Milliman Research Report

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2011 U.S. organ and tissue transplant cost estimates and discussion


Milliman

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I. OVERVIEW

This 2011 report represents Milliman's triennial summary of estimated U.S. average costs per member per month (PMPM), billed charges, and utilization related to the 30 days prior and 180 days after transplant admission for treatment for organ and tissue transplants.

This 2011 report represents Milliman's triennial summary of estimated U.S. average costs per member per month (PMPM), billed charges, and utilization related to the 30 days prior and 180 days after transplant admission for treatment for organ and tissue transplants. For charges pre- and post-transplant admission, we include all medical costs associated with the transplant patient.

Organ transplants include single-organ transplants such as heart, intestine, kidney, liver, lung, pancreas, and a number of multiple-organ transplants.

Tissue transplants include bone marrow and cornea transplants. We split the bone marrow estimates by donor method: autologous, where the donor is the recipient; and allogeneic, where the donor may be related or unrelated to the recipient.

Highlights of this report include:

- **Section II**: 2011 PMPM costs are estimated to be $6.24 and $7.28 for under-age-65 and ages-65-and-over recipients, respectively. These PMPM costs reflect average annual increases of 2% and 8% compared with those in our 2008 report. The trend in the under-age-65 is low due to a negative utilization trend on many transplants and fairly low billed charge trends. However, there were a few transplants (autologous bone marrow, cornea, and double lung) that had significantly higher trends than the composite. The higher trend for the ages-65-and-over population was mainly due to the high utilization trend for autologous and allogeneic bone marrow and cornea transplants. Billed charges for most transplants have increased about 1.5% per year, although many recipients or health plans do not pay billed charges because of transplant provider networks. The 1.5% increase also includes the effect of the change in mix by type of transplant. Hospital lengths of stay for most transplants have not changed much since the 2008 report.

- **Section IV**: Survival rates generally stayed the same or increased slightly from those in our 2008 report, other than for intestine and heart-lung at one, three, and five years.

II. COSTS PMPM, CHARGES, AND UTILIZATION

Table 1 summarizes the estimated U.S. average 2011 transplant costs PMPM for the under-age-65 and ages-65-and-over populations. "Costs" means the product of utilization and billed charges. Table 2 summarizes the estimated U.S. average 2011 billed charges per transplant.

The estimated number of transplants shown in Table 1 reflects removal of transplants provided to foreign citizens. To determine utilization rates, we assumed 2011 U.S. under-age-65 and ages-65-and-over population estimates of 271.8 million and 41.5 million, respectively. These population estimates are based on U.S. government resident population census estimates as of July 1, 2010, and their projections to 2015.

Charges for pre-transplant, follow-up, outpatient (OP) immunosuppressants and other drugs as used in our 2008 report covered the time period from 30 days pre-transplant to 180 days post-transplant admission for follow-up and outpatient immunosuppressant and other drugs. Also for these categories, we included all medical costs associated with the transplant patient, not just those related to the transplant. For this 2011 report, charges for follow-up and outpatient immunosuppressant and other drugs are for the period 180 days post-transplant discharge. These post-transplant costs are now on a consistent time period, whereas previously the length of stay for the transplant caused post-transplant charges in the 2008 report to cover different time periods for each type of transplant. In this 2011 report we still include all medical costs associated with the transplant patient, not just those related to the transplant itself.

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TABLE 1: ESTIMATED U.S. AVERAGE 2011 TRANSPLANT COSTS PER MEMBER PER MONTH (PMPM)

