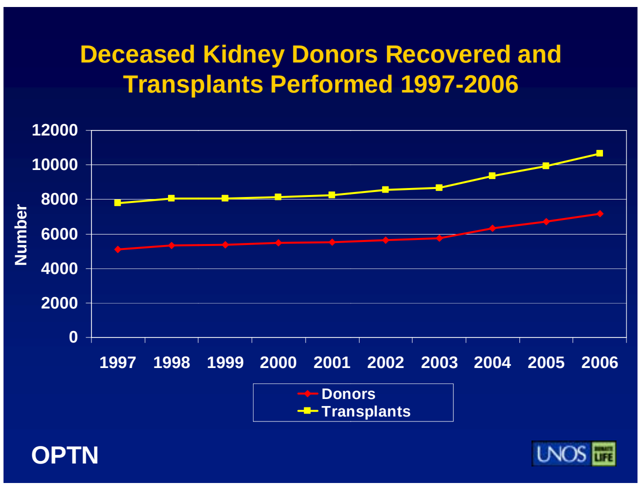
Guidance on Machine Preservation in Deceased Donor Kidneys

Introduction

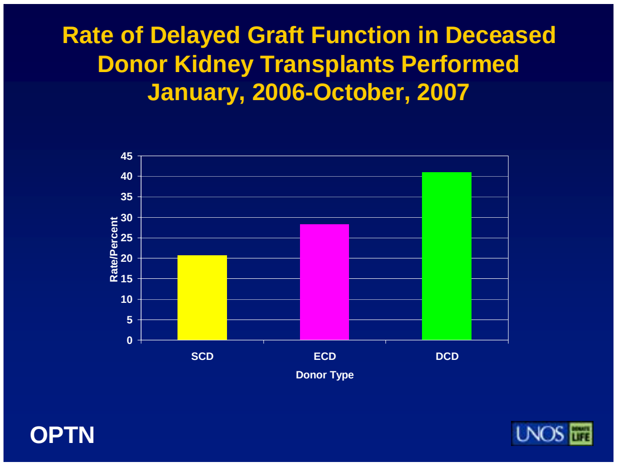
As of January 14, 2008, there were more than 74,000 candidates on the National Waiting List to receive a kidney transplant. The deceased kidney donor wait list continues to grow at an alarming rate paralleling the increase in the end-stage renal disease population. The HRSA Organ Donation Breakthrough Collaborative has been successful as evidenced by an increase in the number of organ donors recovered per year. However, there is a realization that a "gap" exists between the number of organ donors recovered and the number of organs per donor that are transplanted. This is particularly evident with respect to deceased donor kidneys in non-SCD categories.

Figure 1. Deceased Kidney Donors Recovered and Deceased Donor Kidney Transplants Performed



The need to avoid discard of transplantable kidneys while achieving acceptable graft survival outcomes is paramount to achieving the HRSA established Program Goals for kidney transplantation over the next decade (document available at http://www.optn.org/resources/governmentResources.asp). Since meeting the demand for renal transplantation has been limited by the absolute numbers of SCD kidneys, the transplant community has extended the use of ECD and DCD donor kidneys. ECD kidneys are at an increased risk for delayed graft function and overall poorer outcome due to donor related factors such as hypertensive changes, advanced age, and a higher percentage of glomerulosclerosis. As shown in figure 2, DCD kidneys are also at risk for higher rates of delayed graft function (DGF) when compared to SCD kidneys.

Figure 2. Rate of Delayed Graft Function in Deceased Donor Kidney Transplants



Machine perfusion has been an acceptable preservation method for kidneys for more than four decades. Unlike the method of cold storage, objective data can be obtained during the process of machine preservation. Clinicians may use this data to help determine the suitability of a donor kidney for transplantation as well as using machine perfusion methods to limit DGF, especially with increasing cold ischemic times (CIT). Currently, many OPOs across the United States are using machine preservation methods to expand the number of transplantable kidneys, particularly non-SCD kidneys.

