covered outpatient immunosuppressive drugs. Drug coverage is for 1 year from the date of a patient's discharge from the hospital after a Medicare-covered kidney, heart, liver, or bone marrow transplant (see figure 2) (Public Law 99-509).

Medicare reimburses for these drugs on a reasonable *charge* basis when the drugs are dispensed by a retail pharmacy, physician, or other supplier, and on the basis of reasonable *costs* when the drugs are dispensed by a hospital pharmacy.[9] In both cases, the beneficiary is subject to the Part B deductible of $100, a coinsurance amount (20 percent of the charge[10]), and (if the drugs are obtained from a nonhospital supplier) any additional amount above the Medicare-allowed charge.

In addition to the drugs themselves, certain services related to imrnunosuppressive therapy may also be billed to Medicare. Physicians may bill for patient visits during which they provide only therapy management services, and if the management visit takes place in a hospital outpatient setting the hospital could submit a bill for this encounter as well. The extent of such billing in practice, and the amount of patient coinsurance obligations that accompany it, are unknown.

Expanding Medicare's coverage policy will have the most impact on access to therapy if a significant number of beneficiaries do not already have adequate coverage of outpatient immunosuppressives through other payment sources. Under current rules, a beneficiary with no health care coverage other than Medicare must pay the 20 percent coinsurance for the drugs during his or her first year on outpatient immunosuppressives, or between roughly $570 and $850 (in 1988 dollars) (see ch. 4). After the l-year drug coverage period ends, this beneficiary would pay the full cost of the treatment, or roughly $4,000 to $6,000 per year. (The beneficiary might also be purchasing additional drugs uncovered by Medicare, such as antifungal or antiviral drugs used to protect the transplanted organ, or drugs to treat underlying diabetes or hypertension.)

Beneficiaries with other third-party coverage in addition to Medicare have some protections from these costs. During the first year of outpatient immunosuppression, when Medicare covers the immunosuppressive drugs, many beneficiaries have private insurance or Medicaid that covers the beneficiaries 20 percent coinsurance liability. Thereafter, however, Medicare drug coverage ends. The other insurer's policies then apply, and transplant recipients are obligated to pay that insurer's coinsurance and any other liabilities (e.g., deductibles).

Beneficiaries whose private insurance is primary must pay some coinsurance during the frost year. Medicare requires that private insurers covering ESRD beneficiaries be the primary payer for the frost 18 months these beneficiaries are on Medicare. In other words, even though an ESRD patient is entitled to Medicare coverage, Medicare will pay for covered services provided to these beneficiaries only after any existing private insurance policies have paid. About half of ESRD kidney transplant recipients undergo the transplant during the frost year of Medicare eligibility (17). Consequently, for these recipients the private insurer is primary during at least part of the frost year on outpatient immunosuppressives, and the beneficiary must pay that insurer's required coinsurance during that time.

Thus, the degree to which Medicare transplant recipients are at risk of high out-of-pocket expenditures for imnmnosuppressive drugs depends heavily on whether they have additional third-party coverage. As shown in table 1, a majority of Medicare transplant recipients (approximately 57 to 87 percent, or roughly 4,700 to 7,200 recipients in 1988[11]) have third-party coverage through private insurers or State Medicaid programs that pay for outpatient immunosuppressive therapy after Medicare drug coverage ends (see ch. 4). As long as they remain eligible for Medicare, these patients are at low to medium risk of significant out-of-pocket expenses, depending primarily on whether they are liable for copayments. For most of these patients, the major

9 See app. C for definitions of reasonable **charges and reasonable costs.**

10 The relevant charge is the Medicare-allowed charge for nonhospital suppliers and the submitted charge for hospital pharmacies. Although hospital pharmacies are reimbursed by Medicare on the basis of their costs, the beneficiaries' coinsurance is calculated as 20 percent of the submitted charge of these pharmacies.

11 The year 1988 is the most recent for which comprehensive transplant data are available. Projections for 1992 and beyond would entail a somewhat higher number of individuals, since the number of transplants per year has been increasing.

Table l—Kidney Transplant Patients' Risk of Out-of-Pocket Liabilities for Outpatient Immunosuppressive Drugs by Insurance Status

Insurance status	Percentage of total kidney transplants	Post-transplant period		
		Lessthan 1 year[a]	1-3 years[b]	More than 3 years
		Beneficiary obligations/degree of financial risk		
Medicare/Medicaid[c]	20%	No coinsurance obligations/ generally minimal out-of-pocket expenses (Low risk group)	Same as iess than 1 year (Low risk group)	Same as iess than 1 year (Low risk group)
Medicare/private insurance	37 to 37 to 67%	if Medicare prirnary,[d] private coverage wraps around-no coinsurance obligations (Low risk group) If Medicare secondary, generally third-party coverage of drug benefit-coinsurance obligations (Medium risk group)	Same as iess than 1 year but Medicare is primary payer for most beneficiaries during this period (Low to medium risk group)	Coinsurance obligations or iiabie for premium or fuli cost of drug (Medium to high risk group)
Subtotai	57 to 87%			
Medicare only	13 to 4370	Premium and coinsurance obligations (Medium risk group)	Liable for fuii cost of drug (High risk group)	Same as 1 to 3 years (High risk group)
Total	100%			

a Medicare coverage of outpatient immunosuppressive drugs ends 1 year after hospital discharge following transplant surgery.
b Medicare End Stage Renal Disease (ESRD) eligibility ends 3 years after the date of transplant surgery (see figure 1).
c Some Medicaid programs have dollar limits and limits on number of scripts, which would affect adequacy of coverage of outpatient immunosuppresive drugs for these recipients.
d Medicare is the mandatory seondary payer for 18 months after an ESRD beneficiary becomes eligible for the program. About half ofkidney transplant recipients undergo the procedure within their first year of eligibility. Thus, most recipients with private insurance have Medicare as secondary payer for at least part of their first post-transplant year. Few, however, have primary private insurance beyond that year.

SOURCE: Office of Technology Assessment, 1991, based on data from the Health Care Financing Administration (17) and Battelle Human Affairs Research Centers (7).

effect of expanding Medicare's coverage of outpatient immunosuppressives will be to shift financing from other sources to Medicare.

The remaining Medicare transplant recipients (between 13 and 43 percent, or approximately 1,000 to 3,600 recipients in 1988) have no insurance other than Medicare. These individuals are at high risk of financial strain, because they must usually pay the full cost of the drug after Medicare's l-year coverage period ends. Extending Medicare's coverage would alleviate most of the financial burden presently experienced by these patients, although they would still be obligated for the 20 percent coinsurance for the drugs.

Also financially vulnerable are those kidney transplant recipients who are neither elderly nor disabled and who thus become ineligible for Medicare 3 years after their transplant. Some of these patients are eligible for Medicaid. Others have continuing private insurance that covers the drugs, although these individuals are vulnerable to losing insurance if they change jobs. For most individuals who have no private insurance and are ineligible for Medicaid, however, the loss of Medicare eligibility means the loss of all health care coverage. These recipients, as well as those who lose their private insurance due to job changes or other factors, maybe unable to obtain new insurance due to their preexisting health conditions. If they are able to purchase insurance, the premium cost may be very high.

Medicare's outpatient drug coverage policy cannot readily ease the financial burden of this group, since these individuals are no longer Medicare beneficiaries. Like other persons with recurrent or chronic health conditions, transplant recipients may have great difficulty obtaining insurance to cover their anticipated high future health care costs. The solution to this problem may lie in broader health care reforms than can be addressed by Medicare alone.

Table 2—Factors Influencing Future Medicare Expenditures for Immunosuppressive Drug Therapy

	Affects Medicare expenditures under:		
	Current policy	Coverage expansion	Likely effects on Medicare expenditures
Factors influencing the number of beneficiaries and demand for drugs:			
Increase in nonrenal transplants and Medicare coverage of these procedures	J	J	'r
Coverage policy changes by other third-party payers		J	T or J
Change in mix of patients receiving transplants		J	1' or—
Limited supply of living organs to match existing and future demands for transplants	J	J	—
Change in provider prescribing and patient demand if coverage of immunosuppressives is expanded		J	T
Factors influencing cost of drug and overaii expenditures:			
Development of new immunosuppressive drug products and protocols	\	J	T or J
Expiration of cydosporine patent in 1995		J	'T or -J
Expanded prophylactic use of OKT-3		J	'r
Increased patient compliance with extended Medicare drug coverage resulting in fewer organ failures and hospitalizations		J	L
Additional administrative costs for monitoring drug coverage		J	T
Pressure to expand coverage to outpatient nonimmunosuppressive prescription drugs required by transplant recipients		J	T

KEY: ~ = increase expenditures; ~ = decrease expenditures; — _ no significant effect.

SOURCE: Office of Technology Assessment, 1991.

MEDICARE EXPENDITURES FOR IMMUNOSUPPRESSIVE DRUGS

Medicare does not currently play a major role in financing post-transplant immunosuppressive therapy. OTA found that at present, Medicare pays for immunosuppressive drugs for only about 19 percent of the functioning graft recipients with Medicare coverage and for only about 13 percent of all U.S. patients with functioning grafts. Furthermore, since the Medicare program pays for at most 80 percent of the cost of the drugs it covers, actual program outlays are an even smaller proportion of total U.S. drug outlay than these figures would imply. OTA estimates that the Medicare program currently spends roughly $20 to $30 million per year on outpatient immunosuppressive drugs, compared with total annual U.S. spending (including out-of-pocket expenses) of approximately $185 to $280 million (see ch. 5).

This small proportion is due to two factors. First is Medicare's l-year limit on coverage of outpatient immunosuppressives. Second, by law Medicare is the secondary payer for the first 18 months of a patient's eligibility under the ESRD program, which can overlap with a recipient's first year on outpatient immunosuppressives. Kidney transplants account for more than 95 percent of Medicare-covered transplantations, and approximately 37 to 67 percent of Medicare-covered kidney transplant recipients have private insurance during this 18-month period (7,17).

Over time, factors such as FDA approval of new products, generic alternatives to existing drugs, and changes in how immunosuppressive drugs are used could result in either declining or increasing costs of immunosuppressive therapy. Such changes could influence Medicare outlays in the future even if no change in policy is made. Other changes in the number of eligible beneficiaries and the cost of immunosuppressive drugs could come about as a result of system responses to any expansion in Medicare drug coverage. The factors influencing these changes and their likely effects on Medicare expenditures aressummarized in table 2.

ISSUES AND OPTIONS

Even without any changes in Medicare policy, it appears that overall coverage through private and public insurers is sufficient to ensure that many Medicare beneficiaries receive outpatient immunosuppressive drug therapy for the first few years. A substantial minority, however are at high risk of inadequate financial access, because they have only Medicare insurance and may suffer financial hardship in obtaining drugs after Medicare's l-year drug coverage period ends. In addition, in the long term, many other Medicare beneficiaries who had additional coverage at one time may find it difficult to afford immunosuppressive drugs.

Congress could choose not to change Medicare policies regarding outpatient immunosuppressive drug therapy. Alternatively, Congress could change either coverage or payment policy in any of a number of ways (table 3). The following section discusses seven options, which could be implemented either independently or in combination.

Option 1: Extend the current Medicare limit on outpatient immunosuppressives past one year.

Option IA: Extend the limit by a specified number of years (e.g., to cover up to 3 years after hospital discharge).

Option IB: Eliminate the limit completely.

There are two basic goals of coverage expansion of outpatient immunosuppressive drugs: 1) ensuring accessibility to outpatient immunosuppressive drugs with adequate financial protection to the beneficiary, and 2) assuring equal access to transplantation. For those Medicare patients without additional coverage (an estimated 13 to 43 percent), financial inability to obtain immunosuppressive drugs may sometimes lead to failure of the transplanted organ and a return to dialysis (for kidney transplant recipients) or death (for recipients of other organs). Expanding Medicare coverage for immunosuppressive drugs would ease the financial burden for those beneficiaries with inadequate insurance coverage and might improve patient adherence to therapy. A secondary effect might be that of enhancing "equitable access to transplants, by reducing the chance that a patient will forgo the opportunity for a transplant (or not be referred for one) due to financial concerns.

Table 3—Medicare Policy Options for Outpatient Immunosuppressive Drugs

Coverage options:
Option 1: Extend or eliminate the current l-year limit on outpatient immunosuppressives for Medicare beneficiaries with a Medicare-covered transplant.
Option 2: Extend coverage for outpatient immunosuppressive drugs to Medicare beneficiaries whose transplant was not covered by Medicare.
Option 3: If coverage is extended, include preexisting as well as new transplant recipients with functioning grafts.
***Payment* options:**
Option 4: Apply Medicare secondary payer requirements to outpatient immunosuppressive drug benefits.
Option 5: Require nonhospital pharmacies to accept assignment for outpatient immunosuppressive drugs sold to Medicare beneficiaries.
Option 6: Reduce or eliminate the coinsurance requirement for outpatient immunosuppressive drugs.
Option 7: Change the method of paying for outpatient immunosuppressive drugs.

SOURCE: Office of Technology Assessment, 1991.

Extending the l-year limit by a specified number of years addresses these concerns in a limited way. Eliminating the l-year limit may be more effective, since it reduces the possibility of continued extensive out-of-pocket expenses for immunosuppressive for all Medicare-covered transplant recipients. Moreover, eliminating the limit may more effectively counteract any bias that exists in patient selection due to inability to pay for irnmunosuppressives, thus further enhancing the equity of access to transplants. Expanding immunosuppressive coverage will not have much effect on the actual number of transplants performed, because the number of transplants is constrained by the number of suitable organs available.

Coverage expansion will almost certainly raise Medicare expenditures, although there will be some small offsetting savings from averted hospitalizations and returns to dialysis. The increase in expenditures would be less with time-limited than with indefinite coverage. The benefits, however, would be much less as well.

The overall shift in financing from other sources to Medicare that would occur if coverage were expanded is a substantial and legitimate concern. An estimated 57 to 87 percent of Medicare transplant recipients have some kind of public or private insurance in addition to Medicare that currently pays for their immunosuppressive drugs.

Even with unlimited coverage expansion under this option, approximately 50 percent of kidney

transplant recipients would still lose Medicare-based immunosuppressive drug coverage after 3 years, when their ESRD-linked Medicare entitlement expires (17). For these patients, an additional policy issue is whether they should continue to be eligible for Medicare Part B in order to receive Medicare coverage of irnmunosuppressives. Many of these patients may find it difficult to purchase drugs (or insurance coverage) after losing Medicare eligibility. Permitting nondisabled transplant recipients to retain Medicare eligibility would afford these individuals much greater protection. However, it would also confer benefits not available to other chronically ill individuals.

Option 2: Extend coverage for outpatient immunosuppressive drugs to Medicare beneficiaries whose transplant was not covered by Medicare.

At present, only individuals whose organ transplant procedure was covered by Medicare are eligible for outpatient drug coverage. Some other organ transplant recipients, however, are also Medicare beneficiaries. This group of patients encompasses recipients of pancreas, heart/lung, lung, and some heart, liver, and bone marrow transplants who did not meet Medicare's conditions for coverage. Although the exact number of Medicare beneficiaries who fit this description is unknown, it is believed to be small (17).

Extending outpatient immunosuppressive drug coverage for the first time to these recipients would unquestionably raise Medicare expenditures slightly. However, it could further assure protection against the possibility of incurring substantial out-of-pocket expenses for all Medicare transplant recipients regardless of type of transplant.