			UNDER AGE 65			AGES 65 AND OVER		
TRANSPLANT	TOTAL ESTIMATED NUMBER OF TRANSPLANTS	ESTIMATED BILLED CHARGES	ESTIMATED NUMBER OF TRANSPLANTS	ESTIMATED ANNUAL UTILIZATION PER 1,000,000	ESTIMATED COSTS PMPM	ESTIMATED NUMBER OF TRANSPLANTS	ESTIMATED ANNUAL UTILIZATION PER 1,000,000	ESTIMATED COSTS PMPM
SINGLE ORGAN/TISSUE								
BONE MARROW – ALLOGENEIC	6,894	$805,400	6,460	23.82	$1.60	434	10.47	$0.70
BONE MARROW – AUTOLOGOUS	13,263	363,800	10,969	40.82	1.22	2,294	55.32	1.68
CORNEA	46,081	24,400	15,806	75.69	0.12	30,275	730.02	1.48
HEART	2,161	997,700	1,878	6.76	0.57	283	6.82	0.57
INTESTINE	74	1,206,800	72	0.24	0.03	2	0.05	0.01
KIDNEY	16,571	262,900	13,815	53.03	1.11	2,756	66.46	1.46
LIVER	5,898	577,100	5,302	19.79	0.94	596	14.37	0.69
LUNG – SINGLE	734	561,200	443	1.73	0.08	291	7.02	0.33
LUNG – DOUBLE	1,050	797,300	892	3.29	0.22	158	3.81	0.25
PANCREAS	286	289,400	285	1.10	0.03	1	0.02	0.00
MULTIPLE ORGAN								
HEART-LUNG	30	1,248,400	30	0.11	0.01	0	0.00	0.00
INTESTINE WITH OTHER ORGANS	107	1,343,200	106	0.35	0.04	1	0.02	0.00
KIDNEY-HEART	66	1,296,500	59	0.21	0.02	7	0.17	0.02
KIDNEY-PANCREAS	867	474,700	865	3.38	0.13	2	0.05	0.00
LIVER-KIDNEY	369	1,026,000	325	1.21	0.10	44	1.06	0.09
OTHER MULTI-ORGAN	42	1,707,500	41	0.16	0.02	1	0.02	0.00
TOTAL					$6.24			$7.28

This report estimates total PMPM costs for under-age-65 recipients that are $0.09 lower than the 2011 Health Cost Guidelines as a result of a different population in the Guidelines. Most of this decrease is attributed to autologous bone marrow, cornea, and kidney.

Differences from Milliman's 2011 Health Cost Guidelines

Users of both this report and the 2011 Milliman Health Cost Guidelines™ may notice differences in the estimated under-age-65 PMPM costs between the two sources. This report estimates total PMPM costs for under-age-65 recipients that are $0.09 lower than the 2011 Health Cost Guidelines as a result of a different population in the Guidelines. Most of this decrease is attributed to autologous bone marrow, cornea, and kidney.

Charges

Table 2 shows estimated U.S. average 2011 billed charges per transplant. Categories making up the total charges are defined below.

- **30 days pre-transplant**: These charges include all medical costs for the transplant patient incurred during the 30 days prior to the transplant hospital admission, which can include medical costs not related to the transplant. These charges could include history of the candidate, noting indications and contraindications for the transplant; comprehensive physical, psychological, and laboratory evaluations, including blood and tissue typing and serum and cell compatibility matching; cross-matching for donor compatibility; hepatitis and HIV screening; antibody screening; medical and psychological testing; lab tests; and X-rays. Because of the time period between evaluation and transplant, evaluation costs are exceedingly difficult to identify in claim databases, which are our primary source of charge data. Therefore, it is not practical to separate these charges into those related and not related to the transplant because of the short 30-day time period defined.

TABLE 2: ESTIMATED U.S. AVERAGE 2011 BILLED CHARGES PER TRANSPLANT

TRANSPLANT	30 DAYS PRE-TRANSPLANT	PROCUREMENT	HOSPITAL TRANSPLANT ADMISSION	PHYSICIAN DURING TRANSPLANT	180 DAYS POST-TRANSPLANT DISCHARGE	OP IMMUNO-SUPPRESSANTS AND OTHER RX	TOTAL
SINGLE ORGAN/TISSUE							
BONE MARROW - ALLOGENEIC	$41,400	$38,900	$419,600	$22,400	$259,800	$23,300	$805,400
BONE MARROW – AUTOLOGOUS	44,600	18,200	198,200	10,800	84,900	7,100	363,800
CORNEA	0	0	16,500	7,900	0	0	24,400
HEART	47,200	80,400	634,300	67,700	137,800	30,300	997,700
INTESTINE	55,100	78,500	787,900	104,100	146,600	34,600	1,206,800
KIDNEY	17,000	67,200	91,200	18,500	50,800	18,200	262,900
LIVER	25,400	71,000	316,900	46,600	93,900	23,300	577,100
LUNG – SINGLE	10,300	73,100	302,900	33,500	117,700	23,700	561,200
LUNG - DOUBLE	21,400	90,300	458,500	56,300	142,600	28,200	797,300
PANCREAS	17,000	65,000	108,900	17,800	61,400	19,300	289,400
MULTIPLE ORGAN							
HEART-LUNG	56,800	130,500	777,700	81,000	169,100	33,300	1,248,400
INTESTINE WITH OTHER ORGANS	57,900	172,700	795,900	116,300	160,900	39,500	1,343,200
KIDNEY-HEART	48,800	123,600	813,000	93,900	184,800	32,400	1,296,500
KIDNEY-PANCREAS	20,800	102,500	194,900	34,700	100,400	21,400	474,700
LIVER-KIDNEY	46,800	117,500	574,100	83,100	180,100	24,400	1,026,000
OTHER MULTI-ORGAN	75,400	131,000	1,050,100	139,500	278,600	32,900	1,707,500

- **Procurement**: This includes donated organ or tissue recovery services, which may include retrieval, preservation, transportation, and other acquisition costs. This category definition is unchanged from that used in our 2008 report.