As part of their charge to establish practices to increase the supply of donated organs and to examine factors that might limit the number of discards of donated organs, the OPTN/UNOS Organ Availability Committee (OAC) has reviewed data and literature regarding renal machine preservation of deceased donor kidneys including the renal machine perfusion practices of organ procurement organizations (OPOs) and transplant centers, the effect of renal machine perfusion on delayed graft function (DGF) and the relationship of machine perfusion to discard and graft survival in SCD, ECD, and DCD donors. In the fall of 2006, then OPTN/UNOS President Dr. Sue McDiarmid M.D. charged the Committee with determining whether a new policy in support of machine preservation should be considered for non-SCD deceased donor kidneys. In answer to this charge, the Committee has prepared this Summary Document for the OPTN/UNOS Board of Directors.

Data Summary

Over the past three years, the OAC has reviewed numerous analyses regarding renal machine perfusion. Inferential analyses were provided by the SRTR in response to specific requests by the Committee. In addition, the Committee reviewed descriptive requests provided by the OPTN, various published papers, presentations at the Collaborative DSA Kidney Challenge in April, 2007, preliminary results of a study examining the financial impacts, and the preliminary results of the prospective European multi-center trial on machine preservation.

Current Trends in Machine Perfusion.

A survey of executive directors regarding the use of machine perfusion in donation service areas (DSAs) was reviewed. The survey asked the following questions:

- does your OPO pump;
- what type of equipment is used;
- is everything pumped or is it a selective process; and
- when the OPO pumps, is it considered therapeutic or diagnostic.

Results as of January 2007 indicate:

- 38 of 55 responding OPOs currently pump;
- one OPO out sources this service, and four planned to begin utilizing machine perfusion by the end of 2007;
- at least two OPOs in each OPTN region currently pump; and
- of those that responded to the last question, seven OPOs pump for only diagnostic reasons; 23 OPOs pump for both diagnostic and therapeutic reasons; and no OPOs indicated they pump for only therapeutic reasons.

OPTN data also demonstrate the increase in the use of machine perfusion across the country. During 2006, 30% of the total deceased donor kidney transplants were pumped kidneys (22% from SCD, 47% from ECD, and 68% from DCD). This is a substantial increase from the 26% in 2005 of deceased donor kidney transplants that were machine perfused. This trend appears to be continuing with the first ten months of 2007 showing machine perfusion being used in 33% of deceased donor kidney transplants performed.

Pumping and Delayed Graft Function (DGF). Since 2005, the SRTR has presented the Committee with multiple analyses regarding the impact of machine perfusion on the rate of delayed graft function in deceased donor kidney transplants. Specifically, the SRTR performed both a kidney-level and an OPO-level analysis to quantify the impact of pumping on various types of deceased donor kidney transplants. These analyses were based on transplants performed between January 1, 2001 and July 31, 2004. Table 1 summarizes the results from the eight adjusted models. The OPO level models test whether there is an association between the percentage of transplanted kidneys pumped at an OPO and the odds of DGF. The kidney level models test whether there is an association between pumping an individual transplanted kidney and its odds of DGF. The SRTR interpretations of the two different types of models indicates that for all kidneys, kidneys at an OPO that pumps 100% have significantly reduced odds of DGF compared to kidneys at an OPO that pumps 0% (AOR=0.52, p=0.0140). In the model for all kidneys, with pumping at the kidney level, a kidney that is pumped has about half (0.56 times) the odds of DGF as a non-pumped kidney (p<0.0001). The results are similar for each subgroup of kidneys: SCD, DCD and ECD, except that the odds of DGF for DCD kidneys are not significantly reduced.

Table 1. Adjusted Logistic Regression for DGF

		OPO Level		Kidney Level	
Transplant Population	N	OR for 100% vs. 0%	p-value	OR for pumped vs. not	p-value
All	30,815	0.52	0.0140	0.56	< 0.0001
SCD	23,682	0.45	< 0.0001	0.51	< 0.0001
DCD	1,211	0.64	0.1143	0.76	0.1177
ECD	4,709	0.50	0.0083	0.58	< 0.0001

The committee reviewed additional SRTR data regarding the benefits of pumping kidneys in decreasing DGF. A summary of these results are detailed in Table 2. It was noted that pumping a kidney at any point post-procurement is beneficial when compared to not being pumped at all. In the adjusted analysis, the rate of DGF is significantly less when a kidney is pumped at one location and even lower when pumped at both the OPO and transplanting hospital. Additional data in Table 3 showed that if the kidney is not pumped, DGF increases and is further increased by longer cold ischemic times that can be limited by pumping.

