

APPENDIX I. Codes Used to Verify Medicare Status of Kidney Transplant Recipients in Medicare Inpatient and Carrier/Part B Files

CPT Codes	
CPT Code	CPT Code Label
00868	Anesthesia for extraperitoneal procedures in lower abdomen, including urinary tract; renal transplant (recipient)
50323	Backbench standard preparation of cadaver donor renal allograft prior to transplantation, including dissection and removal of perinephric fat, diaphragmatic and retroperitoneal attachments, excision of adrenal gland, and preparation of ureter(s), renal vein(s), and renal artery(s), ligating branches, as necessary
50325	Backbench standard preparation of living donor renal allograft (open or laparoscopic) prior to transplantation, including dissection and removal of perinephric fat and preparation of ureter(s), renal vein(s), and renal artery(s), ligating branches, as necessary
50327	Backbench reconstruction of cadaver or living donor renal allograft prior to transplantation; venous anastomosis, each
50328	Backbench reconstruction of cadaver or living donor renal allograft prior to transplantation; arterial anastomosis, each
50329	Backbench reconstruction of cadaver or living donor renal allograft prior to transplantation; ureteral anastomosis, each
50360	Renal allotransplantation, implantation of graft; without recipient nephrectomy
50365	Renal allotransplantation, implantation of graft; with recipient nephrectomy
50547	Laparoscopy, surgical; donor nephrectomy (including cold preservation), from living donor
ICD-9 Procedure Codes	
ICD-9 Code	ICD-9 Code Label
55.69	Other kidney transplantation
ICD-9 Diagnosis Codes	
996.81	Complications of transplanted kidney
V42.0	Kidney replaced by transplant

APPENDIX II. List of CMS Administrative Codes for Identifying Complications

Lymphoma

ICD-9 Code	ICD-9 Code Label
200	Lymphosarcoma and reticulosarcoma and other specified malignant tumors of lymphatic tissue
2001	Lymphosarcoma
20010	Lymphosarcoma, unspecified site, extranodal and solid organ sites
20011	Lymphosarcoma, lymph nodes of head, face, and neck
20012	Lymphosarcoma, intrathoracic lymph nodes
20013	Lymphosarcoma, intra-abdominal lymph nodes
20014	Lymphosarcoma, lymph nodes of axilla and upper limb
20015	Lymphosarcoma, lymph nodes of inguinal region and lower limb
20016	Lymphosarcoma, intrapelvic lymph nodes
20017	Lymphosarcoma, spleen
20018	Lymphosarcoma, lymph nodes of multiple sites
2002	Burkitt's tumor or lymphoma
20020	Burkitt's tumor or lymphoma, unspecified site, extranodal and solid organ sites
20021	Burkitt's tumor or lymphoma, lymph nodes of head, face, and neck
20022	Burkitt's tumor or lymphoma, intrathoracic lymph nodes
20023	Burkitt's tumor or lymphoma, intra-abdominal lymph nodes
20024	Burkitt's tumor or lymphoma, lymph nodes of axilla and upper limb
20025	Burkitt's tumor or lymphoma, lymph nodes of inguinal region and lower limb
20026	Burkitt's tumor or lymphoma, intrapelvic lymph nodes
20027	Burkitt's tumor or lymphoma, spleen
20028	Burkitt's tumor or lymphoma, lymph nodes of multiple sites
20030	Marginal zone lymphoma, unspecified site, extranodal and solid organ sites
20031	Marginal zone lymphoma, lymph nodes of head, face, and neck
20032	Marginal zone lymphoma, intrathoracic lymph nodes
20033	Marginal zone lymphoma, intraabdominal lymph nodes
20034	Marginal zone lymphoma, lymph nodes of axilla and upper limb
20035	Marginal zone lymphoma, lymph nodes of inguinal region and lower limb
20036	Marginal zone lymphoma, intrapelvic lymph nodes
20037	Marginal zone lymphoma, spleen
20038	Marginal zone lymphoma, lymph nodes of multiple sites
20040	Mantle cell lymphoma, unspecified site, extranodal and solid organ sites
20041	Mantle cell lymphoma, lymph nodes of head, face, and neck
20042	Mantle cell lymphoma, intrathoracic lymph nodes
20043	Mantle cell lymphoma, intra-abdominal lymph nodes
20044	Mantle cell lymphoma, lymph nodes of axilla and upper limb
20045	Mantle cell lymphoma, lymph nodes of inguinal region and lower limb
20046	Mantle cell lymphoma, intrapelvic lymph nodes
20047	Mantle cell lymphoma, spleen
20048	Mantle cell lymphoma, lymph nodes of multiple sites
20050	Primary central nervous system lymphoma, unspecified site, extranodal and solid organ sites
20051	Primary central nervous system lymphoma, lymph nodes of head, face, and neck
20052	Primary central nervous system lymphoma, intrathoracic lymph nodes
20053	Primary central nervous system lymphoma, intra-abdominal lymph nodes
20054	Primary central nervous system lymphoma, lymph nodes of axilla and upper limb
20055	Primary central nervous system lymphoma, lymph nodes of inguinal region and lower limb
20056	Primary central nervous system lymphoma, intrapelvic lymph nodes
20057	Primary central nervous system lymphoma, spleen
20058	Primary central nervous system lymphoma, lymph nodes of multiple sites