Option 3: **If coverage is extended past the current limit, include preexisting as well as new transplant recipients.**

Under current policy, Medicare pays for outpatient immunosuppressive drugs for approximately 6,000 firstt-year transplant patients per year (see ch. 4). Any contemplated coverage expansion could be limited to Medicare-covered transplant recipients who receive their graft in or after the year in which the new coverage policy is made effective.

Alternatively, a new coverage extension could pertain to all existing Medicare-covered transplant recipients with a functioning graft as well. OTA estimates that the cumulative total of living functional-graft recipients in the United States was more than 46,000 persons in 1988, of which about two-thirds had Medicare coverage (see ch. 2). The total number of Medicare-covered transplant recipients was over 31,000 persons in 1988 and is estimated to be over 36,000 in 1991.

"Grandfathering in" all Medicare beneficiaries with functioning grafts would assure the same coverage policy and similar financial protection to Medicare transplant recipients regardless of when the transplant was performed. It would also increase the initial pool of recipients requiring Medicare payment for irnmunosuppressives more than five-fold, resulting in corresponding increases to Medicare expenditures (table 4). If a grandfather clause were combined with elimination of the current l-year limit on coverage, Medicare would cover and pay for immunosuppressive drugs for approximately 67 percent of all U.S. transplant recipients with a functioning graft, compared with the current estimate of 13 percent. Medicare would then have a leading role in financing post-transplant immunosuppressive therapy. Total Medicare-related expenditures, including beneficiary copayments, could be expected to increase from an estimated $24 to $36 million to between $125 and $185 million (in 1988 dollars) .12

Option 4: Apply Medicare secondary payer requirements to outpatient immunosuppressive drug benefits.

Under the ESRD program, having Medicare as secondary payer is a *mandatory* requirement for the frost 18 months of eligibility .13 Medicare pays for covered services provided to ESRD beneficiaries in this period only after any existing private insurer pays. Private insurers are not permitted to discriminate against ESRD beneficiaries, so they may not disenroll beneficiaries or arbitrarily change their benefits during this time. Approximately 37 to 67

12 This increase is equivalent to an increase of less than 0.5 percent of total Medicare Part B dollars.

13 The mandaroty requirement that Medicare be the secondary payer applies to **disabled and ESRD beneficiaries but not to the working-aged Medicare population (many of whom have private employer-based insurance). For the latter group, Medicare is usually the primary payer regardless of any other insurance coverage, although the beneficiary can designate the private insurer as primary if he or she so chooses (37).**

Table 4-Estimated Number of Persons for Whom Medicare Would Have Paid for Immunosuppressive Drug Therapy Based on Selected Coverage Policy Options, 1988-90

	Estimated number of Persons[a]		
Policy option	1988	1989	1990
Retain current 1-year coverage limit for drugs[b]	6,000	5,800	6,100
Extend/eliminate limit (option 1)	6,000	12,100	19,000
Extend/eliminate limit and cover all Medicare-covered successful grafts (options 1 and 3)	31,500	35,400	40,300

a Estimated number includes only Medicare beneficiaries who have a Medicare-covered transplant procedure and for whom Medicare is the primary payer. Estimates have been rounded to nearest 100 to reflect the degree of uncertainty in these numbers.
b Numbers are based on 1987-89 Medicare transplant recipients with functioning grafts in 1989-90, respectively. The number of kidney transplants, while fairly constant in recent years, fell slightly from 1987 to 1988, explaining the decline in functioning graft patients shown in 1989.

SOURCE: Office of Technology Assessment, 1991. Estimates calculated by OTA based on available information from the Health Care Financing Administration and the Health Resources and Services Administration.

percent of Medicare kidney transplant recipients have private coverage during this time (7,17). If the l-year coverage limit for immunosuppressive drugs is eliminated, extending the mandatory secondary payer requirement to all kidney transplant recipients *specific* to immunosuppressive drug coverage would prevent a shift of financing from other sources to Medicare for those patients with additional coverage.

This option could apply to all beneficiaries, not just kidney transplant recipients. However, there is no precedent for expanding mandatory secondary payer policies to a specific service for the general Medicare population. Since Medicare would still be the primary payer for all other services provided to the population, this provision might be difficult to administer. This option is also only effective to the extent that private insurers can be prevented from changing their enrollment and benefit packages. At present, such protection exists in law only for ESRD beneficiaries.

Option 5: Require nonhospital pharmacies and other suppliers to accept assignment for outpatient immunosuppressive drugs.

Individuals requiring outpatient immunosuppressive drugs can obtain these drugs from either hospital pharmacies or from nonhospital pharmacies, physicians, and other sources. Hospital pharmacies serving Medicare patients must accept the Medicare cost-based payment plus the beneficiary copayment (coinsurance and any applicable deductible) as payment in full for the drug. Nonhospital suppliers are not subject to this constraint and may bill beneficiaries more than the Medicare-allowed charge (i.e., more than the Medicare payment plus beneficiary copayment).

Congress could mandate that all nonhospital suppliers accept assignment for post-transplant outpatient irnmunosuppressive drugs. These suppliers would then be required to agree to accept Medicare's allowed charge as payment in full in order to dispense these drugs to Medicare beneficiaries. This option would restrict providers' behavior in exchange for reducing beneficiaries' financial liabilities. The exact extent of protection that would be afforded by this option is unclear; it depends on the extent to which patients purchase their drugs from nonhospital sources.

Option 6: Reduce or eliminate the coinsurance requirement for outpatient immunosuppressive drugs.

Expanding coverage by eliminating the l-year limit does not protect the beneficiary from coinsurance obligations. Under current policy, the patient must pay a coinsurance amount equal to 20 percent of reasonable charges (if the drug is dispensed by a nonhospital pharmacy or supplier) or 20 percent of the actual submitted charge (if dispensed by a hospital pharmacy). OTA estimates that average coinsurance obligations were between roughly $570 and $850 per year in 1988. Payment policy could be changed to recognize a higher proportion (up to 100 percent) of reasonable charges, thus reducing or eliminating the coinsurance liability. This change could be made regardless of any other changes in coverage or payment policy.

The unquestionable benefit of eliminating coinsurance requirements for outpatient irnrnunosuppressives is that it would ease the financial obligations of beneficiaries. However, this benefit would be achieved at the expense of Medicare. The elimination of coinsurance might increase patient adherence to prescribed drug regimens and prevent some organ rejection episodes, with some associated Medicare savings, but the magnitude of the savings is probably small.

Changing coinsurance requirements for outpatient immunosuppressive drugs raise some issues of equitable treatment of other Medicare beneficiaries, who also must pay coinsurance for the benefits they receive. For example, implementing this option could result in pressure to reduce coinsurance obligations for dialysis visits, since coinsurance expenses are higher for that treatment than for outpatient drug therapy.

The most comprehensive alternative for reducing beneficiary out-of-pocket costs would be a combination of three options: eliminating the current l-year coverage limit, requiring mandatory assignment, and eliminating the coinsurance requirement. This approach would offer beneficiaries almost complete protection from the high cost of irnmunosuppressive drugs. (Increases to Medicare outlays could be constrained slightly by mandating Medicare as secondary payer.) However, this approach would raise particularly strong equity issues, since it would afford transplant recipients a degree of financial protection unavailable to any other Medicare beneficiaries.

Option 7: Change the method of paying **for outpatient immunosuppressive drugs.**

At present under the outpatient immunosuppressive drug benefit, the drug is paid separately from the physician visits relating to therapy management and from any associated hospital outpatient visit. One eventual alternative might be to bundle the various covered services together for the purposes of payment. If, as one study suggests, outpatient immunosuppressive drugs are obtained more often from hospital outpatient pharmacies than from retail pharmacies (7), then a global fee with the professional and technical components included might be practical. Two disadvantages with moving immediately to global fees for immunosuppressive drug therapy are the difficulty of paying consistently for hospital- and nonhospital-based services and the potential incompatibility with any other future changes in payment for ambulatory services.

Another payment approach might be to pay for immunosuppressive drugs according to a fee schedule, under which the dispenser would be paid a single price per given amount of drug, regardless of the type of pharmacy from which the drug was obtained. At present, an immunosuppressive obtained from a hospital pharmacy is reimbursed on a different basis than one dispensed by a nonhospital pharmacy or supplier. Under this option, the actual amount paid could be based on a fee schedule that applied uniformly across different suppliers and accounted for factors such as drug dosage level and whether the drug was a generic or a sole source product.

Advantages to a fee schedule for immunosuppressive from Medicare's perspective are that the program could better control its expenditures and could encourage or discourage the use of particular drugs, if desired, by raising or lowering payment rates. A fee schedule might also confer benefits on beneficiaries by making their payments lower and more predictable, particularly if this option were implemented in tandem with mandatory assignment. Disadvantages to a fee schedule include the potential for establishing rates too low (discouraging technological innovation or reducing beneficiary access) or too high (resulting in unnecessary expenditures), and the administrative burden of establishing appropriate rates and updating them frequently.

Chapter 2

Overview of the Transplant Population

Contents

Page

TRANSPLANT COVERAGE POLICY 15
Medicare 15
Other Insurers 15
NUMBER OF TRANSPLANTS 17
TRANSPLANT RECIPIENTS 18
Characteristics 18
Number of Functioning Graft Patients 18

Tables

Table — Page

5. Medicare Coverage Policy for Selected Transplant Procedures... 16
6. Percentage of Medicaid programs and private Insurance Plans Covering Transplants 16
7. Number of Transplants Performed: U.S. Total, Medicine-Covered, and Medicaid-Covered, 1988 17
8. Number of U.S. Transplants Performed and percent Change, 1984-89 18
9. Characteristics of Transplant Recipients, 1989 19
10. Estimated Number of U.S. Transplant Recipients With a Functioning Graft and With Medicare Coverage, 1988 20

Chapter 2
Overview of the Transplant Population

The demand for outpatient post-transplant immunosuppressive drugs depends heavily on the number of people receiving organ transplants. Since January 1987, Medicare has covered these drugs for patients who received a Medicare-covered transplant (Public Law 99-509). This chapter provides an overview of existing coverage policy for transplants, the number of U.S. and Medicare-covered transplant recipients, and transplant patient characteristics. It then presents estimates of the number of living transplant patients with a functioning graft-an essential number in determining how many persons require immunosuppressives.

TRANSPLANT COVERAGE POLICY

Medicare

Medicare restricts its coverage of transplants to certain organs and, to some degree, certain categories of patients. At present, Medicare covers heart, kidney, liver, and bone marrow transplants (table 5) (54).[1,2] Liver and bone marrow transplants are restricted to Medicare beneficiaries with certain medical conditions. At this time, Medicare does not cover heart/lung, lung, or pancreas transplants, regardless of the patient's condition.[3]

Medicare coverage of kidney transplants is statutorily mandated, based on Medicare eligibility through the End-Stage Renal Disease (ESRD) Program. Whereas other patients must already be entitled to Medicare (by being elderly or disabled) in order to receive a Medicare-covered transplant, any patient who needs kidney dialysis or a kidney transplant due to chronic renal failure may be entitled to Medicare as a result of this need.[4] Medicare ESRD-linked entitlement for kidney transplant beneficiaries ends 3 years after the date of transplant surgery (42 U. S. C. A.§426-1).

Other Insurers

State Medicaid programs' and private insurers' policies concerning organ transplants are similar to Medicare's in many instances. For example, kidney, liver, and bone marrow transplants are covered by over 90 percent of State Medicaid programs (table 6). Similarly, kidney transplants are covered by almost all private insurers; heart and liver transplants are covered by many Blue Cross/Blue Shield plans and commercial insurers. As of the mid-1980s, health maintenance organizations' coverage policies also generally appeared to resemble those of the Medicare program (22).

Many private insurers and Medicaid programs also cover transplant procedures currently not covered by Medicare. For example, more than 70 percent of the Blue Cross/Blue Shield plans and a comparable percentage of commercial insurers covered heart/lung transplants even in 1985 (8,22). Almost 25 States cover heart/lung transplants under Medicaid (317). Moreover, all evidence points to continued expansion in coverage of transplants by States and private insurers (27).

Thus, Medicare's coverage policy of nonrenal transplants is comparatively restrictive. Medicare's role in transplant coverage is also somewhat constrained because of the age limit for transplant; people 65 years and over are not generally considered acceptable candidates at present.

---

[1]Medicare also covers cornea and skin transplants. These tissue transplant procedures were not included in this study because they do not usually require immunosuppressive drugs.

[2]Although liver transplants for children have been covered since 1984, coverage for adults was only recently extended (56 FR 15006). Adult coverage is retroactive to March 1990.

[3]Medicare's payment policy for transplant procedures is summarized in app. B.

[4]Such patients are entitled to Medicare if they are fully or currently insured (or the dependent of a worker who is so insured) under the Social Security program. Entitlement normally begins on the first day of the third month after the patient is placed on kidney dialysis, or the first day of the month in which the patient entered the hospital in preparation for a kidney transplant (42 CFR 406.20).

Table 5—Medicare Coverage Policy for Selected Transplant Procedures[a]

Transplant procedure	Effective date	Coverage restrictions/scope
Kidney	July 1, 1973	Coverage is tied to patient eligibility under Medicare's End-Stage Renal Disease Program. Coverage can begin the month of hospitalization for the transplant. Coverage ends 36 months after the date of transplant surgery unless the recipient is also elderly or disabled.
Bone marrow[b]		
Allogeneic	Aug. 1,1978	Covered for treatment of leukemia or aplastic anemia.
	June 3, 1985	Covered for treatment of severe combined immunodeficiency disease or Wiskott-Aldrich syndrome.
Autologous	Apr. 28, 1989	Covered for patients with various specified conditions.
Heart	November 1979	Tentatively covered for transplants performed at Stanford University, pending development of final criteria for transplant.
	June 13,1980	Covered only for transplant and treatment performed at Stanford University and University of Arizona Medical Center on or before June 12, 1980, or on transplant candidates accepted on or before June 12, 1980. Future transplants not revered.
	Oct. 17,1986	Covered if performed according to specific protocols in selected U.S. heart transplant centers.[c]
Liver	Feb. 9,1984	Covered for Medicare recipients age 17 and under with specified conditions.
	Mar. 8, 1990[d]	Covered for adults with specified renditions. Both children's and adults' liver transplants must be performed in Medicare-designated liver transplant centers to be revered.
Heart./lung		Not covered.
Lung		Not covered.
Pancreas		Not covered.

[a]Skin and corneal transplants are also covered by Medicare. Both procedures were accepted medical practice at the time Medicare was implemented and thus required no specific later coverage decision. All other transplants are covered only when Medicare has determined that they are "reasonable and necessary."
[b]Allogeneic bone marrow transplants are those in which the marrow is obtained from a healthy donor. Autologous transplants, in Contrast, use the Patient's own previously extracted and treated bone marrow.
[c]As of January 1991, there were 40 approved heart transplant centers in the United States.
[d]Adult liver transplant final regulations did not appear until Apr. 12, 1991, but coverage was made retroactive to Mar. 8, 1990 (the date the Proposal regulations were first published).

SOURCE: Health Care Financing Administration, Bureau of Policy Development, Division of Dialysis and Transplant Payment Policy, 1991.