- **Hospital transplant admission**: This covers facility charges for the transplant only. Any re-admissions within 180 days of the transplant admission date are included in the 180 Days Post-Transplant Discharge category, whether related to the transplant or not. Hospital services include room and board and ancillary services such as use of surgical and intensive care facilities, inpatient nursing care, pathology and radiology procedures, drugs, supplies, and other facility-based services. Hospital services may also include use of immunosuppressive and other drugs provided during the hospital stay.

- **Physician during transplant**: These are charges for professional non-facility services while the recipient is hospitalized for the transplant, including surgery procedures and other services identified by CPT or HCPCS procedure codes.

- **180 days post-transplant discharge**: This covers post-discharge facility and professional non-facility services, including any hospital readmissions. Services may also include regular lab tests, regular outpatient visits, and evaluation and treatment of complications. These services can include both those related and not related to the transplant.

- **OP immunosuppressants and other Rx**: This category includes all outpatient drugs prescribed from discharge for the transplant admission to 180 days post-transplant discharge, including immunosuppressants, other drugs related to the transplant, and other drugs not related to the transplant. Anti-anxiety medications, antifungal antibiotics, anti-virals, colony-stimulating factors, gastrointestinal drugs, hypertension drugs, and post-operative pain management drugs are examples of drugs other than outpatient immunosuppressants related to the transplant that could also be used in treatment. Immunosuppressant drug charges in this report include assumed discounts of 60% and 15% from average wholesale prices for generics and brand drugs, respectively, which is similar to the Health Cost Guidelines assumptions for all prescription drugs.

Basis of utilization and charge estimates

We based utilization estimates on data from the U.S. Organ Procurement and Transplantation Network (OPTN), the Scientific Registry of Transplant Recipients (SRTR), the Center for International Blood and Marrow Transplant Registry (CIBMTR), and the Eye Bank Association of America. None of the entities on which we relied for data have reviewed or approved our estimates. The content of this report is the responsibility of the authors alone and does not necessarily reflect the views or policies of the Department of Health and Human Services, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. government.

We developed charge estimates for 30 days pre-transplant, physician during transplant, 180 days post-transplant discharge, and non-immunosuppressant drugs based on Milliman proprietary claim data. We based procurement charge estimates on our judgment and 2008 data from Arizona, Iowa, Massachusetts, Maryland, Texas, Vermont, and Washington state hospital data, trended to 2011 and normalized to a national average basis using Milliman area relativity research.

We developed charge estimates for 30 days pre-transplant, physician during transplant, 180 days post-transplant discharge, and non-immunosuppressant drugs based on Milliman proprietary claim data.

We based hospital charge estimates on 2008 Arizona, California, Colorado, Florida, Iowa, Illinois, Kentucky, Massachusetts, Maryland, North Carolina, New Hampshire, New Jersey, New York, Oklahoma, Rhode Island, South Carolina, Texas, Utah, Virginia, Vermont, Washington state, and Wisconsin hospital data normalized to a national average basis.

Our bone marrow charge estimates do not reflect any savings from outpatient treatment because we lacked sufficient outpatient bone marrow data.

We developed cornea hospital charges from 2008 Wisconsin hospital inpatient and outpatient data. The 2008 Wisconsin hospital data showed that outpatient cornea transplants represent well over 99% of these transplants and just under 99% of billed charges.

We assumed no outpatient immunosuppressant charges for autologous bone marrow and cornea transplants. For all other transplants, we estimated when outpatient immunosuppressant coverage began by using estimated 2008 hospital lengths of stay. Average wholesale prices were based on the Medi-Span database and our judgment to project these charges to 2011. We assumed average dosing regimens from MedlinePlus.

Hospital lengths of stay

Table 3 shows that estimated hospital lengths of stay generally have been fairly stable since our 2008 report, which was based on 2006 data.