Table 2. Unadjusted and Adjusted Models for Delayed Graft Function, 7/1/04 – 6/30/05

		Unadjusted		**Adjusted***	
	N	**OR**	**p**	**OR**	**p**
Non-DCD	15,640	1.00	Ref	1.00	Ref
DCD	1,249	2.76	< 0.0001	3.19	< 0.0001
Not Pumped	12,663	1.00	Ref	1.00	Ref
Pumped by OPO only	1,500	0.94	0.60	0.72	0.003
Pumped by Center only	996	0.80	0.14	0.64	0.005
Pumped by OPO and Center	1,730	0.66	0.06	0.50	0.001

*Adjusted for donor age, sex, race, hypertension status, diabetic status, cause of death, creatinine and ECD status, recipient age, sex, race, cause of ESRD and PRA, HLA matching, ABO compatibility, shared status and cold ischemia time.

Table 3. Adjusted Models for Delayed Graft Function by Cold Ischemia Time and Pumped Status Categories, 7/1/04-5/1/06

Pumped		**CIT**								
OPO	**Center**	**< 12**			**12-24**			**24+**		
		N	**AOR**	**p**	**N**	**AOR**	**p**	**N**	**AOR**	**p**
Yes	Yes	330	0.70	0.251	821	0.90	0.581	285	1.33	0.212
No	Yes	79	1.08	0.837	364	0.86	0.467	380	1.28	0.199
Yes	No	181	0.93	0.667	736	1.47	0.039	297	1.86	0.002
No	No	3246	1.00	REF	5854	1.34	0.033	1915	2.13	< .0001

* Adjusted for donor age, sex, race, hypertension status, diabetic status, cause of death, creatinine and ECD status, recipient age, sex, race, cause of ESRD and PRA, HLA matching, ABO compatibility, and shared status.

In addition to the data presented by the SRTR, a recent peer reviewed study published in the American Journal of Transplantation in 2006 and based on data submitted to OPTN/UNOS evaluated the impact of renal machine perfusion on DGF and graft survival in ECD kidneys from January 2000 to December 2003. Of the 4618 kidneys, 912 were machine perfused. It was noted that the three-year graft survival of machine perfused ECD kidneys was similar to cold-stored ECD kidneys, although the machine perfused ECD kidneys had greater risk factors in both the donor and recipient for reduced graft outcomes. Additionally, there was a decreased risk for DGF in the machine perfused group compared to the cold-stored group. The authors concluded this decreased risk for DGF in ECD kidneys might possibly trend toward lowering overall transplantation costs. (Matsuoka, L. et al. AJT 2006; 6: 1473-1478)

Pumping and Kidney Discards. Using the same cohort as the analyses performed to determine the impact of pumping on DGF (Table 1), the SRTR provided the Committee with both a kidney-level and an OPO-level analysis of the impact of pumping on the rate of kidney discard. A summary of the eight adjusted models is provided in Table 3. Unlike the analyses of DGF, the overall results and those for SCD and DCD kidneys differed between the two types of analyses. SRTR data in Table 3 show no statistically significant change in kidney discard at the OPO level but there is a significantly lower discard rate for pumped kidneys at the kidney level for all kidney populations (SCD, ECD, DCD).

Table 4. Adjusted Logistic Regression for Discard

		OPO Level		Kidney Level	
Recovered Kidney Population	N	AOR for 100% vs. 0%	p-value	AOR for pumped vs. not	p-value
All	39,793	1.08	0.8922	0.55	< 0.0001
SCD	30,594	1.54	0.2722	0.65	0.0365
DCD	1,548	1.03	0.9499	0.52	0.0164
ECD	7,911	0.68	0.3830	0.47	< 0.0001

To investigate these conflicting results between the OPO and Kidney level analyses, the SRTR examined data to determine whether there are differences in the quality of kidneys selected for pumping and discard between OPOs with different pumping practices. A scale of kidney quality based on projected 1 year graft survival was developed by the SRTR. Higher values indicated better quality kidneys. Kidney pumping and discard practices were summarized by High (pumped >50%) vs. Low (pumped some kidneys, but less than half) pumping OPOs.