Table 6-Percentage of Medicaid Programs and Private Insurance Plans Covering Transplants

Transplant procedure	Medicaid programs[a] (1990)	Private insurers: Blue Cross/ Blue Shield (1985)	Private insurers: Commercial insurers[b] (1985)	Private insurers: Health maintenance organizations (1985)
	(Percent of States)	(Percent of plans)		
Heart	78%	89%	85%	33%
Kidney	98	100	97	97
Liver	94	91	80	81
Heart/lung	45	82	69	25
Lung	29	NA	NA	NA
Pancreas	24	49	57	19
Bone marrow	92	NA	NA	90

ABBREVIATIONS: NA = not available.
[a]Percentages include the District of Columbia.
[b]Based on a survey of 65 commercial insurers.
[c]Based on a survey of 120 members of the Group Health Association of America, to which 67 members responded.

SOURCES: Intergovernmental Health Policy Project, George Washington University, Washington, DC, September 1990; R. Block, Blue Cross and Blue Shield Association, Chicago, IL, personal communication, Mar. 29, 1991; and F.J. Hellinger, "Status of Insurance Coverage for Organ Transplants in the United States: A Review of Recent Surveys," *Int. J. Technology Assessment in Health Care* 2:563-570, *1986.*

Table 7—Number of Transplants Performed: U.S. Total, Medicare-Covered, and Medicaid-Covered, 1988

Transplant procedure	Us. total	Medicare-oovered		Media"d-covered[a]	
		Number	Percent of Us. total[b]	Number	Percent of U.S. total
Heart	1,647	1 17'	7.1%	94	5.7?40
Kidney	9,1 23[d]	8,145"	89.3	273	3.0
Liver	1,680	7[f]	0.4	120	7.1
Heart/lung[g]	74	0	0.0	5.0	6.8
Lung[g]	31	0	0.0	NA	NA
Pancreas[g]	243	0	0.0	9	3.7
Bone marred	1,908	55	2.9	208	10.3
Total	14.706	8.324	56.6	709	4.8

ABBREVIATIONS: NA = Not available.
[a]Based on Intergovernmental Health Policy Project Organ Transplant Survey, 1988. Data reported is primarily for State fiscal year 1987.
[b]Data provided by U.S. Department of Health and Human Services, Public Health Services, Health Resources and Services Administration, Division of Organ Transplantation, 1991.
[c]Based on Prospective Payment Assessment Commission analysis using inpatient hospital data.
[d]Calculations of the total number of kidney transplants vary depending on the source. According to the U.S. Renal Data System, the 1988 total is 8,923.
[e]Based on data from Office of Research and Demonstrations, U.S. Health Care Financing Administration (HCFA).
[f]These numbers reflect livertransplants for children under the age of 18. Coverage for adults was only recently extended. HCFA estimates that Medicare will cover approximately 19 percent (or over 400) of all U.S. liver transplants in 1994 (56 FR 12006).
[g]Medicare does not cover these procedures.
[h]Basedon International Bone Marrow Transplant Registry data on allogeneic and syngeneic bone marrow transplants. The total does not include number Of autologous transplants, of which approximately 1,200 were reported worldwide in 1987.

SOURCE: Office of Technology Assessment, 1991.

NUMBER OF TRANSPLANTS

In 1988, nearly 15,000 organ transplants were performed in the United States (table 7).[5] Kidney transplants were the most frequently performed transplant procedures, accounting for more than 60 percent of the U.S. total.

Medicare covered an overwhelming majority (nearly 90 percent) of U.S. kidney transplants in 1988.[6] In contrast, Medicare covered only 7 percent of heart transplants, 3 percent of allogeneic bone marrow transplants, and less than 1 percent of liver transplants (5,17,27,62). Nonetheless, because kidneys were the most commonly performed transplants, Medicare covered a majority (57 percent) of the Nation's transplant procedures overall in 1988.

State Medicaid programs sometimes cover transplants that Medicare does not, but Medicaid-covered procedures still account for less than 5 percent of the national total of transplantations. Thus, Medicare is a major payer of kidney transplants only; Medicaid's role is minor. Most other organ transplants are paid for by private insurers.

The number of nonrenal transplants (i.e., of organs other than kidneys) performed each year has increased dramatically over time (table 8). Average annual growth rates from 1984 to 1989 were 48 percent for liver, 37 percent for heart, 37 percent for pancreas, and 25 percent for heart/lung transplants (5). The rapid growth was a product of major advances that have continually taken place in all transplant-related disciplines-immunology, histocompatibility, surgery, organ procurement, organ preservation, and immunosuppression.

These growth rates might have been even greater if the supply of donated organs had been sufficient to meet the needs of those waiting for transplant. In 1989, for example, 31 percent of the patients waiting for a heart transplant died before a suitable organ became available (60). Similarly, the number of available kidney organs is sufficient to provide transplants for only about 60 percent of persons currently on the waiting list. The constrained supply of suitable kidneys explains the relatively small increase in kidney transplants, which grew by only 5 percent per year from 1984 to 1989.

[5]This total does not include skin and cornea transplants because these procedures do not require immunosuppressive drug therapy. It also does nOt include the U.S. number for autologous bone marrow transplants, which was was not available. This number is not critical since these recipients do not usually require immunosuppressives. Recent estimates suggest that approximately 1,200 such transplants were performed worldwide (l).

[6]Although Medicare covers 89 percent of U.S. kidney transplants, it actually pays for less than 50 percent of these transplants, due to the mandatory requirement that Medicare be the secondary payer for the first 18 months of eligibility of any End-Stage Renal Disease beneficiary who also has private insurance (17).

Table 8—Number of U.S. Transplants Performed and Percent Change, 1984-89

Year	Transplant procedure							
	Heart	Kidney	Liver	Heart/lung	Lung	Pancreas	Bone marrow[a]	Total
1984	346	6,968	308	22	0	87	1,000	8,731
1985	719	7,695	602	30	2	130	1,297	11,475
1986	1,368	8,975	924	45	0	140	1,578	13,030
1987	1,512	8,967	1,182	41	11	180	1,659	13,552
1988	1,647	9,123	1,680	74	31	243	1,908	14,706
1989	1,673	8,890	2,160	67	89	413	2,194	15,486
Percent change, 1984-89	383.5%	27.6?'.	601.3%	204.5%	NA	374.7?40	119.470	77.4%
Average annual percent change	37.1%	5.0%	47.6%	24.9%	NA	36.5%	17.0%	12.6%

ABBREVIATIONS: NA=not applicable.

[a]Based on International Bone Marrow Transplant Registry data on allogeneic and syngeneic bone marrow transplants. The 1988 and 1989 numbers are estimated based on a 15-percent increase each year.

SOURCE: U.S. Department of Health and Human Services, Public Health Services, Health Resources and Services Administration, Division of Organ Transplantation, 1991.

TRANSPLANT RECIPIENTS

Characteristics

Transplants are usually performed on relatively young patients (table 9). The average patient age at the time of transplant ranged from 25 years for bone marrow transplant recipients to 47 years for heart transplant recipients between October 1987 and December 1989 (5,62).[7] Across all types of transplants, the majority of recipients were white.

The patient's condition at the time of transplant varies by transplant type. A majority of heart, heart/lung, and lung transplants in 1989 occurred in patients who were reported to be homebound. In contrast, a substantial proportion of individuals receiving kidney, pancreas, and bone marrow transplants were working or going to school Ml-time (5,62). Repeat transplants occurred rarely, except for kidney and liver transplants.[8]

Most transplanted organs function for at least a year, but graft survival rates vary markedly by type of organ. For a 1987-89 cohort of transplant recipients, over 82 percent of heart grafts survived 1 year after the transplant (60). In contrast, only 57 percent of lung transplants survived that long. The l-year graft survival rate for cadaveric-donor kidney transplants, the most common type of organ transplant, was 78 percent, with 52 percent of such grafts surviving at least 5 years. One- and five-year survival rates for living-donor kidneys are somewhat higher (88 and 72 percent, respectively). Patient survival rates are similar to graft survival rates, except for kidney and bone marrow recipients, who can sometimes survive with alternative treatments if the graft fails.

Number of Functioning Graft Patients

To understand the implications of changing Medicare's policies regarding immunosuppressive drugs, one must first determine the number of living transplant recipients whose graft is still functional. Of the nearly 15,000 transplant recipients in 1988, OTA estimates that approximately 73 percent, or 11,000 recipients, were living in 1989 with a functioning graft.[9] The cumulative total of living functional-graft patients in the United States was estimated to be more than 46,000 persons in 1988, of which 66 percent have Medicare coverage (table 10). Kidney transplant recipients account for more than 95 percent of Medicare-covered transplants.

[7]However, the "age limits" criteria have been expanding. The common upper limit for heart transplant patients for example, is reported to have increased from 50 to 55 years of age (39).

[8]For a more detailed description of patient socioeconomic and demographics, see references 57 and 60.

[9]The estimated number of recipients living in 1989 with a functioning graft was calculated by applying l-year survival rates to the pool of persons who received grafts in 1988.

Table 9—Characteristics of Transplant Recipients, 1989

Patient characteristics	Transplant type							
	Heart	Kidney (cadaveric)	Kidney (living donor)	Liver	Heart/lung	Lung	Pancreas	Bone marrow[a]
Mean age	46.6	40.3	30.3	36.2	32.6	42.7	34.8	25.2
Sex (percent):								
Female	19.6%	39.3%	40.7%	46.3%	50.9%	42.9%	46.2%	42.0%
Male	80.4	60.7	59.3	53.7	49.11	57.1	53.8	58.0
Race (percent):								
White	85.7%	65.1%	74.8%	79.5%	92.5%	93.5%	95.7%	86.0%
Black	8.7	22.3	12.0	8.4	1.9	3.2	3.3	2.0
Other	5.5	12.6	13.2	12.1	5.7	3.2	1.1	12.0
Condition at time of transplant (percent):								
Work/school full time	0.3%	36.7%	42.2%	4.3%	0.0%	0.0%	40.4%	78.0%
Partially disabled	2.7	31.5	33.5	4.5	7.5	9.5	26.8	NA
Homebound	50.6	24.8	19.2	29.9	75.5	73.0	28.9	NA
Intensive care	20.7	2.5	2.5	11.4	9.4	3.2	0.7	NA
On life support	18.6	0.1	0.0	25.0	1.9	3.2	0.3	NA
Hospitalized	7.2	4.4	2.6	34.9	5.7	11.1	2.9	NA
With previous transplant (percent):								
None	97.4%	84.8%	92.7%	82.6%	100.0%	93.7%	94.4%	95.2%
One or more	2.6	15.2	7.3	17.4	0.0	6.3	5.6	4.8
1-year graft survival rate	82.4	77.6	87.6	63.2	58.6	56.6	76.5	93.0[b]
1-year patient survival rate	83.2	92.4	96.7	74.3	58.6	58.6	91.2	52.0[b]

[a]Based on International Bone Marrow Transplant Registry data on allogeneic bone marrow transplants. The 1989 numbers are estimated based on a 15-percent increase each year.
[b]The patient survival rate reflects treatment failure rather than graft failure. Patient disease-free survival rates would be similar to graft survival rates.

SOURCE: U.S. Department of Health and Human Services, Public Health Service, Health Resources and Services Administration, Division of Organ Transplantation, 1990.

Table 10-Estimated Number of U.S. Transplant Recipients With a Functioning Graft and With Medicare Coverage, 1988

Organ	Us. total	Recipients with Medicare coverage[a]	
		Number	As percent of U.S. total
Kidney	39,400	30,400[b]	77.2?40
Heart	3,075	220	7.1
Liver	1,660	10'	0.4
Heart/lung	65	[d]	[d]
Lung	10	[d]	[d]
Pancreas	365	[d]	[d]
Bone marrow	2,030	55	2.7
Total	46,605	30,685	65.8

[a]Includes only those for whom Medicare is assumed to be the primary payer. Medicare is the secondary payer for some kidney recipients with Medicare coverage.
[b]This total is based on the finding that 50 percent of kidney transplant recipients continue to receive Medicare benefits past the 3-year limit of End Stage Renal Disease-based Medicare eligibility.
'These numbers include liver transplants for children under the age of 18. Coverage for adults was only recently extended (56 FR 15006). U.S. Health Care Financing Administration estimates that Medicare will cover approximately 19 percent (or over 400) of all U.S. liver transplants in 1994 compared with less than 3 percent of U.S. liver transplants covered by Medicare in 1990.
[d]Medicare does not cover these transplant procedures.

SOURCE: Office of Technology Assessment, 1991. Calculations based on data provided by U.S. Department of Health and Human Services, Public Health Services, Health Resources and Services Administration, Division of Organ Transplantation; and Health Care Financing Administration, Office of Research and Demonstration.

The percentage of recipients covered by Medicare is high because of Medicare's ESRD entitlement program, which continues to cover nearly all of the U.S. kidney transplant recipients for 3 years after the day of the transplant surgery. The U.S. Health Care Financing Administration found that 50 percent of kidney transplant recipients with a functioning graft continue to receive Medicare benefits past the 3-year limit of ESRD-based Medicare eligibility (17). Disability, not age, is usually the criterion under which these recipients continue to qualify for Medicare.

Chapter 3

Immunosuppressive Drug Therapies

Contents

Page

IMMUNOSUPPRESSIVE DRUG PROTOCOLS 23
Components of Immunosuppressive Therapy 23
Variation in Drug Treatment Protocols 24
COSTOF IMMUNOSUPPRESSIVE THERAPY 25

Tables

Table *Page*

11. U.S. Food and Drug Administration Approval Status and Medicare Coverage of Post-Transplant Immunosuppressive Drugs 24
12. Typical Immunosuppressive Drug Protocols for Kidney Transplant Patients 24
13. Percentage of Kidney Transplant Recipients Receiving Cyclosporine, 1984-89 25
14. Percentage of Transplant Recipients Receiving Specific Immunosuppressive Drugs by Drug Type, 1987-90 26
15. Annual Drug Costs for Immunosuppressive Protocols of Kidney Transplant Patients, 1988 27

Chapter 3
Immunosuppressive Drug Therapies

This chapter reviews the immunosuppressive agents currently used to prevent organ rejection[1] and describes the variation in drug treatment regimens used by transplant recipients. It then discusses the costs associated with various immunosuppressive drug therapies.

IMMUNOSUPPRESSIVE DRUG PROTOCOLS

Components of Immunosuppressive Therapy

Despite the slow but relatively steady development of immunosuppressive products, the number of drugs is still few. Presently, only four drugs are approved by the U.S. Food and Drug Administration (FDA) specifically for post-transplant immunosuppression: azathioprine, cyclosporine, antithymocyte globulin (ATG), and muromonab CD3 (OKT-3) (table 11) (55,56).[2] All four of these drugs are sole-source (i.e., each is produced by only one manufacturer). Prednisone, an adrenal corticosteroid, is also usually administered to patients as part of the immunosuppressive drug regimen and is covered under Medicare for this purpose.

Early approaches to long-term chemical immunosuppression in transplant recipients included a combination of azathioprine (or, after its FDA approval in 1981, ATG) a.ndprednisone. Cyclosporine-based protocols, introduced into general use in 1984, rapidly replaced these approaches to become the mainstay of immunosuppressive therapy in patients who receive organ grafts. The incidence and success rates of heart, heart/lung, and lung transplants increased particularly dramatically in the era following FDA approval of cyclosporine (58). For kidney transplants, cyclosporine use apparently also reduced mortality and morbidity to levels significantly lower than the conventional protocols (7,23,29,43).