TABLE 3: HOSPITAL LENGTHS OF STAY BY TRANSPLANT (DAYS)

TRANSPLANT	2006	2008
SINGLE-ORGAN/TISSUE		
BONE MARROW – ALLOGENEIC	33.9	33.1
BONE MARROW - AUTOLOGOUS	20.7	20.4
HEART	38.8	40.1
INTESTINE	64.1	69.4
KIDNEY	8.1	7.3
LIVER	22.2	20.9
LUNG - SINGLE	19.6	18.9
LUNG - DOUBLE	29.9	28.1
PANCREAS	8.2	9.4
MULTIPLE-ORGAN		
HEART-LUNG	44.0	44.7
KIDNEY-HEART	60.4	46.0
KIDNEY-PANCREAS	12.6	12.4
LIVER-KIDNEY	30.9	27.5

Annual number of transplants

Tables 4A, 4B, and 4C show the annual number of transplants performed in the United States from 2007 to 2011. These numbers include all ages and transplants for non-U.S. citizens. We project increases in the numbers of most transplants from 2010 to 2011 because the population increases even though the expected transplant rate per million people may increase or decrease for various types of transplants.

We project increases in the numbers of most transplants from 2010 to 2011 because the population increases even though the expected transplant rate per million people may increase or decrease for various types of transplants.

We based Tables 4A and 4B on OPTN data as of August 6, 2010. We estimated the split of lung transplants between single and double lung using 2008 state hospital databases and actuarial judgment. We based the bone marrow estimates in Table 4C on North American data from the CIBMTR. We based the cornea estimates in Table 4C on information from the 2009 Eye Banking Statistical Report.

TABLE 4A: SINGLE-ORGAN TRANSPLANTS PERFORMED IN THE UNITED STATES

YEAR	HEART	INTESTINE	KIDNEY	LIVER	LUNG–SINGLE	LUNG–DOUBLE	PANCREAS
2007	2,142	57	16,114	5,894	601	860	353
2008	2,084	69	16,061	5,820	606	866	324
2009	2,137	76	16,386	5,844	677	968	283
2010*	2,158	77	16,545	5,901	707	1,012	286
2011*	2,179	77	16,705	5,958	739	1,057	289

Above numbers include ages 65+ and foreign citizens
* Milliman estimates

TABLE 4B: MULTIPLE-ORGAN TRANSPLANTS PERFORMED IN THE UNITED STATES

YEAR	HEART-LUNG	INTESTINE WITH OTHER ORGANS	KIDNEY-HEART	KIDNEY-PANCREAS	LIVER -KIDNEY	OTHER MULTI-ORGANS
2007	31	141	56	864	445	24
2008	27	116	66	837	378	22
2009	30	104	60	854	362	29
2010*	30	106	63	862	366	31
2011*	31	108	66	871	369	37

Above numbers include ages 65+ and foreign citizens
* Milliman estimates

TABLE 4C: TISSUE TRANSPLANTS PERFORMED IN THE UNITED STATES

YEAR	BONE MARROW–AUTOLOGOUS	BONE MARROW–ALLOGENEIC	CORNEA
2007	10,000	6,200	39,391
2008	10,900	6,500	41,652
2009	11,800	6,500	42,606
2010*	12,510	6,694	44,310
2011*	13,263	6,894	46,081

Above numbers include ages 65+ and foreign citizens
* Milliman estimates

Bone marrow classifications

Table 5 shows that bone marrow transplants can be classified according to graft source: bone marrow, peripheral blood stem cell, bone marrow cell plus peripheral blood stem cell, or umbilical cord blood stem cell. Generally speaking, bone marrow cell graft use continues to decrease and peripheral blood stem cell graft use continues to increase.

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TABLE 5: BONE MARROW TRANSPLANT GRAFT SOURCES, 2004-2008

	GRAFT SOURCES			
AGE AT TIME OF TRANSPLANT	BONE MARROW	PERIPHERAL BLOOD STEM CELL	BONE MARROW PLUS PERIPHERAL BLOOD STEM CELL	CORD BLOOD STEM CELL
AUTOLOGOUS				
UNDER 21	ABOUT 5-10%	ABOUT 90%	ABOUT 1%	N/A
21+	ABOUT 1%	ABOUT 98%	ABOUT 1%	N/A
ALLOGENEIC				
UNDER 21	ABOUT 55%	ABOUT 25% -30%	N/A	ABOUT 20%
21+	ABOUT 15% - 20%	ABOUT 80%	N/A	ABOUT 5%