The results are shown in Tables 5-8. Using this SRTR developed methodology for assigning kidney quality, for all categories of kidneys Low pumping OPOs pumped lower quality kidneys (85.6) than those not pumped (87.73) and discarded more pumped than not-pumped. High pumping OPOs pumped better quality kidneys (88.58) than those not pumped (87.22) and discarded more not-pumped than pumped kidneys. For ECD kidneys, Low pumping OPOs pumped lower quality kidneys (88.62) than those not pumped (89.21) and discarded more pumped than not-pumped. High pumping OPOs pumped better quality kidneys (89.80) than those not pumped (88.94) and discarded more not-pumped than pumped.

Table 5. Organ Quality by Pumping and Discard Status – All Kidneys/Low Pumping OPOs

Percent of Kidneys Discarded in Low Pumping OPOs		
Pumped	Not Pumped	Total
22.55%	13.79%	14.64%

Organ Quality* Discarded in Low Pumping OPOs			
	Pumped N=4062	Not Pumped N=38069	Total N=42131
Discarded N=6166	82.59	82.37	82.40
Not Discarded N=35965	86.48	88.59	88.40
Total N=42131	85.60	87.73	87.52

Table 6. Organ Quality by Pumping and Discard Status – All Kidneys/High Pumping OPOs

Percent of Kidneys Discarded in High Pumping OPOs		
Pumped	Not Pumped	Total
8.16%	29.67%	14.32%

Organ Quality* Discarded in High Pumping OPOs			
	Pumped N=3896	**Not Pumped N=1564**	**Total N=5460**
Discarded N=782	84.70	83.29	83.86
Not Discarded N=4678	88.92	88.88	88.91
Total N=5460	88.58	87.22	88.19

Table 7. Organ Quality by Pumping and Discard Status – ECD Kidneys/Low Pumping OPOs

Percent of Kidneys Discarded in Low Pumping OPOs		
Pumped	**Not Pumped**	**Total**
33.88%	42.48%	40.79%

Organ Quality* Discarded in Low Pumping OPOs			
	Pumped N=1656	**Not Pumped N=6770**	**Total N=8426**
Discarded N=3437	80.20	79.19	79.36
Not Discarded N=4989	82.13	82.36	82.31
Total N=8426	81.47	81.01	81.10

Table 8. Organ Quality by Pumping and Discard Status – ECD Kidneys/High Pumping OPOs

Percent of Kidneys Discarded in High Pumping OPOs		
Pumped	**Not Pumped**	**Total**
22.54%	67.38%	37.89%

Organ Quality* Discarded in High Pumping OPOs			
	Pumped N=630	**Not Pumped N=328**	**Total N=958**
Discarded N=363	81.48	80.03	80.60
Not Discarded N=595	83.25	82.39	83.10
Total N=958	82.85	80.80	82.15

One possible explanation for these results is that a selection bias for kidney quality exists between High and Low pumping OPOs. High pumping OPOs may pump kidneys they are likely to use (better quality), and discard a higher percentage of kidneys that they do not pump. Low pumping OPOs may pump kidneys they are less likely to use (lower quality), and discard a higher percentage of kidneys that they pump. For ECD kidneys, both High and Low pumping OPOs may pump higher quality kidneys and discard a higher percentage of kidneys that are not pumped. For every category the difference in discard between pumped/not pumped is much greater for High than Low pumping OPOs.

The Committee surmised that the quality of kidneys pumped and discarded likely varies from OPO to OPO. This variation in perfusion practice would create selection bias and could explain the conflicting findings between the OPO level and kidney level data. The Committee noted that beginning January 2008, eligible death data will be collected by the OPTN. At their next meeting, the Committee requested additional data from the OPTN separating the DSAs by their kidney utilization rate (based on two kidneys recovered). The effect of pumping on utilization rates will be examined. A future directive of the Committee is to review data on utilization rates of OPO's that have been pumping greater than two years.
A presentation was also given on *DSA Kidney Utilization after Beginning Machine Perfusion*. The data concluded that for each donor type (SCD, DCD, ECD), DSAs with the highest percentage of kidneys pumped also had the highest median kidneys transplanted per donor; however the results were inconsistent among the other categories of pumping.