Orthoclone OKT-3 (the brand name of muromonab CD3, a monoclinal antibody) is a relatively recent addition to the roster of immunosuppressive agents. OKT-3 is approved by the FDA for the treatment of acute rejection of transplanted organs. However, it has also been used prophylactically (i.e., to prevent organ rejection) by some treatment programs as a replacement for ATG (15). To date, prophylactic OKT-3 therapy has been administered to inpatients, but outpatient administration is not beyond the realm of possibility.

Antilymphocyte globulin (ALG), a new immunosuppressive developed at the University of Minnesota, is not yet approved for general use by the FDA. Like ATG, ALG is used primarily to reverse particularly severe rejection episodes, but it has also been administered routinely as part of a standard immunosuppressive protocol.

Another promising new drug is FK-506, manufactured by a Japanese firm. FK-506 is a powerful and selective immunosuppressive agent with a mode of action similar to that of cyclosporine (7,33,47,63). The most appropriate place of FK-506 in the post-transplant immunosuppressive drug regimen is still a matter of study and debate. Further investigation is necessary to determine the toxicity, potential benefits, and most appropriate clinical application when compared with cyclosporine (16,45).

At least two other potential immunosuppressive drugs are also under development. One new drug under testing is 15-deoxyspergualin (also known as NKT-01), a relative of the antitumor antibiotic spergualin. NKT-01 has been shown to prolong the graft survival of organ and tissue transplants in rodents (19,44) and is currently in Phase I clinical trials in humans (14). Another new compound, rapamycin, has also shown encouraging potential in the laboratory but has not yet been tested in humans (24).

All current and potential immunosuppressive drugs have associated side effects and complications. For example, despite its major contribution to the improved outcome of human organ transplantation over the past decade, cyclosporine is nephrotoxic; it can cause impaired kidney fiction in both kidney transplant recipients and in patients with normal kidneys who have received transplants of

[1]Immunosuppression is used for other indications as well, such as rheumatoid arthritis and various other immune disorders. These uses are not discussed in this Report.

[2]For a review of the historical developments in clinical and experimental immunosuppression, see references 41 and 46.

Table 11—U.S. Food and Drug Administration (FDA) Approval Status and Medicare Coverage of Post-Transplant Immunosuppressive Drugs

Drug	Brand or common name	Manufacturer/developer	FDA approval date (form of administration)	Medicare coverage
Azathioprine	Imuran	Burroughs Wellcome	Mar. 20, 1968 (oral) July 19, 1974 (IV)	Yes
Antithymocyte globulin	Atgam	Upjohn	Nov. 17, 1981 (IV)	Yes
Cyclosporine	Sandimmune	Sandoz	Nov. 14, 1983 (oral and IV)	Yes
Muromonab CD3	Orthoclone OKT-3	Ortho	June 19, 1986 (IV)	Yes
Prednisone	No brand name	Multiple sources	Multiple forms approved	Yes
Antilymphocyte globulin	ALG	University of Minnesota	Not approved	No
Macrolide antibiotic	FK-506	Fujisawa	Not approved	No

ABBREVIATION: IV = intravenous.

SOURCE: Office of Technology Assessment, 1991.

Table 12—Typical Immunosuppressive Drug Protocols for Kidney Transplant Patients

Drug protocol	Setting and protocol phase: Inpatient initial and rejection phases	Setting and protocol phase: Outpatient maintenance phase
Traditional therapy	PRED + AZA	PRED + AZA
Augmented with ALG or ATG ...	PRED + AZA + ALG/ATG	PRED + AZA
Cyclosporine therapy[a]		
Double-drug	CSA + PRED	CSA + PRED
Triple-drug (with ALG, ATG, or OKT-3)	PRED + AZA + ALG/ATG/OKT-3	CSA + PRED + AZA
Quadruple-drug cyclosporine therapy	CSA + PRED + AZA + ALG	CSA + PRED + AZA

ABBREVIATIONS: PRED = Prednisone; AZA = Azathioprine; ALG/ATG = Anti lymphocyte orantithymocyte globulin; CSA = Cyclosporine; OKT-3 - Orthoclone OUT-3.

aThe terms double, triple, and quadruple drug therapy refer here to the number of drugs administered in the initial or inpatienstage.

SOURCE: Battelle Human Affairs Research Centers, Seattle, WA, Cost *and Outcome Analysis of Kidney Transplantation: The Implications of Initial Immunosuppressive Protocol and Diabetes,* under agreement with the Health Care Financing Administration Cooperative Agreement 14-C-98564/0, August 1989.

other organs (7,42). Hypertension (high blood pressure) after heart transplant is another frequently observed complication of cyclosporine-induced immunosuppression (40).

Many of these side effects are dose-related and can be minimized through the use of multiple-drug approaches to irnrnunosuppression that permit lower doses of individual drugs. Indeed, because of the nephrotoxicity associated with cyclosporine, lower dosages of various immunosuppressive agents are being used in increasingly complicated immunosuppressive protocols.

Variation in Drug Treatment Protocols

Until the clinical introduction of cyclosporine, immunosuppressive drug protocols for kidney transplants, the most cornrnon transplant procedure, were similar across transplant programs in the United States and abroad. The mainstay traditional therapy consisted of a combination of azathioprine and prednisone (table 12).

With the introduction of cyclosporine, a variety of new protocols followed in an effort to maximize immunosuppression while minimizing side effects such as nephrotoxicity and susceptibility to infection. The different preferred drug combinations vary across transplant centers and across individual patients within any particular center (7,21). Because the therapy is tailored to the patient, the mix and dosages of drugs also vary over time in any particular patient, depending on the treatment phase and the patient's physiologic reactions to the drugs.

The drugs administered to a given patient differ according to three possible immunosuppressive treatment phases:[3]

[3]For kidney transplant recipients, chronic renal dysfunction may require yet a different protocol (7).

- *The induction phase* consists of approximately the first 6 weeks of use of immunosuppressive drugs during the immediate, post-transplant period. Treatment is usually on an inpatient basis during this phase, since it is the time when the patient's status is most uncertain.
- *Maintenance treatment,* which is usually administered on outpatient basis, is initiated after the patient's medical condition has stabilized and when the organ function is normal or near-normal.
- *Therapy during acute organ rejection,* which sometimes occurs despite maintenance therapy, is usually a short phase requiring higher dosages and, often, different drugs while the patient is hospitalized (7).

For kidney transplants, cyclosporine has increased the complexity of transplant recipient management; distinguishing between a rejection episode and nephrotoxicity is quite obviously confusing on the one hand and critical on the other.

The improved effectiveness of cyclosporine-based protocols over traditional therapy is reflected in the dramatic shift in the immunosuppressive management of kidney transplant recipients since FDA approval of cyclosporine in late 1983. From 1984 to 1989, the number of cadaveric kidney transplant recipients receiving cyclosporine grew from 73 to 93 percent (17) (table 13). The use of this drug increased even more dramatically for living-donor kidney transplant recipients, from 38 percent in 1984 to 87 percent in 1989. Overall, approximately 90 percent of kidney transplant recipients, regardless of source of graft, received cyclosporine as the primary immunosuppressive agent in 1989.[4]

The percentage of transplant recipients receiving cyclosporine is probably similar for recipients of other organs, since cyclosporine was already known to be the most effective irnmunosuppressive drug when these procedures began to be performed more regularly. In contrast, when kidney transplants were initially performed, cyclosporine had not yet been approved by the FDA. Consequently, physicians

Table 13-Percentage of Kidney Transplant Recipients Receiving Cyclosporine, 1984-89

Year	Source of graft	
	Living donor	Cadaveric donor
1984	38%	73%
1985	53	84
1986	68	90
1987	78	92
1988	80	91
1989	87	93

SOURCE: Health Care Financing Administration, Office of Research and Demonstrations, Division of Beneficiary Studies, 1990.

may have tended to keep patients with older transplants on their original regimens. Moreover, because nephrotoxicity is the most significant side effect of cyclosporine, traditional therapies may be warranted for some kidney transplant recipients.

Despite the predominance of cyclosporine as the primary imrnunosuppressive agent, azathioprine and prednisone remain stable components of both inpatient and outpatient irnmunosuppression (table 14). These drugs continue to be important adjuncts to cyclosporine in most of the therapies currently in use.

COST OF IMMUNOSUPPRESSIVE THERAPY

The variation in cost associated with immunosuppressive agents and protocols is substantial. Costs of cyclosporine maintenance therapy protocols, for example, are much higher than those of traditional maintenance therapy.[5] The reported costs for traditional outpatient therapy using only prednisone and azathioprine were $2 per day in 1988, compared with reported average costs for cyclosporine-based therapies ranging from $9 to $23 per day, depending on the source of information (6,7).

Annual costs are similarly variable across protocols and over time (table 15). In 1988, average annual costs for traditional therapy were reported to be $852 for the first year of outpatient therapy and $793 for the subsequent year in 1988 (7). In contrast,

[4]In general, conventional immunosuppressive therapy is only used by patients who received transplants before the cyclosporine era (i.e., before 1984), or by patients unable to tolerate cyclosporine. Nearly all new patients are now placed on cyclosporine, while very few patients who have been on conventional therapy are converted to cyclosporine, unless unique problems arise (7).

[5]The 1991 average wholesale prices (AWPs) for drugs used in immunosuppressive therapy were: $19.43 for 1,000 5-mg tablets of prednisone (manufactured by Rugby); $87.25 for 10050-mg tablets of azathioprine (Imuran); $209.79 for one 5-ml ampule of 50 mg/ml of antithymocyte globulin (Atgam); $214.20 for one 50-mg oral solution of 100 mg/ml of cyclosporine (Sandimmune); and $522.00 for one 5-ml ampule of 1 mg/ml of muromonab CD3 (OKT-3) (34a). These numbers do not necessarily reflect comparable dosages, but nonetheless the differences in the AWPS among traditional and more recent drugs are striking.

Table 14—Percentage of Transplant Recipients Receiving Specific Immunosuppressive Drugs by Drug Type, 1987-90[a]

Transplant type and setting[b]	Percentage of patients receiving: Cyclosporine	Azathioprine	Prednisone	ALG/ATG	OKT-3	Other drugs and therapies
Heart						
Inpatient	94.7%	91.070	89.2%	26.5%	28.3%	1 .2?40
At 1 year outpatient	NA	NA	NA	NA	NA	NA
Kidney (cadaveric)						
Inpatient	96.9	82.7	*94.0*	28.7	16.0	25.4
At 1 year outpatient	94.0	81.5	*92.5*	1.6	3.3	11.6
Kidney (living-donor)						
inpatient	85.5	81.5	92.9	16.0	8.3	23.5
At 1 year outpatient	84.4	82.3	90.7	1.4	2.5	11.5
Liver						
inpatient	98.5	66.2	90.8	13.2	27.7	44.8
At 1 year outpatient	96.3	67.2	92.3	0.6	2.8	15.3
Heart/lung						
inpatient	92.6	91.2	*73.0*	48.0	32.4	*2.0*
At 1 year outpatient	NA	NA	NA	NA	NA	NA
Lung						
inpatient	83.1	89.2	77.1	41.0	34.9	4.8
At 1 year outpatient	NA	NA	NA	NA	NA	NA
Pancreas						
Inpatient	98.5	98.1	96.3	40.2	32.0	14.1
At 1 year outpatient	99.0	98.6	98.6	14.5	23.5	1.7

ABBREVIATIONS: NA = not available; ALG/ATG = anti lymphocyte or antithymocyte globulin; OKT-3 = Orthoclone OKT-3.
[a]Basedon information about patients transplanted between Oct. 1, 1987and Dec. 31, 1989forwhom information was available. Most recipients received more than one immunosuppressive drug.
[b]Information on immunosuppressive therapy for bone marrow transplant recipients was not available.
[c]The "other" category includes FK-506, cyclophospharnide, trimethoprirn/sulfa, solumedrol, chemotherapy, total lymphoid irradiation, and methylprednisolone.

SOURCE: U.S. Department of Health and Human Services, Public Health Service, Health Resources and Services Administration, Division of Organ Transplantation, 1991.

average costs for cyclosporine double drug therapy (i.e., maintenance therapy with cyclosporine plus predisone) were $5,338 in the first year and $4,025 in the subsequent years. Thus, the simplest cyclosporine maintenance therapy is roughly seven times more costly than the traditional therapy.[6]

These numbers are underestimates of total current ongoing costs, since they do not account for costs associated with such factors as organ rejection, conversion from one protocol to another, and general inflation related to the cost of the drugs. For example, the treatment of organ rejection can add considerably to the frost-year immunosuppressive drug costs of transplant recipients. (For the most part, the added drug costs would be absorbed in the hospital's inpatient payment for Medicare patients. However, rejection episodes would increase outpatient costs to some extent as well.) Nonetheless, the annual costs appearing in table 15 illustrate cost differences across the more common protocols and are reasonable approximations of the 1988 costs of outpatient immunosuppressive protocols.

The differences in the estimates of the average annual costs of cyclosporine therapies deserve note. The higher historical figures cited in table 15 are based on a literature review of published data; the lower Battelle numbers are based on results of a 1989 study done under a cooperative agreement with the U.S. Health Care Financing Adrninistration. Rough cost estimates provided by some transplant surgeons likewise suggest that the earlier published numbers may have been somewhat overstated compared with present costs. (28,32). Based on these opinions and the findings of the Battelle study, a best estimate of the current average annual costs of

[6]Note that the simplest cyclosporine-based protocol is not necessarily the least expensive, since the addition of other drugs could permit the dosage (and thus the cost) of cyclosporine to be decreased.

Table 15-Annual Drug Costs for Immunosuppressive Protocols of Kidney Transplant Patients, 1988a

Immunosuppressive protocol	First year costs			Subsequent year outpatient cost	5-year outpatient totals[b]
	Inpatient	Outpatient	Total		
Traditional therapy:					
Without ATG/ALG while inpatient	$ 95	$ 852	$ 947	$ 793	$4,024
With ATG/ALG while inpatient	10,385	852	11,237	793	4,024
Cyclosporine therapy:[c]					
Double-drug					
Historical[d]	638	8,126	8,764	8,198	40,918
Battelle study[e]	550	5,338	5,888	4,028	21,450
Triple-drug					
Historical[d]	4,034	7,756	11,790	8,227	40,664
Battelle study[e]	4,274	3,899	8,173	3,157	16,527
Quadruple-drug					
Historical[d]	5,626	7,193	12,819	6,870	34,673

[a]Based on a 70-kg person (154 pounds).

[b]Costs are in constant 1988 dollars.

[c]Double, triple, and quadruple drug therapy refers hereto the number of drugs administered in the initial or inpatient phase.

[d]Based on previously published data as reviewed by Battelle Human Affairs Research Center, Seattle, WA.

[e]Based on a recent Battelle study of 99 patients, August 1989.

SOURCE: Battelle Human Affairs Research Centers, Seattle, WA, Cost *and Outcome Analysis of Kidney Transplantation: The Implications of Initial /immunosuppressive Protocol and Diabetes,* under agreement with the Health Care Financing Administration, Cooperative Agreement 14-C-98564/0, August 1989.

cyclosporine-based treatment protocols is $4,000 to $6,000 per year.