Actual costs versus Milliman estimates

As we mentioned in Section II, "costs" means the product of utilization and billed charges. We did not research the actual costs that hospitals and physicians incur to provide transplants, as that would involve proprietary arrangements. Actual PMPM transplant costs may vary from our estimates for a variety of reasons that are beyond the scope of our report:

- The transplant cost estimates assume full insurance coverage; patient cost-sharing and benefit limitations would reduce full coverage costs.
- Costs may vary by geographic area and transplant center due to volume or incidence of complications.
- Growth in the average number of organs procured per donor and number of centers may change costs, as long as suitable donor organs and tissue can continue to be found.
- Private insurance, Medicare, Medicaid, and uninsured recipient costs may vary by transplant; for example, Medicare covers a significant portion of kidney transplants through the End Stage Renal Disease program.
- Federal and state legislative efforts and private initiatives may change utilization and costs.
- Changes in selection criteria may affect costs.
- Costs may vary by underlying diagnosis and/or disease state.
- Medical management may reduce costs, particularly with respect to hospital charges.
- Costs may be reduced with use of cost-control mechanisms such as greater donor and recipient selectivity by centers, critical pathways to reduce inpatient lengths of stay, and aggressive use of outpatient therapies and other more cost-effective treatments.

- Wide availability of mechanical, artificial, or cloned organs; experimental procedures becoming accepted practice; or other innovations may affect costs.
- Cost estimates may be subject to change if the OPTN data and other data relied on changes due to future data submissions or corrections.
- Administration costs and profit margins will vary, and were not considered in our analysis.
- Any estimate of costs after the first year should reflect adjustments for trend, survival, and probability of re-transplantation.

Actual charges compared to Milliman billed charge estimates

"Charges" in this report refer to the amount billed, which may not be the actual amount paid for the transplant services due to the presence of case rates, discounts, or other negotiated reimbursement arrangements. Significant reductions from billed charge levels may be obtained and the chances for successful treatment may be maximized by directing patients to specific centers. Actual charges will likely vary for private insurers, Medicare, or Medicaid.

"Charges" in this report refer to the amount billed, which may not be the actual amount paid for the transplant services due to the presence of case rates, discounts, or other negotiated reimbursement arrangements.

Negotiated case rates may combine hospital and physician charges. Procurement charges may be included in the negotiated case rate, but usually the procurement charges reflect slight, if any, discounts from billed levels.

We have observed that case rates do not typically cover pre-transplant medical services and maintenance therapy outpatient immunosuppressants. Some case rates may include follow up costs within a specified time period such as the first 90 days after discharge. Services and charges not defined under a case rate may be provided by the patient's normal provider network.

Some transplant centers address charge variation by developing separate payment rates by diagnosis or by patient disease state. Our charge estimates may require adjustment to reflect diagnosis, disease state, or other variables specific to a given situation.

An outlier provision may provide additional payment beyond the case rate after a specified number of days in the hospital or after a certain level of billed charges. The outlier provision may pay for hospital days at a discount from billed charges or at a per diem rate. Centers may also have outlier payments for physician services.

Actual outpatient immunosuppressant charges will vary from our estimates for several reasons:

- Actual hospital lengths of stay that we used to estimate when outpatient immunosuppressant charges begin will vary from our estimates.
- Drug discounts other than those assumed in this report will yield different estimates.
- Actual dosing regimens will vary from the dosing regimens assumed.
- The actual use and prevalence of single and multiple outpatient immunosuppressant regimens will vary from our estimates.

The transplant charge estimates do not reflect differences in charges due to age. Billed transplant charges may vary for pediatric patients, adults under the age of 65, and patients ages 65 and over.

Charges may continue after the first year and may include continued testing and evaluation, medical services for transplant rejection, and outpatient immunosuppressants.

III. PRIMARY DIAGNOSES

Table 6 summarizes the most common primary indications for transplantation by organ/tissue. Organ data is based on OPTN data as of February 11, 2011. Bone marrow data is based on 2008 North American data from the CIBMTR 2010 Summary Slides. Cornea data comes from the 2009 Eye Banking Statistical Reports. Since our 2008 report, the order and magnitude of the top indications has changed slightly for several types of transplants.