20060	Anaplastic large cell lymphoma, unspecified site, extranodal and solid organ sites
20061	Anaplastic large cell lymphoma, lymph nodes of head, face, and neck
20062	Anaplastic large cell lymphoma, intrathoracic lymph nodes
20063	Anaplastic large cell lymphoma, intra-abdominal lymph nodes
20064	Anaplastic large cell lymphoma, lymph nodes of axilla and upper limb
20065	Anaplastic large cell lymphoma, lymph nodes of inguinal region and lower limb
20066	Anaplastic large cell lymphoma, intrapelvic lymph nodes
20067	Anaplastic large cell lymphoma, spleen
20068	Anaplastic large cell lymphoma, lymph nodes of multiple sites
20070	Large cell lymphoma, unspecified site, extranodal and solid organ sites
20071	Large cell lymphoma, lymph nodes of head, face, and neck
20072	Large cell lymphoma, intrathoracic lymph nodes
20073	Large cell lymphoma, intra-abdominal lymph nodes
20074	Large cell lymphoma, lymph nodes of axilla and upper limb
20075	Large cell lymphoma, lymph nodes of inguinal region and lower limb
20076	Large cell lymphoma, intrapelvic lymph nodes
20077	Large cell lymphoma, spleen
20078	Large cell lymphoma, lymph nodes of multiple sites
2008	Other named variants of lymphosarcoma and reticulosarcoma
20080	Other named variants of lymphosarcoma and reticulosarcoma, unspecified site, extranodal and solid organ sites
20081	Other named variants of lymphosarcoma and reticulosarcoma, lymph nodes of head, face, and neck
20082	Other named variants of lymphosarcoma and reticulosarcoma, intrathoracic lymph nodes
20083	Other named variants of lymphosarcoma and reticulosarcoma, intra-abdominal lymph nodes
20084	Other named variants of lymphosarcoma and reticulosarcoma, lymph nodes of axilla and upper limb
20085	Other named variants of lymphosarcoma and reticulosarcoma, lymph nodes of inguinal region and lower limb
20086	Other named variants of lymphosarcoma and reticulosarcoma, intrapelvic lymph nodes
20087	Other named variants of lymphosarcoma and reticulosarcoma, spleen
20088	Other named variants of lymphosarcoma and reticulosarcoma, lymph nodes of multiple sites
201	Hodgkin's disease
2010	Hodgkin's paragranuloma
20100	Hodgkin's paragranuloma, unspecified site, extranodal and solid organ sites
20101	Hodgkin's paragranuloma, lymph nodes of head, face, and neck
20102	Hodgkin's paragranuloma, intrathoracic lymph nodes
20103	Hodgkin's paragranuloma, intra-abdominal lymph nodes
20104	Hodgkin's paragranuloma, lymph nodes of axilla and upper limb
20105	Hodgkin's paragranuloma, lymph nodes of inguinal region and lower limb
20106	Hodgkin's paragranuloma, intrapelvic lymph nodes
20107	Hodgkin's paragranuloma, spleen
20108	Hodgkin's paragranuloma, lymph nodes of multiple sites
2011	Hodgkin's granuloma
20110	Hodgkin's granuloma, unspecified site, extranodal and solid organ sites
20111	Hodgkin's granuloma, lymph nodes of head, face, and neck
20112	Hodgkin's granuloma, intrathoracic lymph nodes
20113	Hodgkin's granuloma, intra-abdominal lymph nodes
20114	Hodgkin's granuloma, lymph nodes of axilla and upper limb
20115	Hodgkin's granuloma, lymph nodes of inguinal region and lower limb
20116	Hodgkin's granuloma, intrapelvic lymph nodes
20117	Hodgkin's granuloma, spleen
20118	Hodgkin's granuloma, lymph nodes of multiple sites
2012	Hodgkin's sarcoma
20120	Hodgkin's sarcoma, unspecified site, extranodal and solid organ sites
20121	Hodgkin's sarcoma, lymph nodes of head, face, and neck
20122	Hodgkin's sarcoma, intrathoracic lymph nodes
20123	Hodgkin's sarcoma, intra-abdominal lymph nodes