A likely reason for lower present than historical cyclosporine costs is that the dosage requirements, and thus the costs, for cyclosporine have declined over time. The added cost of drugs used adjunctively with cyclosporine is apparently not high enough to offset the cost savings from the lower cyclosporine dosages in the protocols using these drugs.

Although the annual therapy-related costs of the cyclosporine protocols are still higher than those of traditional therapy, dramatic improvements in graft survival and decreased complications are also evident (7,23,28). Consequently, the higher therapy-related costs are balanced to some extent with cost savings from preventing complications and episodes of acute rejection. Recent studies have suggested, however, that the initial association of cyclosporine with lower total costs diminishes over time (42). In other words, for grafts surviving beyond several months, the use of cyclosporine may reduce actual costs only slightly.

Chapter 4

The Adequacy of Current Medicare Coverage of Immunosuppressive Therapy

Contents

Page

MEDICARE COVERAGE 31
Historical Overview 31
Current Coverage and payment policies 31
Beneficiary Liabilities 33
COVERAGE BY OTHER PAYERS 33
ASSESSING THE ADEQUACY OF COVERAGE 34
Extent ofCoexisting Private Coverage for Medicare Recipients 34
Risk of High Drug-Related Expenses 35
Effects of Expanding Coverage 36

Box

Box *Page*

A. The Battelle Study 34

Table

Table *Page*

16. Kidney TransplantPatients' Risk of Out-of-Pocket Liabilities for ImmunosuppressiveD rugs 35

Chapter 4
The Adequacy of Current Medicare Coverage of Immunosuppressive Therapy

This chapter begins with a historical overview of the development of Medicare's coverage policy for outpatient immunosuppressive drugs. It then describes Medicare's current coverage and payment policies for outpatient immunosuppression and briefly reviews the policies of other third-party payers. Finally, the chapter assesses the patient's financial burden and the adequacy of current coverage of immunosuppressive drugs.

MEDICARE COVERAGE

Historical Overview

Post-transplant irnrnunosuppressive drugs approved by the U.S. Food and Drug Administration (FDA) and administered during an inpatient hospital stay, either at the time of the transplant procedure or at any subsequent hospitalization, are automatically covered by Medicare. Reimbursement for these inpatient drugs is included in the hospital's payment for inpatient services. Similarly, drugs that must be administered under the direct supervision of a physician are routinely covered when given in a physician's office.

Drugs administered outside of a medical setting, however, are subject to different rules. Medicare statutes have historically prohibited coverage of most self-administered pharmaceuticals. Thus, throughout the 1960s and 1970s, Medicare did not pay for outpatient self-administered immunosuppressive drugs.

Congressional interest in the issue of Medicare coverage of outpatient post-transplant immunosuppressive drugs dates to 1983, the year the FDA approved cyclosporine. Evidence of cyclosporine's improved effects over previous immunosuppressive agents, and concern over its high costs, led the House Committee on Energy and Commerce to convene a hearing on outpatient immunosuppressive drug coverage in November 1983 (49). Although the hearing did not result in immediate legislation specific to outpatient immunosuppressive coverage, Congress did require the Secretary of the Department of Health and Human Services (DHHS) to establish the National Task Force on Organ Transplantation as part of the National Organ Transplantation Act the following year (Public Law 98-507).

The task force's report on immunosuppressive therapies, submitted in October 1985, emphasized that cyclosporine was a major breakthrough in transplant imrnunosuppression and recommended that all public and private health benefit programs provide coverage for outpatient immunosuppressive drugs (59). The task force placed particular emphasis on targeting Federal funding to those patients who were regarded as most financially needy.

Subsequently, in the Omnibus Budget Reconciliation Act of 1986 (Public Law 99-509), Congress extended Medicare coverage to FDA-approved immunosuppressive drugs for 1 year following the date on which a beneficiary is discharged from the hospital after a Medicare-covered transplant. Thus, since January 1, 1987, all patients qualifying for Medicare who purchase the optional Part B coverage[1] and who received a Medicare-covered transplant have been eligible for outpatient immunosuppressive drug coverage.

Congress temporarily extended the l-year coverage limit in the Medicare Catastrophic Coverage Act of 1988 (Public Law 100-360). Under this Act, immunosuppressive drug therapy was to be covered indefinitely as long as it was medically necessary, and coverage was also to be provided to Medicare beneficiaries who were recipients of an organ transplant that Medicare did not cover. Both of these coverage extensions for self-administered immunosuppressive drugs, however, were repealed along with the Act in December 1989 (Public Law 101-234).

Current Coverage and Payment Policies

In the outpatient setting, Medicare coverage and payment rules apply separately to the two main components of immunosuppressive drug therapy: the drug products themselves, and the physician management component. A facility reimbursement

[1]More than 96 percent of eligible persons purchase Part B coverage (53).

component may also apply, if a patient visits an outpatient hospital clinic to see a physician and fill the prescription. Each of these components is discussed below.

Immunosuppressive Drug Products

Medicare currently covers self-administered outpatient immunosuppressive drugs for 1 year, starting on the date of the patient's discharge from the hospital after a Medicare-covered kidney, heart, liver, or bone marrow transplant (2,55). Medicare's policy is to cover all drug products that are approved by the FDA and have a label indicating use for immunosuppressive therapy.[2] In addition, Medicare covers adjunct prescription drugs (e.g., prednisone) when they are used as part of the immunosuppressive therapeutic regimen.

Coverage applies to both oral and parenteral (non-oral) forms of administration as long as FDA has approved the drug for that type of administration. Outpatient coverage includes both prophylactic therapy to prevent organ rejection and acute treatment when rejection occurs.

Because Medicare's coverage of outpatient immunosuppressive drugs is provided through Part B, the Supplementary Medical Insurance Trust Fund, it is limited to those patients who qualify for Medicare and who have purchased the optional Part B coverage. The beneficiary's premium cost for this coverage is $29.90 per month during calendar year 1991.

Reimbursement of outpatient immunosuppressive drugs is determined on a customary, prevailing, and reasonable charge basis when the drugs are dispensed by a retail pharmacy, physician, supplier, or mail-order house.[3,4] Reirnbursement of these drugs is determined on the basis of reasonable costs when they are dispensed by a hospital pharmacy. In either case, the beneficiary is subject to the Part B deductible of $100 (Public Law 101-508). The beneficiary is also liable for a coinsurance amount equal to 20 percent of reasonable charges (for drugs purchased from a nonhospital source) or 20 percent of the facility's actual submitted charges (for drugs obtained from a hospital pharmacy).[5,6]

Physician Management

The management services provided by a physician in connection with immunosuppressive therapy include prescribing and adjusting the dosage of the various drugs and monitoring the patient for any possible side effects and complications associated with therapy. Physician management services are covered under Medicare for all organ transplant recipients. These services would be recognized as physician outpatient visits and, therefore, payment is based on the allowed charge for the visits.

Medicare's policy varies slightly for a Medicare-covered kidney transplant procedure. Medicare recognizes all transplant surgeon services furnished during a 60-day period following post-transplant hospital discharge as a global service. Kidney transplant surgeons receive the lesser of the actual submitted charge or a maximum allowance for all related services, including immunosuppressive therapy management. After the 60-day period, immunosuppressive drug management services are recognized as a physician outpatient visit and paid according to the allowed charge.[7]

Outpatient Facility Component

In a hospital outpatient setting, Medicare may pay not only for the drugs and the physician encounter but also for the use of the facility. If the patient visits

---

[2]Two specialty contractors process all claims for self-administered drugs received from nonhospital Outpatient sources: Transamerica Occidental of California and Blue Cross/Blue Shield of South Carolina. These carriers are expected to keep informed of FDA additions to the list of the immunosuppressive drugs.

[3]See glossary (app. C) for an explanation of customary, prevailing, and reasonable charges.

[4]Medicare's payment for self-administered immunosuppressive drugs will be unaffected by the implementation of the new Medicare physician fee schedule-based payment system that begins January 1992 (55 FR 36178). Payment for immunosuppressives, however, will be included in the fee schedule when the drug cannot be self-administered and is provided as part of a physician visit.

[5]Since the drug is reimbursed on a reasonable cost basis, and these costs are not determined until after the service is performed, it is administratively infeasible to base beneficiary coinsurance on actual Medicare payments. The beneficiary's out-of-pocket costs are based on submitted charges for these providers, and thus they can be higher than when the drug is received through other sources even if Medicare's payment is lower.

[6]Congress is considering other systems of payment for hospital outpatient services (Public Law 99-509). Reimbursement of immunosuppressive drugs in the outpatient hospital setting could be affected by any such system.

[7]Immunosuppressive therapy management services will not be included in the forthcoming Medicare fee schedule until a Common Procedure Terminology (CPT) code is created that recognizes the provision of this service. According to staff at the Health Care Financing Administration, the agency has requested carriers to continue assigning local codes for immunosuppressive management services in the absence of CPT code.

the physician while at a hospital-based clinic, the hospital may submit a bill for the facility-related costs of that visit. Payment to the hospital is based on reasonable costs. Under this circumstance, a separate physician bill for immunosuppressive therapy management could also be submitted, as could a bill from the hospital pharmacy for the drug. In short, depending on the site of the therapy, multiple bills may be submitted to Medicare for coverage of services related to immunosuppressive therapy.

Beneficiary Liabilities

From the patient perspective, out-of-pocket expenditures for outpatient irnmunosuppressive drug therapy can be substantial. Average annual costs for most maintenance immunosuppressive treatment are between approximately $4,000 and $6,000 (see ch. 3). Given that the national average charge reduction rate for Medicare was 28.8 percent in 1988 (3,36), aroughapproximationof the average Medicare-determined allowed charge is $2,850 to $4,270.[8] The beneficiary would be required to pay 20 percent of the allowed charge, or between $570 and $850 on average during the first year following the transplant.

Similar cost-sharing requirements would hold true in subsequent years for patients with private insurance in addition to their Medicare benefits. However, those patients with Medicare only would be responsible for the full cost of the outpatient immunosuppressive treatment every year that therapy is needed following the first year post-transplant.

These estimates of beneficiary liabilities may be understated, if protocol and drug costs have increased since 1988. Furthermore, the out-of-pocket expenses could be still greater if the pharmaceutical provider does not accept assignment.[9] In this case, the beneficiary is obligated to pay any billed amount that is above the Medicare-determined allowed charge.

Out-of-pocket expenditures for outpatient immunosuppressive drugs are believed by some to act as disincentives that discourage some end-stage renal disease (ESRD) patients from having a transplant. The extent of the disincentives is unclear because the alternative treatment to kidney transplants is dialysis, for which the coinsurance amount ($3,800 a year)[10] is nearly as much as the annualcost of outpatient imrnunosuppressive drugs. Since both the dialysis coinsurance amount and the annual costs of immunosuppressive vary substantially among patients, however, for some patients immunosuppressive may indeed be significantly more costly. A stronger disincentive may be fear of losing all Medicare coverage. Half of kidney transplant recipients become ineligible after 3 years, whereas dialysis patients are eligible indefinitely (17).

Some beneficiaries have protection from these obligations. During the first year of immunosuppressive therapy when Medicare drug coverage applies, some patients have their coinsurance paid by Medicaid or private insurers (7,17). After that frost year, recipients with private insurance are usually covered for the majority of their drug costs from that source. They are then responsible for that payer's coinsurance and any other insurance-related payments (e.g., premium costs). In contrast, beneficiaries with insufficient coverage (no drug benefit)-or with no additional third-party coverage at all-would be required to pay the full cost of outpatient immunosuppressive therapy entirely out-of-pocket after the frost year (see below).

COVERAGE BY OTHER PAYERS

State Medicaid programs appear to have broad coverage of outpatient immunosuppressive drugs (31). Although prescription drug coverage is an optional Medicaid service, virtually all States include it (48).[11] A 1990 survey of 10 State Medicaid programs, which examined their ESRD coverage and payment practices, found that all surveyed States covered and paid for immunosuppressive

[8] The charge reduction rate is the percentage difference between a billed charge and the Medicare-allowed charge. This calculation would not apply directly to drugs obtained from hospital pharmacies, which are paid on the basis of their own costs. For the purposes of this report, however, it was assumed that Medicare-allowed costs were lower than patient-reported charges by a similar amount.

[9] "Assignment" refers to a provider's agreement to accept the Medicare-allowed charge as payment in full and to bill Medicare for reimbursement on the beneficiary's behalf.

[10] The Health Care Financing Administration estimates that the average annual recognized (composite) rate for dialysis is approximately $19,000 (17). The beneficiary's coinsurance liability is 20 percent of this amount, or $3,800.

[11] As of Oct. 1, 1987, 14 States offered this service to categorically needy only, while 37 States offered services to both the categorically and medically needy population (48).

drugs for eligible Medicaid recipients (26). However, there are some limitations to Medicaid coverage that may burden some patients. Twelve States, for example, limit the number of prescriptions per month that Medicaid will reimburse (20).[12]

Private insurance coverage for outpatient immunosuppressive drugs also seems to be fairly comprehensive. Blue Cross and Blue Shield plans and commercial insurers generally have policies that cover any medically necessary outpatient drugs (13). A 1989 Bureau of Labor survey of full-time employees, for example, found that 96 percent had prescription drug coverage through their employer-based insurance (5a).

ASSESSING THE ADEQUACY OF COVERAGE

An estimated 31,000 Medicare beneficiaries were alive with functioning grafts in 1988 (see table 10, p. 20). The goal of the remainder of this chapter is to estimate how many of these beneficiaries have inadequate coverage of outpatient immunosuppressives, suggesting that unless they have high incomes they may have impaired financial access to these drugs.

Extent of Coexisting Private Coverage for Medicare Recipients

Overall insurance coverage for outpatient immunosuppressive medications in the year following the transplant appears to be fairly adequate, since Medicare covers the drug during that time and private insurance is often still in effect as well. However, in the long term the number of beneficiaries at risk of significant out-of-pocket costs for these drugs could be substantial if they have no other source of coverage.

In 1985, the National Task Force on Organ Transplantation concluded that approximately 25 percent of transplant recipients had no coverage of immunosuppressive drugs by private insurers, or by Medicaid or other State programs (59). More recent information from the U.S. Health Care Financing Administration (HCFA) and from the Battelle Human Affairs Research Centers (see box A) provide insights into the current insurance status of Medicare kidney transplant recipients. (Kidney transplants account for that vast majority of Medicare-covered transplants (95 percent in 1988).)

Box A—The Battelle Study

The Battelle study was sponsored by the U.S. Health Care Financing Administration under a cooperative agreement and was completed in August 1989. This study collected some of the most comprehensive data available on kidney transplant patients and immunosuppressive protocols, including patient characteristics, types of protocols and outcomes, quality of life analysis, and cost and charge information associated with immunosuppressive therapies.

Although they are some of the most current available, data from the study are nonetheless several years old. Data collection extended over an 18-month period November 1, 1985 through October 31, 1986. The data were obtained through a review of medical records from transplant centers and from patient questionnaires. The five participating transplant centers were University of California (San Francisco); Ohio State University; University of Pittsburgh; University of Texas (Houston); and University of Wisconsin. A total of 396 patients initially agreed to participate in the study. Of these, 258 patients were still actively participating in the patient survey portion of the study at the end of the 15-month post-transplant followup period.