TABLE 6: INDICATIONS FOR TRANSPLANT

ORGAN OR TISSUE	MOST COMMON PRIMARY DIAGNOSIS AND PREVALENCE	SECOND-MOST COMMON PRIMARY DIAGNOSIS AND PREVALENCE	NEXT MOST COMMON PRIMARY DIAGNOSIS AND PREVALENCE
SINGLE ORGAN/TISSUE			
BONE MARROW – ALLOGENEIC	ACUTE MYELOGENOUS LEUKEMIA (36%)	ACUTE LYMPHOCYTIC LEUKEMIA (16%)	MYELODYSPLATIC SYNDROME/ MYELOPROLIFERATIVE DISEASE (12%)
BONE MARROW – AUTOLOGOUS	MULTIPLE MYELOMA (45%)	NON-HODGKIN'S LYMPHOMA (30%)	HODGKIN'S DISEASE (13%)
CORNEA	KERATOCONUS (22%)	REPEAT CORNEAL TRANSPLANT (17%)	POST-CATARACT SURGERY EDEMA (15%)
HEART	DILATED MYOPATHY: IDIOPATHIC (32%)	DILATED MYOPATHY: ISCHEMIC (30%)	CONGENITAL HEART DEFECT - WITH SURGERY (7%)
INTESTINE	SHORT GUT SYNDROME: GASTROSCHISIS (13%)	SHORT GUT SYNDROME: OTHER (13%)	SHORT GUT SYNDROME: NECROTIZING ENTEROCOLITIS (8%)
KIDNEY	HYPERTENSIVE NEPHROSCLEROSIS (21%)	DIABETES MELLITUS - TYPE II (17%)	POLYCYSTIC KIDNEYS (9%)
LIVER	CIRRHOSIS: TYPE C (22%)	PRIMARY LIVER MALIGNANCY: HEPATOMA (HEPATOCELLULAR CARCINOMA) AND CIRRHOSIS (14%)	ALCOHOLIC CIRRHOSIS (10%)
LUNG (SINGLE AND DOUBLE)	IDIOPATHIC PULMONARY FIBROSIS (33%)	COPD/EMPHYSEMA (26%)	CYSTIC FIBROSIS (14%)
PANCREAS	DIABETES MELLITUS - TYPE I (66%)	RETRANSPLANT/GRAFT FAILURE (11%)	DIABETES MELLITUS - TYPE II (1%)
MULTIPLE ORGAN			
HEART-LUNG	PRIMARY PULMONARY HYPERTENSION (33%)	CONGENITAL HEART DEFECT - WITH SURGERY (17%)	IDIOPATHIC PULMONARY FIBROSIS (13%)
KIDNEY-PANCREAS	DIABETES MELLITUS - TYPE I (85%)	DIABETES MELLITUS - TYPE II (7%)	HYPERTENSIVE NEPHROSCLEROSIS (4%)

IV. WAITING TIMES AND SURVIVAL RATES

Waiting times

Table 7 summarizes transplant waiting times in days by organ, based on OPTN data as of May 4, 2009, from the OPTN/SRTR 2009 annual report. The waiting times reflect a patient who has been registered on a waiting list and takes into account all the things that can happen to the patient after wait listing, such as receiving a transplant, being removed from the waiting list, and dying. No data is shown for bone marrow because we were unable to find a data source for tissue transplant waiting times.

The percentile-based waiting times shown in Table 7 are estimates of the time in which 50% of patients received a transplant. For example, a heart transplant patient placed on a waiting list in 2008 had a 50% chance of being transplanted within 168 days.

The percentile-based waiting times shown in Table 7 are estimates of the time in which 50% of patients received a transplant.

Table 7 also shows that waiting times vary by organ over time. Waiting times may also vary by other characteristics not shown. Waiting time estimates shown in Table 7 can differ from the estimates shown in our 2008 report because of additions, deletions, or other revisions that OPTN may have made to its data or the manner in which it measures the wait.

TABLE 7: WAITING TIMES BY TRANSPLANT

ORGAN	2004	2005	2006	2007	2008
	50TH PERCENTILE (i.e., MEDIAN) TIME TO TRANSPLANT IN DAYS				
HEART	166	131	111	114	168
INTESTINE	212	232	257	159	142
KIDNEY	1,219	1,269	*	*	*
LIVER	400	296	286	319	*
LUNG (SINGLE AND DOUBLE)	792	200	134	142	148
PANCREAS ALONE	376	356	436	260	*
PANCREAS AFTER KIDNEY	552	751	887	*	*
HEART-LUNG#	284	100	142	89	72
KIDNEY-PANCREAS	428	451	444	406	*

* Not determined due to insufficient follow-up; fewer than this percentile have been transplanted.
#These values are the 25th percentile as all 50th percentile values were not determined.