Table 9. Distribution of Kidneys Transplanted Per Donor by DSA Pumping Practice, All Donor Types Combined: July, 2006-June, 2007

	Kidneys Transplanted Per Donor				
	Number of DSAs	**Min**	**Median**	**Max**	**Mean**
DSA Pumping					
0%	12	1.30	1.47	1.76	1.49
>0% - < 15%	14	1.18	1.42	1.72	1.48
15% - <40%	17	1.16	1.48	1.82	1.49
40% - <70%	12	1.21	1.44	1.66	1.44
70%+	3	1.47	1.68	1.72	1.63

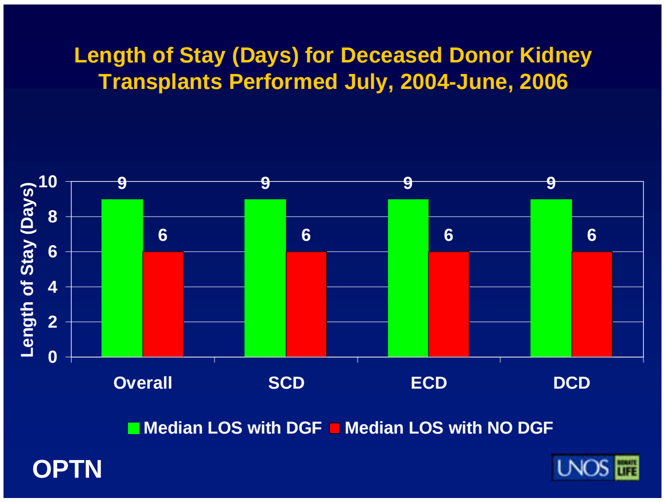
In addition, the Vice Chair updated the Committee on unpublished results from a European multi-center trial on kidney preservation that was completed fall 2007. This trial compared machine perfused and cold stored kidneys. The trial used kidneys from 337 donors (674 kidneys, age >16). Both kidneys for each donor were used. The endpoints of the study include DGF, primary non function, serum creatinine, creatinine clearance, DGF duration, length of stay, and acute rejection for 1, 3, 6 and 12 months. Preliminary six month data (n=337) demonstrated that kidneys machine perfused had less primary non function (p=0.04), less DGF (20.8%vs.26.5%; p=0.05), and decreased duration of DGF (8 days vs. 13 days; p=0.001). Machine perfusion decreased the overall risk for DGF (odds ratio of 0.62).

Financial Implications. At its October 2006 meeting, guest presenter Dr. Mark Schnitzler, PhD presented data about the impact of machine perfusion on the life-year benefit and cost-effectiveness of kidney transplants using the United States Renal Data System (USRDS) data from 1999-2002. It was noted that the pumping experience in 1970 is the same as the pumping experience in 2006. Recipients of pumped SCD kidneys cost less in their lifetime post-transplant because they have fewer complications and therefore cost less to care for overall. More specifically, pumping costs $3,000.00 but during the life of the patient, the cost savings is between $10,000.00 and $15,000.00 for patients not requiring dialysis. Recipients of pumped ECD kidneys also have decreased healthcare costs of $8000 during their lifetimes compared to those patients receiving a non-pumped kidney. As far as total costs of treatment, dialysis is the most expensive ($79,000.00); ECD transplants are less expensive ($54,000.00) than dialysis; DCD transplants are less expensive ($44,000.00) than ECD; and SCD transplants cost the least ($41,000.00). Conclusions from his presentation were: machine preservation is likely cost saving at prices up to $5,000.00 per use; much of the cost savings accrues after the transplant admission; there are large potential benefits available if machine perfusion expands the ECD organ pool; financial advantages occur for the OPO in limiting discard rates and for the transplant center by limiting DGF; and pumping all types of kidneys cost less than dialysis.

The Vice-Chair presented to the Committee an analysis from one DSA on the costs of machine preservation. This information had been previously presented at a 2007 AOPO meeting. At this particular DSA, an increase in the cost per kidney occurred during the first year of instituting machine preservation. However, by year two the DSA was able to increase kidney utilization by recovering kidneys from donors who previously would have been identified as liver only donors. This increased utilization resulted in a lowered overall cost per kidney than had been obtained in the years prior to implementation of machine preservation.