20124	Hodgkin's sarcoma, lymph nodes of axilla and upper limb
20125	Hodgkin's sarcoma, lymph nodes of inguinal region and lower limb
20126	Hodgkin's sarcoma, intrapelvic lymph nodes
20127	Hodgkin's sarcoma, spleen
20128	Hodgkin's sarcoma, lymph nodes of multiple sites
2014	Hodgkin's disease, lymphocytic-histiocytic predominance
20140	Hodgkin's disease, lymphocytic-histiocytic predominance, unspecified site, extranodal and solid organ sites
20141	Hodgkin's disease, lymphocytic-histiocytic predominance, lymph nodes of head, face, and neck
20142	Hodgkin's disease, lymphocytic-histiocytic predominance, intrathoracic lymph nodes
20143	Hodgkin's disease, lymphocytic-histiocytic predominance, intra-abdominal lymph nodes
20144	Hodgkin's disease, lymphocytic-histiocytic predominance, lymph nodes of axilla and upper limb
20145	Hodgkin's disease, lymphocytic-histiocytic predominance, lymph nodes of inguinal region and lower limb
20146	Hodgkin's disease, lymphocytic-histiocytic predominance, intrapelvic lymph nodes
20147	Hodgkin's disease, lymphocytic-histiocytic predominance, spleen
20148	Hodgkin's disease, lymphocytic-histiocytic predominance, lymph nodes of multiple sites
2015	Hodgkin's disease, nodular sclerosis
20150	Hodgkin's disease, nodular sclerosis, unspecified site, extranodal and solid organ sites
20151	Hodgkin's disease, nodular sclerosis, lymph nodes of head, face, and neck
20152	Hodgkin's disease, nodular sclerosis, intrathoracic lymph nodes
20153	Hodgkin's disease, nodular sclerosis, intra-abdominal lymph nodes
20154	Hodgkin's disease, nodular sclerosis, lymph nodes of axilla and upper limb
20155	Hodgkin's disease, nodular sclerosis, lymph nodes of inguinal region and lower limb
20156	Hodgkin's disease, nodular sclerosis, intrapelvic lymph nodes
20157	Hodgkin's disease, nodular sclerosis, spleen
20158	Hodgkin's disease, nodular sclerosis, lymph nodes of multiple sites
2016	Hodgkin's disease, mixed cellularity
20160	Hodgkin's disease, mixed cellularity, unspecified site, extranodal and solid organ sites
20161	Hodgkin's disease, mixed cellularity, lymph nodes of head, face, and neck
20162	Hodgkin's disease, mixed cellularity, intrathoracic lymph nodes
20163	Hodgkin's disease, mixed cellularity, intra-abdominal lymph nodes
20164	Hodgkin's disease, mixed cellularity, lymph nodes of axilla and upper limb
20165	Hodgkin's disease, mixed cellularity, lymph nodes of inguinal region and lower limb
20166	Hodgkin's disease, mixed cellularity, intrapelvic lymph nodes
20167	Hodgkin's disease, mixed cellularity, spleen
20168	Hodgkin's disease, mixed cellularity, lymph nodes of multiple sites
2017	Hodgkin's disease, lymphocytic depletion
20170	Hodgkin's disease, lymphocytic depletion, unspecified site, extranodal and solid organ sites
20171	Hodgkin's disease, lymphocytic depletion, lymph nodes of head, face, and neck
20172	Hodgkin's disease, lymphocytic depletion, intrathoracic lymph nodes
20173	Hodgkin's disease, lymphocytic depletion, intra-abdominal lymph nodes
20174	Hodgkin's disease, lymphocytic depletion, lymph nodes of axilla and upper limb
20175	Hodgkin's disease, lymphocytic depletion, lymph nodes of inguinal region and lower limb
20176	Hodgkin's disease, lymphocytic depletion, intrapelvic lymph nodes
20177	Hodgkin's disease, lymphocytic depletion, spleen
20178	Hodgkin's disease, lymphocytic depletion, lymph nodes of multiple sites
2019	Hodgkin's disease unspecified type
20190	Hodgkin's disease, unspecified type, unspecified site, extranodal and solid organ sites
20191	Hodgkin's disease, unspecified type, lymph nodes of head, face, and neck
20192	Hodgkin's disease, unspecified type, intrathoracic lymph nodes
20193	Hodgkin's disease, unspecified type, intra-abdominal lymph nodes
20194	Hodgkin's disease, unspecified type, lymph nodes of axilla and upper limb
20195	Hodgkin's disease, unspecified type, lymph nodes of inguinal region and lower limb
20196	Hodgkin's disease, unspecified type, intrapelvic lymph nodes
20197	Hodgkin's disease, unspecified type, spleen