Survival rates

Table 8 summarizes one-year, three-year, five-year and 10-year patient survival rates by transplant. The organ transplant survival rates for patients transplanted during 2002 through 2007 generally show improvement from those in our 2008 report, and are based on OPTN data as of May 4, 2009.

Bone marrow transplant survival rates are based on 1998 to 2008 CIBMTR survival rate data. Autologous and allogeneic survival rates vary significantly by individual diagnosis, age, type of donor, and disease stage. We developed composite autologous bone marrow estimates reflecting survival rates for multiple myeloma, non-Hodgkin's lymphoma, Hodgkin's disease, and acute myelogenous leukemia, which represented more than 91% of all North American autologous bone marrow transplants in 2008. The composite allogeneic bone marrow estimates we developed reflect survival rates for acute myelogenous leukemia, acute lymphoblastic leukemia, myelodysplasia, non-Hodgkin's lymphoma, aplastic anemia, chronic myelogenous leukemia, multiple myeloma, and Hodgkin's disease, which represent more than 87% of all allogeneic bone marrow transplants in 2008. The CIBMTR has not reviewed or approved our composite survival estimates.

TABLE 8: PATIENT SURVIVAL RATES BY TYPE AND YEAR OF TRANSPLANT

	ONE-YEAR		THREE-YEAR		FIVE-YEAR		TEN-YEAR
ORGAN	**2008 REPORT**	**2006-2007**	**2008 REPORT**	**2004-2007**	**2008 REPORT**	**2002-2007**	**1997-2007**
HEART	88%	88%	79%	82%	72%	75%	56%
INTESTINE	79	89	59	72	48	58	46
KIDNEY	96	97	91	92	85	86	68
LIVER	86	89	78	80	72	74	61
LUNG	83	83	63	66	47	54	29
PANCREAS	94	97	90	92	82	86	70
HEART-LUNG	66	81	50	62	39	45	29
KIDNEY-PANCREAS	95	96	90	92	86	87	71
TISSUE	**1998-2004**	**1998-2008**	**1998-2004**	**1998-2008**	**1998-2004**	**1998-2008**	
BONE MARROW – AUTOLOGOUS	85-89%	83-87%	65-69%	64-68%	50-54%	51-55%	
BONE MARROW – ALLOGENEIC	59-63%	58-62%	47-51%	46-50%	43-47%	42-46%	

V. 2009 RECIPIENT DEMOGRAPHICS

Tables 9A and 9B highlight 2009 transplant recipient demographics. The demographic data and categories are based on OPTN data as of February 11, 2011, for solid organs and 2008 state hospital databases for bone marrow. There was a significant shift in the distribution by race for heart-lung transplants, although there are few of those types of transplants to begin with.

TABLE 9A: 2009 RECIPIENT DEMOGRAPHICS: SINGLE-ORGAN/TISSUE TRANSPLANTS

	BONE MARROW	HEART	INTESTINE	KIDNEY	LIVER	LUNG	PANCREA
GENDER							
MALE	53%	72%	51%	60%	66%	57%	52%
FEMALE	47%	28%	49%	40%	34%	43%	48%
TOTAL	100%	100%	100%	100%	100%	100%	100%
RACE							
WHITE	71%	68%	63%	53%	70%	85%	80%
BLACK	9%	19%	20%	25%	11%	8%	8%
HISPANIC	14%	9%	11%	15%	13%	6%	9%
ASIAN	3%	3%	3%	5%	5%	1%	1%
OTHER	3%	1%	2%	2%	1%	0%	1%
TOTAL	100%	100%	100%	100%	100%	100%	100%
AGE							
UNDER 1	1%	5%	12%	0%	3%	0%	5%
1-5	5%	4%	31%	1%	4%	0%	8%
6-10	3%	2%	6%	1%	1%	1%	2%
11-17	4%	5%	3%	3%	1%	3%	1%
18-34	14%	9%	12%	13%	6%	11%	18%
35-49	20%	18%	14%	27%	17%	14%	45%
50-64	39%	44%	21%	39%	57%	49%	21%
65+	14%	13%	1%	16%	11%	22%	0%
TOTAL	100%	100%	100%	100%	100%	100%	100%