A 1988 survey of kidney transplant patients by Battelle found that approximately 13 percent of these patients had no third-party coverage of their immunosuppressives other than Medicare (7). Two-thirds (67 percent) of the surveyed patients in this study said that financial assistance was provided by private insurers, and another 20 percent received Medicaid benefits. Overall, slightly less than 25 percent reported difficulty with paying for their immunosuppressive drugs.

In contrast, HCFA examined 5 years of data (1984-88) on Medicare enrollees receiving kidney transplants and found that 37 percent of these patients had private insurers as primary payers (17). The Battelle study may possibly overstate coverage, if uninsured people were undersampled,[13] while the HCFA number is probably an underestimate since it did not count patients whose private coverage had

[12] Some of these States permit exceptions to the limit if prior authorization is obtained (20).

[13] Some experts believe that the Battelle sample of 258 patients overrepresents well-insured populations and that therefore the percentage with third-party coverage would be less than the estimated 67 percent (25,28).

Table 16-Kidney Transplant Patients' Risk of Out-of-Pocket Liabilities for Immunosuppressive Drugs

Insurance status	Percentage of total kidney transplants	Post-transplant period		
		Less than 1 year	1-3 years	More than 3 years
		Beneficiary obligations/degree of financial risk		
Medicare/Medicaid[a]	*20%*	*No* coinsurance obligations/ generally minimal out-of-pocket expenses (Low risk group)	Same as less than 1 year (Low risk group)	Same as less than 1 year (Low risk group)
Medicare/private insurance	37 to 67%	If Medicare primary, private coverage wraps around-no coinsurance obligations (Low risk group) If Medicare secondary, generally third-party average of drug benefits—insurance obligations (Medium risk group)	Same as less than 1 year but Medicare is primary payer for most beneficiaries during this period (Low to medium risk group)	Coinsurance obligations or liable for premium or full cost of drug (Medium to high risk group)
Subtotal	57 to 87%			
Medicare only	13 to 43%	Premium and coinsurance obligations (Medium risk group)	Liable for full cost of drug (High risk group)	Same as 1 to 3 years (High risk group)
Totai	100%			

[a]Some Medicaid programs have dollar limits and limits on number of scripts, which would affect adequacy of outpatient immunosuppressive drugs for these recipients.

SOURCE: Office of Technology Assessment, 1991, based on data from the Health Care Financing Administration (1 7) and Battelle Human Affairs Research Centers (7).

become secondary. Thus, it is reasonable to assume that the true percentage of beneficiaries with third-party coverage (in addition to Medicare) is somewhere between 37 and 67 percent. Obviously, the lower the estimate of additional financial assistance (other than Medicare), the greater the pool of patients experiencing potential difficulty with paying for their immunosuppressive medications.

Risk of High Drug-Related Expenses

Medicare-Only Recipients

The different categories of insurance coverage are associated with different risks of high out-of-pocket expenses for immunosuppressive drugs. The group for whom this risk is simplest to predict are those Medicare beneficiaries with no other insurance. If a transplant recipient has only Medicare, he (or she) is at medium risk of financial strain in the first year, when he must pay coinsurance on the drugs. He is at high risk thereafter, because he must pay the full cost of the drugs. Extrapolating from the Battelle and HCFA data, between 13 and 43 percent of Medicare transplant recipients are in this group (table 16).

Medicare/Medicaid Recipients

A second group of beneficiaries-about 20 percent of Medicare transplant recipients—are those who are eligible for Medicaid as well as Medicare. These beneficiaries are generally at low risk of financial strain attributable to the cost of immunosuppressive drugs, because Medicaid usually pays for the coinsurance and the full drug costs even when Medicare drug coverage ends. Exceptions to this generalization might be beneficiaries who require multiple drugs in addition to their immunosuppressive and who live in States that limit the number of prescriptions covered under Medicaid.

Medicare/Private Insurance Recipients

The third major group of beneficiaries, constituting between 37 and 67 percent, are those with private insurance in addition to Medicare. These beneficiaries are at low to medium risk of financial strain in the first year on immunosuppressives. For many of these beneficiaries, Medicare is the secondary payer during this time. This group would have to pay any drug coinsurance required by their private payer who is the primary payer. For other beneficiaries, Medicare is the primary payer; this group is at low risk

during the first year, when Medicare pays most drug-related costs and the private payer picks up the Medicare-required coinsurance.

From the end of the first to the third year post-transplant, all beneficiaries with private insurance are at medium risk of financial strain. During this time, Medicare does not cover the drugs; private payers would cover the cost, but the beneficiary would be liable for any coinsurance.

The period of greatest overall financial vulnerability for this group of beneficiaries is that beginning at 3 years post-transplant, when about half of kidney transplant of recipients become ineligible for Medicare (17). The remainder retain eligibility (due to continued disability or age) but have no drug coverage. At this time, individuals with private insurance may become responsible for:

- copayment amounts, if a private insurance was available through the employer or spouse's employer;
- premium and copayment amounts, if the patient was no longer employed and was able to purchase an individual policy;[14] or
- the full cost of the drug, if the patient lost private insurance and was unable to purchase insurance.

Note that although Medicare-only beneficiaries differ substantially in risk from those who also have private insurance before 3 years post-transplant, after this time many beneficiaries in that group also lose all Medicare eligibility.

Both the Battelle and HCFA numbers on insurance coverage are based on information gathered within 15 months after the transplant. A recipient's private insurance status can change over the long term, however. If the recipient (or the recipient's spouse) changes jobs, for example, the recipient may be unable to obtain full insurance coverage through the new employer.

There is no information available on the extent to which transplant recipients change employment post-transplant and what occurs regarding continued insurance coverage and copayment/premium amounts. During the period in which Medicare insures the patient through ESRD eligibility, the patient is protected from the loss of employment or insurance coverage due to a law that states that employers cannot provide different insurance plans on the basis of ESRD status (Sec. Sec. Act sec. 1862). However, after Medicare eligibility is terrninated 3 years post-transplant, the recipient is no longer considered to have ESRD, and therefore the possibility exists that a different policy (or no policy at all) could be offered by employers to kidney transplant recipients.

Effects of Expanding Coverage

Assuming that these kidney transplant-related percentages are similar for Medicare recipients with successful grafts of other organs, it appears that approximately 13 to 43 percent of transplant recipients have no insurance coverage after the l-year coverage period by Medicare. These percentages may increase over time if recipients lose their private third-party insurance. Since recipients with Medicare-only coverage would be responsible for the fill cost of the outpatient immunosuppressive drug therapy,[15] extending Medicare's coverage of outpatient immunosuppressive drug therapy would alleviate, to a large extent, the financial burden presently experienced by this group.

The percentage of patients eligible for transplants who have insufficient coverage for drugs could be even greater. It is possible that the patient's ability to pay for post-transplant immunosuppressives is considered either implicitly or explicitly when a patient is considering, or being considered for, a transplant. Thus, eliminating the limit may further ensure that all Medicare beneficiaries who are potential transplant recipients have equal access to transplantation.

On the other hand, current financing overall appears fairly adequate for 57 to 87 percent of Medicare transplant recipients, at least in the short term. For most of these recipients, expanding Medicare's coverage of outpatient irnmunosuppression would shift financing from other sources to Medicare.

[14] The premium costs of individual insurance policies are likely to be very high for transplant recipients, where insurance can be purchased at all.

[15] Many transplant patients might not be able to obtain private insurance because Of the preexisting condition of ES~.

Chapter 5

Medicare Expenditures for Immunosuppressive Drug Therapy

Contents

Page

CURRENT EXPENDITURES 39
FACTORS INFLUENCING FUTURE EXPENDITURES 40
Changes in the immmosuppressive Drug Market *40*
Patient Demand and Patient Mix. 41
Patient Adherence to Therapy 42
Manufacturers' Incentives for Technological Developments 43
Other Program Costs Associated With Expanded Coverage 43

Figure

Figure *Page*

3. U.S. Kidney Transplants Performed, and Persons on Waiting List 1984-89 41

Tables

Table *Page*

17. Estimated Number of Transplant Recipients Receiving Medicare Payment of Immunosuppressive Drugs, 1988 39
18. Estimated U.S. and Medicare Expenditures for Outpatient Immunosuppression Drug Therapy, 1988 40

Chapter 5

Medicare Expenditures for Immunosuppressive Drug Therapy

This chapter commences with a baseline estimate of current spending for outpatient immunosuppressive drugs in the United States and under the Medicare program. The chapter then describes factors influencing drug costs, the potential pool of patients requiring post-transplant immunosuppressive drugs, and overall future Medicare expenditures.

CURRENT EXPENDITURES

Medicare does not currently play a major role in financing post-transplant immunosuppressive therapy. Medicare covers and pays for imrmmosuppressive drugs for only an estimated 19 percent of Medicare-covered functioning graft recipients (table 17). Likewise, Medicare pays the immunosuppressive drug costs for only about 13 percent of the U.S. total number of living, functioning graft patients. This small proportion is due largely to the l-year limit on coverage of immunosuppressives.

Another element of financing that influences these percentages is the mandatory requirement that Medicare be the secondary payer for the first 18 months of a patient's eligibility under the End-Stage Renal Disease (ESRD) Program.[1] In other words, even though an ESRD patient is entitled to Medicare coverage once determined eligible for Medicare benefits, Medicare will pay for covered services provided these beneficiaries only after any existing private insurance policies have paid. Approximately 37 to 67 percent of Medicare-covered kidney transplant recipients have private insurance during this period (see ch. 4).[2] Therefore, even within the l-year coverage period for outpatient immunosuppressives, Medicare is not paying for the drugs administered to these ESRD kidney transplant recipients because of the mandatory secondary payer requirement.

The Office of Technology Assessment (OTA) estimates that national spending for outpatient immunosuppressive agents was between $185 and $280 Won in 1988 (table 18). Medicare-related expenditures, including all beneficiary liabilities, were an estimated $20 to $30 million, or nearly 11 percent of total U.S. spending in this area (7,17). These estimates are based on the assumption that all functioning graft patients are on a cyclosporine protocol costing between $4,000 to $6,000 per year (see ch. 3).[3] Because of patient copayments, actual Medicare program outlays would have been somewhat less than 80 percent of the $24 to $36 million, or under roughly $20 to $30 million.

These estimates are a reasonable first approximation of national and Medicare expenditures for

Table 17—Estimated Number of Transplant Recipients Receiving Medicare Payment of Immunosuppressive Drugs, 1988

Graft type	Number[a]	Proportion with Medicare drug payment as a percent of: All Medicare-covered transplant recipients	Proportion with Medicare drug payment as a percent of: All U.S. transplant recipients
Kidney	5,850'	1970	15%
Heart	95	45	3
Liver	5C	48	<1
Heart/lung	0	—	—
Lung	0	—	—
Pancreas	0	·	—
Bone marrow	30	55	1
Total	5,980	19	13

[1]Since 1982, Medicare has been the mandatory secondary payer for ESRD beneficiaries for the first 12 months of eligibility. A provision in the Omnibus Budget Reconciliation Act of 1990 (Public Law 101-508) extended this limit to cover the first 18 months of eligibility, effective Jan. 1, 1991.

[2]In contrast, only 3 percent of the working aged have selected Medicare as secondary payer (37).

[3]This assumption should result in an overestimate of expenditures, since a few patients are not on cyclosporine-based protocols.

Table 18—Estimated U.S. and Medicare Expenditures for Outpatient Immunosuppressive Drug Therapy, 1988

	Number of recipients with functioning graft	cost of therapy	Total expenditures (in millions)[a]
United States	46,605[b]	$4,000-$6,00W	$185-$280
Medicare-covered	5,98@	$4,000-$6,00&	$24-$36"

[a]Assumes that 100 percent of functioning graft patients are on cyclosporine drug therapy. This overstates actual expenditures, since some kidney transplant recipients are on traditional therapies with lower costs and a few are not on outpatient immunosuppressive therapy.
[b]see table 11.
[c]See oh. 3.
[d]See table 16.
elncludes all beneficiary liabilities. Actual program outlays would be lower.

SOURCE: Office of Technology Assessment, 1991.

outpatient immunosuppressive medications in 1988; 1991 expenditures would be somewhat higher, due to the continuing increase in the number of organ transplant procedures. The Medicare figure is a baseline **estimate** of 1988 expenditures (including beneficiary liabilities). It is based on coverage as set out in current law, under which **outpatient** immunosuppressive drug coverage is limited to one year, starting with the patient's discharge date from a hospital or designated transplant center after a Medicare-covered organ transplant.

Note that these figures are not estimates of the overall cost of immunosuppressive therapy. They do not, for instance, encompass other services related to immunosuppressive therapy, such as a hospital outpatient visit or physician immunosuppressive drug management services. They also do not account for the costs of drug therapy in organ rejection episodes or the costs of treating side effects caused by immunosuppressive drugs. Other factors that might affect these expenditure estimates include patient behavior, such as noncompliance; variation in patient treatment; and provider prescribing (e.g., conversion from one therapy to another).

FACTORS INFLUENCING FUTURE EXPENDITURES

The effect of any particular change in Medicare policy regarding irnrnunosuppressives depends in part on a number of outside factors, which can be separated into two groups. The first set of factors affects the cost of the drug product. A second set of factors affects the potential pool of transplant patients receiving Medicare coverage for imrnunosuppression. Both affect the overall cost of providing this therapy.

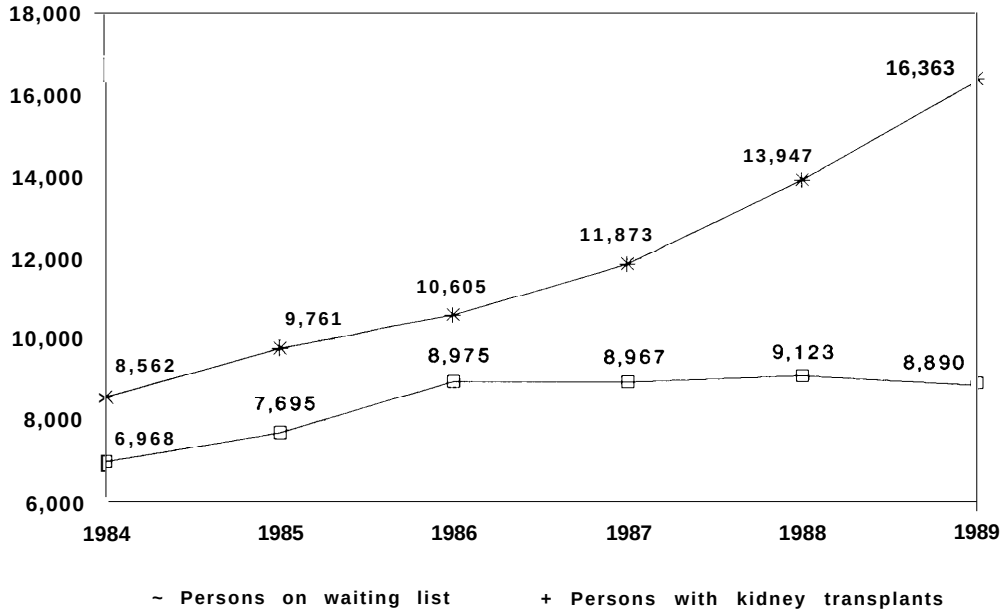
No definitive empirical evidence is available on the precise effect of any one of these factors on current or future Medicare expenditures. Nonetheless, the effects could be substantial. Nearly half of the factors could influence Medicare outlays in the future even if there are no changes in coverage policy. Other factors are issues to consider only if Medicare's policy for coverage of outpatient immunosuppressives is expanded.