20198	Hodgkin's disease, unspecified type, lymph nodes of multiple sites
202	Other malignant neoplasms of lymphoid and histiocytic tissue
2020	Nodular lymphoma
20200	Nodular lymphoma, unspecified site, extranodal and solid organ sites
20201	Nodular lymphoma, lymph nodes of head, face, and neck
20202	Nodular lymphoma, intrathoracic lymph nodes
20203	Nodular lymphoma, intra-abdominal lymph nodes
20204	Nodular lymphoma, lymph nodes of axilla and upper limb
20205	Nodular lymphoma, lymph nodes of inguinal region and lower limb
20206	Nodular lymphoma, intrapelvic lymph nodes
20207	Nodular lymphoma, spleen
20208	Nodular lymphoma, lymph nodes of multiple sites
2021	Mycosis fungoides
20210	Mycosis fungoides, unspecified site, extranodal and solid organ sites
20211	Mycosis fungoides, lymph nodes of head, face, and neck
20212	Mycosis fungoides, intrathoracic lymph nodes
20213	Mycosis fungoides, intra-abdominal lymph nodes
20214	Mycosis fungoides, lymph nodes of axilla and upper limb
20215	Mycosis fungoides, lymph nodes of inguinal region and lower limb
20216	Mycosis fungoides, intrapelvic lymph nodes
20217	Mycosis fungoides, spleen
20218	Mycosis fungoides, lymph nodes of multiple sites
2022	Sezary's disease
20220	Sezary's disease, unspecified site, extranodal and solid organ sites
20221	Sezary's disease, lymph nodes of head, face, and neck
20222	Sezary's disease, intrathoracic lymph nodes
20223	Sezary's disease, intra-abdominal lymph nodes
20224	Sezary's disease, lymph nodes of axilla and upper limb
20225	Sezary's disease, lymph nodes of inguinal region and lower limb
20226	Sezary's disease, intrapelvic lymph nodes
20227	Sezary's disease, spleen
20228	Sezary's disease, lymph nodes of multiple sites
2027	Peripheral t-cell lymphoma
20270	Peripheral T cell lymphoma, unspecified site, extranodal and solid organ sites
20271	Peripheral T cell lymphoma, lymph nodes of head, face, and neck
20272	Peripheral T cell lymphoma, intrathoracic lymph nodes
20273	Peripheral T cell lymphoma, intra-abdominal lymph nodes
20274	Peripheral T cell lymphoma, lymph nodes of axilla and upper limb
20275	Peripheral T cell lymphoma, lymph nodes of inguinal region and lower limb
20276	Peripheral T cell lymphoma, intrapelvic lymph nodes
20277	Peripheral T cell lymphoma, spleen
20278	Peripheral T cell lymphoma, lymph nodes of multiple sites
2028	Other malignant lymphomas
20280	Other malignant lymphomas, unspecified site, extranodal and solid organ sites
20281	Other malignant lymphomas, lymph nodes of head, face, and neck
20282	Other malignant lymphomas, intrathoracic lymph nodes
20283	Other malignant lymphomas, intra-abdominal lymph nodes
20284	Other malignant lymphomas, lymph nodes of axilla and upper limb
20285	Other malignant lymphomas, lymph nodes of inguinal region and lower limb
20286	Other malignant lymphomas, intrapelvic lymph nodes
20287	Other malignant lymphomas, spleen
20288	Other malignant lymphomas, lymph nodes of multiple sites
2029	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue
20290	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, unspecified site, extranodal and solid organ sites
20291	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, lymph nodes of head, face, and neck
20292	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, intrathoracic lymph nodes
20293	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, intra-

	abdominal lymph nodes
20294	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, lymph nodes of axilla and upper limb
20295	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, lymph nodes of inguinal region and lower limb
20296	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, intrapelvic lymph nodes
20297	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, spleen
20298	Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, lymph nodes of multiple sites
2038	Other immunoproliferative neoplasms
20380	Other immunoproliferative neoplasms, without mention of having achieved remission
20381	Other immunoproliferative neoplasms, in remission
20382	Other immunoproliferative neoplasms, in relapse
2733	Macroglobulinemia