TABLE 9B: 2009 RECIPIENT DEMOGRAPHICS: MULTIPLE-ORGAN TRANSPLANTS

	HEART-LUNG	INTESTINE WITH OTHER ORGANS	KIDNEY-HEART	KIDNEY-PANCREAS	LIVER-KIDNEY	OTHER MULTI-ORGAN
GENDER						
MALE	40%	46%	80%	62%	63%	76%
FEMALE	60%	54%	20%	38%	37%	24%
TOTAL	100%	100%	100%	100%	100%	100%
RACE						
WHITE	44%	62%	60%	69%	64%	90%
BLACK	33%	20%	33%	18%	14%	7%
HISPANIC	13%	13%	5%	10%	17%	3%
ASIAN	7%	3%	2%	2%	3%	0%
OTHER	3%	2%	0%	1%	2%	0%
TOTAL	100%	100%	100%	100%	100%	100%
AGE						
UNDER 1	0%	20%	0%	0%	0%	0%
1-5	7%	34%	0%	0%	1%	0%
6-10	3%	8%	2%	0%	1%	0%
11-17	3%	2%	0%	0%	2%	3%
18-34	30%	8%	7%	20%	5%	21%
35-49	40%	11%	25%	59%	17%	38%
50-64	17%	16%	44%	21%	57%	38%
65+	0%	1%	22%	0%	17%	0%
TOTAL	100%	100%	100%	100%	100%	100%

VI. DONOR FACTS AND DATA

Deceased donor

Deceased donor data reflects only donors recovered by U.S. organ procurement organizations. United Network for Organ Sharing defines a recovered, deceased donor as one from whom at least one vascularized solid organ–heart, intestine, kidney, liver, lung, or pancreas–was recovered for transplantation. Hearts recovered for heart valves would not be counted.

Table 10 summarizes U.S. deceased donor counts from 2006 to 2009, based on OPTN data as of February 11, 2011. Unlike Tables 1, 4A, and 4B, heart, intestine, kidney, liver, lung, and pancreas transplants in Table 10 include multiple-organ transplants with that organ. Heart-lung and kidney-pancreas transplants are the exception, as those transplants are counted separately and only counted once.

TABLE 10: PRIMARY ORGAN TRANSPLANTS FROM DECEASED DONORS

YEAR	HEART	INTESTINE	KIDNEY	LIVER	LUNG	PANCREAS	HEART-LUNG	KIDNEY-PANCREAS
2006	2,192	171	10,661	6,363	1,401	467	31	923
2007	2,209	197	10,591	6,228	1,465	471	31	864
2008	2,163	185	10,553	6,070	1,478	435	27	837
2009	2,211	178	10,442	6,101	1,659	379	30	854

Living donor

The most common transplants using living donors include bone marrow, kidney, and liver. However, intestine, lung, pancreas, and kidney-pancreas transplants can use living donors. Living lung donors have a segment of one lung removed for transplants. Lung lobes do not regenerate the donated segment, but the average decrease of 15% in the living donor's lung capacity generally yields minimal physical limitations for the donor. The liver can regenerate the donated segment. A donor may live with one kidney with little danger because the remaining kidney enlarges to do the work that both kidneys previously shared.

Living donor data includes living donors from whom organs were transplanted in the United States. The number of living donor transplants may differ from the number of living donors because living donors might donate segments from more than one organ, or there may be multiple donors for one transplant.

Table 11 summarizes U.S. living donor counts from 2006 to 2009, based on OPTN data as of February 11, 2011. Unlike Tables 1, 4A, and 4B, intestine, kidney, liver, lung, and pancreas transplants include multiple-organ transplants with that organ. Kidney-pancreas transplants are the exception, as these transplants are counted separately and only counted once.

Living donor data includes living donors from whom organs were transplanted in the United States. The number of living donor transplants may differ from the number of living donors because living donors might donate segments from more than one organ, or there may be multiple donors for one transplant.

TABLE 11: PRIMARY ORGAN TRANSPLANTS FROM LIVING DONORS

YEAR	INTESTINE	KIDNEY	LIVER	LUNG	PANCREAS	KIDNEY-PANCREAS
2006	4	6,434	288	4	0	1
2007	1	6,043	266	3	0	0
2008	0	5,968	249	0	1	0
2009	2	6,387	219	1	0	0

VII. TABLE INDEX

Milliman is among the world's largest independent actuarial and consulting firms. Founded in 1947 as Milliman & Robertson, the company currently has 54 offices in key locations worldwide. Milliman employs more than 2,500 people. The firm has consulting practices in healthcare, employee benefits, property & casualty insurance, life insurance and financial services. Milliman serves the full spectrum of business, financial, government, union, education and nonprofit organizations. For further information, visit milliman.com.

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