Changes in the Immunosuppressive Drug Market

Even without any changes in policy, future Medicare expenditures for outpatient irnmunosuppressives could be significantly affected by changes in the market. For example, any new products now under development (e.g., the drug FK-506) have the potential to be more costly than cyclosporine when approved for clinical use. Medicare outlays for outpatient irnmunosuppressives may increase with the use of more costly drugs, even if coverage policy is unchanged from the l-year coverage limit. Alternatively, a greater choice of drugs and the development of lower-cost protocols could reduce Medicare expenditures.

Other changes in drug pricing could occur when the patent for cyclosporine expires in 1995. After that time, the potential for the availability of less expensive generic drugs also exists. Whether this potential will be realized depends on whether other pharmaceutical manufacturers decide to enter the irnrnunosuppressive market. The extent to which future costs are lower also depends on Sandoz' own reliance on revenues from this drug. Some research suggests that Sandoz may maintain a high price for

Figure 3-U.S. Kidney Transplants Performed, and Persons on Waiting List, 1984-89



SOURCE: Office of Technology Assessment, 1991, based on data provided by the Health Care Financing Administration.

cyclosporine if this product is a major source of revenues to the company (10,50).

Changes in the way existing drugs are used could also affect the cost of therapy and Medicare outlays. For example, the use of OKT-3 as an outpatient prophylactic would tend to increase the cost of outpatient immunosuppressive therapy. Minnesota's antilymphocyte globulin may also be used more widely once it receives approval from the U.S. Food and Drug Administration, although this is more likely to affect inpatient costs than outpatient maintenance expenses.

Innovations and substitutions can have significant and not always consistent consequences for the cost of irnmunosuppressives. For example, if a new drug is more expensive but reduces the need for adjunct drugs, or reduces rejection and complications-related expenses, it could result in lower treatment costs per patient.

Patient Demand and Patient Mix

It is possible that patient selection for a transplant procedure may be influenced, however indirectly, by the ability of the patient to pay for expensive outpatient therapy following the transplant. To this extent that this is so, more comprehensive outpatient immunosuppressive drug coverage by Medicare may increase patient demand, either directly or by increasing physician recommendations for transplants.

Despite possible higher demand, the limited supply of suitable organs will continue to constrain the number of transplant procedures performed. Even with existing demand, for example, the number of persons on the waiting list for kidney transplants is much higher than the number of persons transplanted (figure 3). The existing unmet need for donated kidney organs is projected to continue through the decade (18,21). Thus, expanding irnmunosuppressive coverage may increase the demand for organ transplants, but it will have little effect on the actual number of transplants performed.

Although the number of transplants may not be influenced by Medicare's coverage policy for outpatient irnmunosuppression, the mix of patients receiving transplants may be affected. The criteria by which one patient is selected over other another for a transplant are broad and complex, and inability to pay for drugs in the future would rarely, if ever, be an explicit criterion (30,38). Nonetheless, current

discrepancies due to insurance status and race have been noted in the treatment of patients for kidney failure (30,58). Broader Medicare drug coverage might indirectly improve the equity of access to transplants. If Medicare's coverage limit of 1 year were eliminated, for example, patients who are now unable to afford the expense of these drugs following kidney transplant may be more likely to consider the procedure rather than continue on dialysis. Similarly, transplant centers and physicians may change their evaluation process for selecting transplant candidates.

The implications that changes in patient mix may have for Medicare outlays overall are not easily predicted; expenditures may either increase or decrease depending on the resulting differences in the health status, age, or other characteristics of the new transplant population served. Any effect specifically on Medicare drug expenditures, however, would probably be small.

Patient Adherence to Therapy

Expanded coverage may increase patient adherence to the prescribed drug regimen, resulting in more regular and continued use of the immunosuppressive drugs that the patient requires. The outcome may be fewer episodes of acute organ rejection, fewer hospitalizations, and possibly fewer patients returning to dialysis. Expanding Medicare's coverage policy may thus reduce certain other Medicare expenditures.

Estimating the number of organ rejections that result from nonadherence to therapy, due to a financial inability to obtain drugs, is difficult. On the one hand, the American Society of Transplant Surgeons (ASTS) believes that nearly 47 percent of transplant recipients have difficulty paying for drugs, implying a high potential inability to obtain drugs (4)[4] On the other hand, U.S. Health Care Financing Administration (HCFA) data show that less than 3 percent of all graft failures occur as a result of patient nonadherence to therapy for any reason (17).5 Advocates argue that the HCFA data is poorly coded (25,28). A National Kidney Foundation survey suggests that nonadherence to therapy may account for almost 10 percent of kidney graft losses after the frost year (25).

Thus, the extent to which impaired financial access leads to organ rejection is highly uncertain. Furthermore, perfect patient adherence to the prescribed protocol is in no way guaranteed even if Medicare's coverage is expanded. Some patients voluntarily stop immunosuppressive therapy because of their perceived poor quality of life (7). Nonetheless, it is likely that at least some of the costs associated with organ rejection (e.g., additional hospital admissions, return to dialysis for kidney graft failure patients, and other costs associated with rejection episodes) would be reduced with expanded Medicare coverage.

Despite the lack of precise data, tracing out a very simplistic hypothetical scenario is a useful exercise to explore the potential magnitude of savings. If, hypothetically, as many as 10 percent of all graft failures were caused by the patient's financial inability to adhere to the drug regimen, this would mean that beyond the frost year of a transplant, approximately 268 Medicare recipient renal graft failures per year would be associated with nonadherence.[6] In the case of patients with ESRD, increased graft failure results in more patients returning to dialysis, at an annual average cost to Medicare (including patient liabilities) of approximately $19,000 per patient each year (17). Thus, under this hypothesis, a Medicare policy that eliminated all graft failures associated with nonadherence would have an offsetting program savings of roughly $5 million per year. Under a hypothesis of fewer graft failures due to nonadherence, offsetting savings would be correspondingly lower (e.g., if 3 percent failed for this reason, eliminating all of these failures would save approximately $1.5 million). Preventing hospitalizations due to acute organ rejection would result in some additional savings.

Another way to view the potential savings from averting graft failure is to examine the relative

[4]There are some potential problems with this figure. It is based on a survey of surgeons' opinions regarding the percentage of their patients who have financial difficulty, not a survey of the patients themselves. In addition, the analysis of this survey averaged all of the surgeon-reported percentages together, which results in an accurate aggregate percentage only if all surgeons have the same number of patients.

[5]Based on an assessment of kidney graft failure codes from the transplant followup forms for all transplant failures occurring during the Calendar years 1985 through 1988. Of the 5,580 graft failures in which a failure code was submitted, 3.3 percent were due to poor patient compliance with immunosuppressive therapy (17).

[6]There were an average of 2,677 kidney graft failures per year from 1985 to 1988 (17).

benefits of successful transplantation. HCFA has found that transplants pay for themselves when compared with dialysis within 3.7 years for living-donor kidney patients and 4.7 years for cadaver-donor kidney patients (17).[7]

Manufacturers' Incentives for Technological Developments

Medicare coverage policy changes will probably have only a slight effect on overall level of use of outpatient immunosuppressive drugs. Thus, coverage policy changes will probably also have little effect on manufacturers' incentives to pursue technological developments. The main effect might be to remove any existing disincentive against developing new immunosuppressives that would be expensive on the market, since Medicare currently pays fairly generously for covered drugs.

Changes in payment policy for the drugs, on the other hand, could affect development incentives substantially. Studies have shown that industry is extremely sensitive to changes in method of payment in terms of pricing strategies and incentives for developing emerging technologies (51). The precise direction of the incentives would depend on the payment policy adopted.

Other Program Costs Associated With Expanded Coverage

If coverage were expanded past the current 1-year limit, Medicare outlays would increase due to the cost of the outpatient immunosuppressive drug. In addition, Medicare expenditures would result from any related increase in services provided by physicians and outpatient hospital facilities.

Furthermore, if coverage for drugs were expanded, Medicare might come under pressure to cover other outpatient services that are required by transplant recipients or other Medicare beneficiaries. For example, some transplant recipients require outpatient nonimmunosuppressive prescriptions to prevent development of secondary complications (e.g., hypertension, stomach ulcers, and bone disorders). Total program costs might increase if coverage were extended to include these drugs as well. Similarly, easing financial access to drugs for transplant recipients through measures such as reducing coinsurance obligations might lead other Medicare beneficiaries (e.g., dialysis patients) to argue that their coinsurance obligations should be reduced as well.

[7]The costs in this comparison did not include immunosuppressive drug costs for transplant patients or costs of erythropoietin for dialysis.

Appendixes

Appendix A
Method of the Study

History of the Project

The origins of this study lie in the passage of the Medicare Catastrophic Coverage Act of 1988 and its subsequent repeal in 1989. That act included a broad measure that would have extended Medicare coverage to outpatient prescription drugs. In doing so, it would have resulted in greater coverage of outpatient immunosuppressive drugs (now limited to coverage for only 1 year), and it also would have established a home intravenous drug therapy benefit. With the repeal of that act, these two specific coverage expansions once again became issues before Congress.

In April of 1990, the Senate Committee on Finance asked the Office of Technology Assessment (OTA) to revisit these two topics and the relevant coverage and payment issues they involve. The proposed assessment was approved by OTA's congressional Technology Assessment Board on June 2, 1990, and it began the following month. The assessment was conducted in two parts leading to two separate reports, one on immunosuppressive drugs and one on home intravenous drugs.

Conduct of the Immunosuppressive Drug Study

The preliminary draft of the study of immunosuppressive drugs was prepared under contract to OTA by Diane Burnside Murdock of Falls Church, Virginia.[1] During her preparation of the draft, the contractor consulted with consumer and professional organizations, Federal and State agency personnel, health services researchers, independent health professionals, and other interested individuals in order to identify critical issues and relevant sources of data. The contractor also consulted **frequently** with OTA staff regarding the scope and directions of the study.

In addition, the contractor conducted literature reviews and received a substantial amount of data from a variety of individuals and organizations. Some of these data were previously unpublished, and OTA is indebted to these individuals and organizations for their cooperation and assistance.

Most major OTA studies have a panel of outside experts chosen to advise OTA staff on the study and ensure that all significant points of view are represented. This study was originally intended to be performed in coordination with an ongoing study of drug research and development, with the same advisory panel. It transpired, however, that the two studies had little directly in common, and the advisory panel for the earlier study proved inappropriate for the existing study. Because of the short time me for this study, it also proved infeasible to appoint a separate advisory panel at the point for the current study.

To ensure that sufficient expert advise was obtained and that all viewpoints were represented, OTA staff took especially great care to involve a variety of outside persons in the review of the draft material. Some preliminary findings from the report were presented in organized informal discussions with staff of the U.S. Health Care Financing Administration, the Urban Institute, and OTA. A revised draft was then sent to over 40 experts in the field, including medical providers, patient organizations, health care payers, researchers, and others with interest and knowledge in the area of organ transplantation and immunosuppressive therapy for their review and comment. The final draft, incorporating revisions based on reviewers' comments, was transmitted to the Technology Assessment Board in May 1991.

[1] Diane Burnside Murdock is a consultant in health policy and planning in the Washington DC area. Before turning to consulting she held a number of positions in the health policy field, including senior policy analyst at the Prospective Payment Assessment Commission and senior budget analyst at the Congressional Budget Office.

Appendix B

Medicare Payment Policy for Organ Transplant Procedures

Service	Payment recipient	Payment method
Organ procurement	Hospital	Paid through Medicare Part A based on actual Costs.[a]
	Physician	Charges considered to be part of hospital costs and paid as part of those rests if organ obtained from a cadaver. Charges reimbursed directly on the basis of customary, prevailing, and reasonable charges if living-donor organ. No beneficiary coinsurance required.
Transplant procedure	Hospital	Paid through Medicare Part A's prospective payment system for hospital inpatient Care.[b]
	Physician: *Heart, liver, and bone marrow transplants*	Paid through Medicare Part Bon basis of customary, prevailing, and reasonable charges. Patient pays Part B deductible and coinsurance.
	Kidney transplants	Payment is the lesser of the customary/prevailing/reasonable charge or a maximum amount in a carrier's area for renal transplant surgery. Patient pays Part B deductible and coinsurance.

[a]For bone marrow transplants, the payment for acquisitions is included in the diagnosis-related group payment Under the Prospective payment System.
[b]A few hospitals (e.g., certain cancer specialty hospitals) are not paid under the prospective payment system. Inpatient care in these hospitals is based On historical hospital-specific costs.

SOURCE: U.S. Health Care Financing Administration, Bureau of Policy Development, Division of Dialysis and Transplant Payment Policy, 1991.

Appendix C

Glossary of Abbreviations and Terms

Abbrevia.tions

ALG — Antilymphocyte globulin
AMA — American Medical Association
ASTS — American Society of Transplant Surgeons
ATG — Antithymocyte globulin
AWP — Average wholesale price
AZA — Azathioprine
CPT — Common Procedure Terminology
CSA — Cyclosporine
DHHS — U.S. Department of Health and Human Services
ESRD — End-stage renal disease
FDA — Food and Drug Administration (Public Health Service)
HCEA — Health Care Financing Administration (DHHS)
OKT-3 — Orthoclone OKT-3 (muromonab CD3)
OTA — Office of Technology Assessment (U.S. Congress)
PRED — Prednisone
UNOS — United Network of Organ Sharing

Terms

Adjunct prescription **drugs:** Medications that are used as part of the immunosuppressive therapeutic regimen but that are not themselves primary post-transplant immunosuppressive drugs.

Allogeneic **bone marrow transplant:** A procedure in which the bone marrow is obtained from a healthy donor and delivered by intravenous infusion into the recipient.

Aplastic **anemia:** A blood disorder in which the bone marrow fails to produce adequate numbers of red blood cells.

Assignment: A process whereby a Medicare beneficiary assigns his or her right to payment from Medicare to the physician or supplier. In return, the physician or supplier agrees to accept Medicare's reasonable (i.e., allowed) charge as payment in full for covered services. The physician (or supplier) may not charge the beneficiary more than the applicable deductible and coinsurance amounts. For physicians and suppliers who do not accept assignment, payment is made by Medicare directly to the beneficiary, who is responsible for paying the bill. In addition to the deductible and coinsurance amounts, the beneficiary is liable for any difference between the physician's actual charge and Medicare's reasonable (allowed) charge.

Autologous **bone marrow transplant:** A procedure in which a patient's own bone marrow is extracted, treated, and then restored to the patient.

Balance billing: In the Medicare program, the practice of billing a Medicare beneficiary in excess of Medicare's allowed charge. The "balance billing' amount would be the difference between Medicare's allowed charge and the physician's (or supplier's) billed charge.

Cadaveric kidney: A kidney obtained from a deceased donor.

Carrier: A fiscal agent (typically a private insurance company) under contract to the Health Care Financing Administration to administer Medicare Part B benefits.

Coinsurance: That percentage of covered hospital and medical expenses, -after subtraction of any deductible, for which an insured person is responsible. Under Medicare Part B, after the annual deductible has been met, Medicare will generally pay 80 percent of approved charges for covered services and supplies; the remaining 20 percent is the coinsurance, which the beneficiary pays.