As a surrogate marker for cost, the Committee also examined the impact of DGF on length of stay (LOS). OPTN data noted that kidney recipients with DGF had a three day longer LOS compared to those recipients without DGF regardless of the type of kidney they received.

Figure 3. Length of Stay for Deceased Donor Kidney Transplants Stratified by Donor Type and Delayed Graft Function for Transplants July, 2004-June, 2006



Conclusions

The Committee concludes that good evidence exists to support the use of machine preservation in decreasing the risk for DGF, particularly in ECD kidneys. Decreased risk for DGF likely has implications for post-transplantation costs as reflected in shorter length of hospital stays and less need for dialysis. SRTR analyses by OPO pumping practice and an informal survey of OPO executive directors suggest that machine preservation is used by the transplant community both as a diagnostic and therapeutic tool.

The impact of machine preservation on kidney graft outcomes was not clearly elucidated by the data reviewed by the Committee, although benefit was inferred in two published studies that utilized OPTN/UNOS data for their analyses (Matsuoka L., et al. in AJT 2006; 6: 1473-1478 and Schold JD., et al in AJT 2005; 5: 1681-1688). Selection bias is suggested by the contradictory findings between the OPO and kidney level analyses of machine preservation on kidney discard. OPTN/UNOS data as it is currently collected does not allow for a clear understanding of the relationship between pumping and kidney discard. Eligible death data will be collected beginning January 2008. Examination of utilization rates may provide more detail about machine preservation use in terms of expanding the number of kidneys accepted for transplantation, especially in the non-SCD categories. The Committee concludes that at the current time data is not sufficiently robust to proceed with a mandatory machine preservation policy based on kidney categories (SCD, ECD, DCD).

Machine preservation remains a controversial topic within the transplant community--its merits and disadvantages hotly debated. One year results of the European multi-center trial on machine preservation will hopefully be available soon and may help define the role of machine preservation in deceased donor kidneys. In the interim, the expanded use of non-SCD kidneys will likely continue if the transplant community is to meet the rising demand for kidney transplantation and HRSA Program Goals. Machine preservation is one tool that is currently being used by many DSAs in a diagnostic or therapeutic manner to expand the kidney pool. The Committee concludes that access to this modality should be available to the transplant community.

The Committee holds the opinion that the information in this summary document should be disseminated into the greater transplant community by OPTN/UNOS. This could be accomplished through its relationships with other organ transplant/donation organizations such as the Association of Organ Procurement Organizations (AOPO), the North American Transplant Coordinators Organization (NATCO), the National Kidney Foundation (NKF) the American Society of Transplantation (AST), and the American Society of Transplant Surgeons (ASTS) as well as making it available on the UNOS, Organ Procurement and Transplantation Network (OPTN) and Scientific Registry of Transplant Recipients (SRTR) websites.

This Summary Document represents three years of OAC review of machine preservation for deceased donor kidneys. Numerous individuals of the transplant community have participated in the work of the Committee during this time. Their respective names are listed in the Appendix.

This Summary Document is respectively submitted to the OPTN/UNOS Board of Directors.

Lisa S. Florence MD
Chair
Organ Availability Committee
January 22, 2008

Brief List of Supporting Literature

Pulsatile perfusion reduces the incidence of delayed graft function in expanded criteria donor kidney transplantation. Matsuoka L., et al. in AJT 2006; 6: 1473-1478.

Donor treatment with phentolamine mesylate improves machine preservation dynamics and early renal allograft function. Polyak, M.R., et al. in Transplantation 2000; 69: 184-186.

Six-Year experience in continuous hypothermic pulsatile perfusion kidney preservation. Kwiatkowski A., et al. in Transplantation Proceedings 2001; 33: 913-915.

Machine perfusion for kidneys: how to do it at minimal cost. Balupuri, S. et al in Transplant International 2001; 14: 103-107.

Early function of kidneys stored by continuous hypothermic pulsatile perfusion can be predicted using a new “viability index”. Kosieradzki, M et al. in Transplantation Proceedings 2002; 34: 541-543.

NOS: the underlying mechanism preserving vascular integrity and during ex vivo warm kidney perfusion. Brasile, L. et al. in AJT 2003; 3: 674-679.

Pulsatile machine perfusion vs. cold storage of kidneys for transplantation: a rapid and systematic review. Wight J. et al in Clinical Transplantation 2003; 17: 293-307.