Conventional immunosuppressive therapy: See *traditional immunosuppressive therapy*

Customary, prevailing, and reasonable charge method (Medicare): The method used by Medicare carriers to determine the approved charge for a particular Part B service from a particular physician or supplier. Under this method, the approved charge is limited to the lowest of the physician's actual charge for the service, the physician's customary charge for the service, and charges by peer physicians or suppliers in the same locality. If necessary, prevailing charges are adjusted by the Medicare Economic Index.

Deductible: The Medicare Part B deductible is the portion of approved charges (for covered services each calendar year) for which a beneficiary is responsible before Medicare assumes liability. The deductible is set at $100 in 1991.

Functioning graft: An implanted organ that is still functioning to some capacity of its purpose.

Graft: An implanted organ.

Histocompatibility: The genetic compatibility between the donor and recipient, which determines in part whether an organ graft will be rejected.

Hypertension: High blood pressure.

Immunology: The science concerned with the study of the immune system.

Immunosuppressive drug: Any drug that suppresses the natural reactions of the immune system. In organ transplants, such drugs can reduce or prevent the body's immune system's rejection of the organ as a foreign substance.

In vitro: Outside of the living body and in an artificial environment.

Medicare coverage: Refers to the health care benefits available to eligible Medicare beneficiaries.

Nephrotoxic: Poisonous to the kidney.

Nonrenal transplant: Any transplant other than a kidney transplant (e.g., heart, liver).

Organ graft **failure: The** failure of an implanted organ to function and fulfill its purpose. For kidney transplant patients, this means a return to dialysis until another organ is available. For other transplant patients, organ failure could mean death unless another organ is available for transplantation.

Organ rejection: A condition caused by the incompatibility between an organ recipient's genetic makeup and the donor's genetic makeup, leading the recipient's immune system to act against the transplanted organ. If untreated, organ rejection leads to organ failure.

Parenteral **drug administration: Any** non-oral means of introducing a drug into the body (e.g., by injection).

Prophylactic therapy: Preventive measures to inhibit disease. For transplant recipients, prophylactic immunosuppressive therapy is that which prevents or inhibits organ rejection.

Protocol: A standard course of therapy, designed to achieve certain ends.

Reasonable charge (Medicare): Payment on the basis of *customary, prevailing, and reasonable charges.*

Reasonable cost-based reimbursement (Medicare): A method of payment for health care services in which hospitals (or other providers) are paid their incurred costs of treating patients after the treatment has Occurred.

Regimen: Any plan of therapy designed to achieve certain ends.

Renal: Of or relating to the kidney.

Successful graft: An organ that functions effectively.

Syngeneic: In bone marrow transplantation, refers to a transplant involving a donor and recipient with identical genetic makeups.

Traditional immunosuppressive therapy: Drug therapy to prevent organ rejection using azathioprine and prednisone.

References

1. **Advisory Committee** of the International **Autologous** Bone Marrow Transplant Registry, **''Autologous** Bone Marrow Transplants: Different Indications in Europe and North **America,''** *Lancet* **11(8658:317-318,** Aug. 5, 1989.
2. *American Journal of Hospital Pharmacy,* Questions and Answers Column, 'Reimbursement for Immunosuppressive Drug Products,' **44:2005-2008,** September **1987.**
3. American Medical Association, Group on Health Policy, personal communication, Chicago, IL, January 1991.
4. American Society of Transplant Surgeons, 'Survey on Present Status of Reimbursement for **Immunosuppressive** Drugs,' Houston, TX, 1990.
5. **Aronoff,** R., U.S. Department of Health and Human Services, Public Health Service, Health Resources and Services Administration, Bureau of Health Resources Development, Division of Organ Transplantation, personal communications, November 1990-January 1991.

5a. Baker, C., and Kramer, N., "Employer-Sponsored Prescription Drug Benefits," ***Monthly Labor Review*** **114(2):31-34,** February 1991.

6. Based on a review of the scientific literature performed by **Battelle** and **reported** in **Battelle** Human Affairs Research Centers, Seattle, Washington, *Cost and Outcome Analysis of Kidney Transplantation; The Implications of Initial Immunosuppressive Protocol and Diabetes,* under agreement with the Health Care Financing Administration, Cooperative Agreement 14-C-98564/0, August 1989.
7. **Battelle** Human Affairs Research Centers, Seattle, Washington, *Cost and Outcome Analysis of Kidney Transplantation ;The Implications of Initial Immunosuppressive Protocol and Diabetes,* **under agreement** with the Health Care Financing Administration, Cooperative Agreement 14-C-98564/0, August 1989.
8. Block, R., Blue Cross/Blue Shield Association, Chicago, IL, personal communication, Mar. 29, 1991.
9. Bochinno, **Carmella,** ***Nursing Economics,*** Legislative Services Division, Washington, DC, personal communication, Apr. 9, 1991.
10. Bond, R. S., and **Lean,** D.F., "Sales, Promotion and Product Differentiation in Two Prescription Drug Markets," staff report to the Federal Trade Commission, Washington, DC, 1977.
11. "Bone Marrow Autotransplantation in Man," Report of an International Cooperative Study, ***Lancet,*** Oct. **25, 1986, pp. 960-962.**
12. **Bortin, M.M., andRimm, A.A., ''Increasing Utilization of Bone Marrow Transplantation, Results of the 1985-1987 Survey,"** *Transplantation 48(3):453-458,* September 1989.
13. **Buco,** M., Blue Cross/Blue Shield Association, Chicago, IL, personal communication, November 1990.
14. Cancer Information Center, National Cancer Institute, Bethesda, MD, personal communication, June 1991.
15. **Debure,** A., **Chkoff,** N., Chatenoud, L., et al., "One-Month Prophylactic Use of **OKT-3** in Cadaver Kidney Transplant Recipients," ***Transplantation*** *45* **(3):546-553,** March 1988.
16. Dunn, J., Golden, D., Van Buren, C.T., et al., "Causes of Graft **Loss** Beyond Two **Years** in the **Cyclosporine** Era," ***Transplantation 49(2):349-353,*** February 1990.
17. Eggers, P.W., Chief, Program Evaluation Branch, Office of Research, Health Care Financing **Administration,** Baltimore, MD, personal communications, 1990 and 1991.
18. Eggers, P.W., "The Medicare Experience With End-Stage Renal Disease: Trends in Incidence, Prevalence, and Survival," *Health Care Financing Review* **5(3):69-88,** *1984.*
19. **Engemann,** R., **Gassel,** H.J., **LaFrenz,** E., et al., "The Use of 15-Deoxyospergualin in Orthotropic Rat Liver Transplantation," ***Transplant Procedures 20(1): 237-239*** **(SUP@.** 1), 1988.
20. Ford, M., "Medicaid: Reimbursement for Outpatient Prescription Drugs," U.S. Congress, Congressional Research Service, Washington, DC, March 1991.
21. Held, P.W., Senior Economist, The Urban Institute, Washington, DC, personal communication, Jan. 10, 1991.
22. **Hellinger,** F.J., "Status of Insurance Coverage for Organ Transplants in the United States: A Review of Recent Surveys, "*InternationalJournal of Technology Assessment in Health Care* **2:563-570,** *1986.*
23. Henry, F. C., Kootee, A.M.M., Van **Bockel,** J.H., et al., "A Prospective Study on the Influence of **Cyclosporine** and **Azathioprine** on Renal **Allograft** Survival and Function," *Transplant Procedures* **19:1853-1955,** *1987.*
24. Hohman, R., National Institute of Allergy and Infectious Disease, National Institutes of Health, Bethesda, MD, personal communication, January 1991.

25. Hull, A.R., Dallas Nephrology Associates, Dallas, TX, personal communication, 1991.
26. Intergovernmental Health Policy Project, George Washington University, Washington, DC, *Medicaid Coverage and Payment of ESRD Services,* under contract to the Institute of Medicine, ESRD Study Committee, July 6, 1990.
27. Intergovernmental Health Policy Project, George Washington University, Washington, DC, ***Medicaid Coverage and Payment Policies for Organ Transplants: Findings of a National Survey,*** prepared for the U.S. Department of Health and Human Services, Health Resources and Services Administration, Contract No. HRSA 88-457, November 1988.
28. Kahan, B.D., Director, Division of Immunology and Organ Transplantation, University of Texas Medical School, Houston, TX, personal communication, November 1990.
29. Kahan, B. D., "The Impact of CSA Therapy," ***Transplantation and Immunology Letter*** 4(4):15, ***1988.***
30. Kasiske, B.L., Neylan III, J.F., Riggio, R.R., et al., "The Effect of Race on Access and Outcome in Transplantation,' New ***Eng. J. Med.,*** 324:302-307, Jan. 31, 1991.
31. Laudicina, Susan S., Intergovernmental Health Policy Project, George Washington University, Washington, DC, personal communication, January 1991.
32. Light, J., Washington Hospital Center, Washington, DC, personal communication, Nov. 19, 1990.
33. Macleod, A.M., and Thomson, A.W., ''FK-506: An Irnmunosuppressant for the 1990s?" *Lancet* 337 (8732):25-27, Jan. 5,1991.
34. McCullough, S., IMS America, Plymouth, PA, personal communications, Jan. 2, 1991.
34a. Medical Economics Data, *Drug Topics Red Book 1991* (Oradell, NJ: Medical Economics Co., Inc., 1991).
35. North American Autologous Bone Transplant Registry, University of Nebraska, Lincoln, NE, personal communication with J. Armitage, December 1990.
36. Physician Payment Review Commission, *Annual Report to Congress, 1990* (Washington, DC:PPRC, 1990).
37. Prospective Payment Assessment Commission, *Medicare Prospective Payment and the American Health Care System* (Washington, DC: PropAC, June 1988).
38. Rettig, R., The Institute of Medicine, *ESRD Study,* Washington, DC, personal communication, December 1990.
39. Scheaffer, L., U.S. Department of Health and Human Services, Health Resources and Services Administration, Rockville, MD, personal communication, April 1991.
40. Schemer, U., Vissing, S.F., Morgan, B.J., et al., ''Cyclosporine-Induced Sympathetic Activation and Hypertension After Heart Transplantation," New *Eng. J. Med.* 323(11):693-699, Sept. 13, 1990.
41. Schulak, J.A., and Corry, R.J., 'Manipulation of the Immune Response: Other Methods," in Cerrilli, G.J. (cd.), *Organ Transplantation and Replacement (New* York, NY: J.B. Lippincott Co., 1988), pp. 137-150.
42. Showstack, J., Katz, P., Arneud, W., et al, "The Association of Cyclosporine With the l-Year Costs of Cadaver-Donor Kidney Transplants," *J.A.M.A.* 264(14):1818-1823, Oct. 10, 1990.
43. Sisk, J.E., Cook-Deegan, R., Dougherty, D., et al., ***The Use of Immunosuppressive Drugs in Kidney Transplantation—Staff Paper*** (Washington, DC: Office of Technology Assessment, March 1984).
44. St. Collier, J.D., Caine, R., Thiru, S., et al., ''15-Deoxyspergualin in Experimental Dog Renal Allografts," ***Transplant Procedures*** 10(1):240-241 (suppl. 1), 1988.
45. Starzl, T.E., Fung, J., Jordan, M., et al., "Kidney Transplantation Under FK-506," ***J.A.M.A. 264(1):63-67,*** July *4,* 1990.
46. Tilney, N.L., and Strom, T.B., ' 'Chemical Manipulation of the Immune Responses," in Cerrilli, G.J. (cd.), ***Organ Transplantation and Replacement (New*** York, NY: J.B. Lippincott Co., 1988), pp. 118-136.
47. Todo, S., Murase, N., Ueda, Y., et al., "Effect of FK-506 in Experimental Organ Transplantation," ***Transplant Procedures*** 20(1):233-236 (suppl. 1), 1988.
48. U.S. Congress, Congressional Research Service, *Medicaid Source Book: Background Data and Analysis* (Washington, DC: U.S. Government Printing Office, November 1988).
49. U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Health and the Environment, hearing on payment for outpatient immunosuppressive drugs for transplant recipients, Washington, DC, Nov. 14, 1983.
50. U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Health and the Environment, "Second Staff Report on Price Increases for Prescription Drugs and Related Information," Washington, DC, Apr. 21, 1987.
51. U.S. Congress, Office of Technology Assessment, *Medical Technology and Costs of the Medicare Program,* OTA-H-227 (Washington, DC: Office of Technology Assessment, July 1984).
52. U.S. Department of Health and Human Services, Health Care Financing Administration, "Blood

Platelet Transfusions and Bone Marrow Transplantation,' Chapter 11-Coverage Issues Appendix, Medicare Coverage Issues Manual, HCFA Pub. No. 6, Baltimore, MD, June 1985.

53. U.S. Department of Health and Human Services, Health Care Financing Administration, Bureau of Data Management and Strategy, ***Annual Medicare Program Statistics,*** HCFA Pub. No. 03282 (Baltimore, MD: U.S. DHHS, June 1989).
54. U.S. Department of Health and Human Services, Health Care Financing Administration, Bureau of Policy Development, Division of Dialysis and Transplant Payment Policy, "Coverage of Transplants Under Medicare," unpublished staff paper, Baltimore, MD, Nov. 28,1990.
55. U.S. Department of Health and Human Services, Health Care Financing Administration, Office of Payment Policy, Division of Special Payment Programs, "Medicare Payment for Immunosuppressive Drugs," unpublished staff paper, Baltimore, MD, Sept. 24, 1990
56. U.S. Department of Health and Human Services, Health Care Financing Administration, "Payment for Immunosuppressive Drugs Furnished to Transplant Patients," section 5249, Reasonable Charges, Medicare Coverage Issues Manual, April 1990.
57. U.S. Department of Health and Human Services, Health Care Financing Administration, *Research Report: End-Stage Renal Disease,* Baltimore, MD, various years series.
58. U.S. Department of Health and Human Services, Office of Inspector General, *The **Distribution of** Organs for Transplantations: Expectations and Practices,* OEI-01-89-00550, draft report, August 1990.
59. U.S. Department of Health and Human Services, Public Health Service, Task Force on Organ Transplantation, ***Report to the Secretary and the Congress on Immunosuppressive Therapies*** (Rockville, *MD:* U.S. DHHS, 1985).
60. U.S. Department of Health and Human Services, public Health Service, Health Resources and Services Administration, Bureau of Health Resources Development, Division of Organ Transplantation, ***Annual Report on the U.S. Scientific Registry for Organ Transplantation and the Procurement and Transplantation Network, 1988 & 1989,*** contract Nos. 240-87-0069 and 240-87-0063 (Washington, DC: HRSA, 1990).
61. U.S. Department of Health and Human Services, Public Health Service, Health Resources and Services Administration, Report of the Task Force on Organ Transplantation, *Organ Transplantation: Issues and Recommendations,* April 1986.
62. Waldoch Koser, D., Data Administrator, International Bone Marrow Transplant Registry, Medical College of Wisconsin, Milwaukee, WI, personal communication, Dec. 14, 1990.
63. Zevi, A., Duquesnoy, R., Eiras, G., et al., "In Vitro Effects of FK-506 in Combination With Other Drugs," *Transplant Procedures* 20(1):220-222 (suppl. 1), 1988.