Revival of machine perfusion: new chances to increase the donor pool? An editorial in Expert Rev. Med. Devices 2005; 2 (1): 7-8.

Are we frozen in time? Analysis of the utilization and efficacy of pulsatile perfusion in renal transplantation. Schold JD. Et al in AJT 2005; 5: 1681-1688.

National impact of Pulsatile perfusion on cadaveric kidney transplantation. Burdick JF. Et al in Transplantation 1997; 64(12): 1730-1733.

Appendix

Name	Position	Term
Courtney Bland	Support Staff	2005-2007
Dawn Brim, RN	Regional 7 Representative	2007-2009
Stacey Burson	Support Staff	2007-2008
Suphamai Bunnapradist, MD	Regional 5 Representative	2004-2006
Philip Carlson, RNP	Regional 3 Representative	2006-2008
Dolph Chianchiano	BOD Liaison	2004-2006
Laura Christensen, MS	SRTR Liaison	2005-2007
Michelle Christensen	At Large	2005-2007
James Coates, MD	At Large	2004-2006
Jacqueline Colleran	At Large	2007-2009
John Davis	BOD Liaison	2003-2005
Niraj Desai, MD	Regional 8 Representative	2007-2009
Dale Distant, MD	Regional 9 Representative	2000-2002
Dale Distant, MD	Vice Chairman	2002-2004
Dale Distant, MD	Chairman	2004-2006
Dale Distant, MD	Ex. Officio	2007
Robert Esterl Jr. MD	Regional 4Representative	2004-2006
Douglas Farmer, MD	Regional 5Representative	2006-2008
Lisa Florence, MD	Regional 6 Representative	2002-2004
Lisa Florence, MD	Vice Chairman	2004-2006
**Lisa Florence, MD	Chairwoman	2006-2008
James Galloway, PhD	SRTR Liaison	2006-2008
Mary Ganikos, PhD	Ex. Officio	2005-2007
Stuart Greenstein, MD	Ex. Officio	2005
Michael Hagan, DO	At Large	2005
Patrick Healey, MD	Regional 6 Representative	2007-2008
David Hull, MD	Regional 1 Representative	2004-2006
**David Hull, MD	Vice Chairman	2006-2008
Madeleine Hess, PhD	Ex. Officio	2007
Adrian Jarquin-Valdivia, MD	At Large	2004-2006
Kim Johnson, MS	Support Staff	2005-2008
Myron Kauffman Jr., MD	Support Staff	2005-2007
Karen Kennedy, RN	Regional 2 Representative	2007-2009
Sharon Kiely, MD	Regional 2 Representative	2003-2005
Mark Laftavi, MD	Regional 9 Representative	2006-2008
Christopher McCullough, MD	Regional 3 Representative	2005-2007
Luis Morales, MD	Regional 3 Representative	2004-2006
Martin Mozes, MD	Regional 7 Representative	2003-2005
Mary Nachreiner, BSPT	BOD Liaison	2005
Stephen Oelrich	BOD Liaison	2005
Paul O’Flynn	Regional 11 Representative	2006-2008
Susan Orloff, MD	Regional 6 Representative	2004-2006
Jeff Orlowski, MS	At Large	2006-2008
Shane Pennington, RN	Regional 4 Representative	2006-2008
Dinesh Ranjan, MD	Regional 11 Representative	2003-2005

Deborah Savaria	At Large	2004-2006
James Schneider	Regional 9 Representative	2004-2006
Shelley Scholl	Regional 11 Representative	2005-2007
Charles Shield III, MD	Regional 8 Representative	2005-2007
Joshua Sonett, MD	At Large	2006
Clyde Spann Jr.	Regional 10 Representative	2004-2006
Randy Sung, MD	SRTR Liaison	2006-2008
Sarah Taranto	Support Staff	2005-2008
Christie Thomas, MD	At Large	2005-2009
Alice Thurston, Esq.	At Large	2005
Judy Jones Tisdale, PhD	BOD Liaison	2005-2006
David Van Thiel, MD	Regional 7 Representative	2005-2007
Bruce White	Regional 1 Representative	2004-2006
Laurel Williams, RN	Regional 8 Representative	2005
Emily Winn, RN	Regional 10 Representative	2006-2008