Sepsis

ICD-9 Code	ICD-9 Code Label
0380	Streptococcal septicemia
0381	Staphylococcal septicemia
0382	Pneumococcal septicemia [Streptococcus pneumoniae septicemia]
0383	Septicemia due to anaerobes
0384	Septicemia due to other gram-negative organisms
03840	Septicemia due to gram-negative organism, unspecified
03841	Septicemia due to hemophilus influenzae [H. influenzae]
03842	Septicemia due to escherichia coli [E. coli]
03843	Septicemia due to pseudomonas
03844	Septicemia due to serratia
03849	Other septicemia due to gram-negative organisms
0388	Other specified septicemias
0389	Unspecified septicemia
03810	Staphylococcal septicemia, unspecified
03811	Methicillin susceptible Staphylococcus aureus septicemia
03812	Methicillin resistant Staphylococcus aureus septicemia
03819	Other staphylococcal septicemia
78552	Septic shock
7907	Bacteremia

Melanoma

ICD-9 Code	ICD-9 Code Label
172	Malignant melanoma of skin
1720	Malignant melanoma of skin of lip
1721	Malignant melanoma of skin of eyelid, including canthus
1722	Malignant melanoma of skin of ear and external auditory canal
1723	Malignant melanoma of skin of other and unspecified parts of face
1724	Malignant melanoma of skin of scalp and neck
1725	Malignant melanoma of skin of trunk, except scrotum
1726	Malignant melanoma of skin of upper limb, including shoulder
1727	Malignant melanoma of skin of lower limb, including hip
1728	Malignant melanoma of other specified sites of skin
1729	Melanoma of skin, site unspecified

APPENDIX III. Resource Utilization-Based Cost Accounting and Calculation of Medicare Payments

1. Facility and Accommodation Costs from the Inpatient File:

- a. Accommodations:
 - i. Determine number of inpatient critical care and non-critical care days from revenue centers in the Inpatient file.
 - ii. Multiply number of critical care/non-critical care days by average daily cost for each type (adjusted to 2008 values using CPI-M, hospital component - CCM: \$3,913.15; Non-CCM: \$1,282.51)

Non-Critical Care Revenue Centers	Critical Care Revenue Centers
0100-0101 All-inclusive rate-room and board	0200-0209 Intensive care
0110-0119 Private medical or general	0210-0213, 0219 Coronary care
0120-0129 Semi-private 2 bed (medical or general)	
0130-0139 Semi-private 3 and 4 beds	
0140-0149 Private (deluxe)	
0150-0159 Room & Board ward (medical or general)	
0160, 0164, 0167 Other Room & Board	

- b. Operating Room Time Cost (index admission only)
 - i. Determine operating room time using “best anesthesia chart time,” if available; If best anesthesia time missing, use claim anesthesia time from Physician/Carrier (Part B) file; if both best chart time and claim time missing, assign each patient median best anesthesia time by procedure
 - ii. Multiply anesthesia time by mean of OR time cost range and inflate to 2008 dollars (\$18.03/minute)
- b. Emergency Room Visit Fixed Costs (post-discharge only)
 - i. For post-discharge Part B records only, separate records into line items and locate place of service code 23 (“Emergency Room – Hospital”)
 - ii. Treat each unique ER date as separate visit, sum visits per patient
- c. Multiply by average ER visit cost, inflated to 2008 dollars (\$415.39)

2. Service Costs from Carrier/Part B and Outpatient Files: (Note: Office visits, Home Care, SNF, and non-ER Outpatient use only section 2 methods)

- a. Separate line items from Part B (each includes patient ID, CPT code, units count, place of service)
- b. Anesthesia - if first two digits of CPT code are 00 or 01, code indicates anesthesia billing
 - i. Apply standard CMS base units (2008 list) to each CPT code; if applicable, anesthesia modifier AD reduces base units to 3 per procedure for medical supervision
 - ii. Since time units count reflects anesthesia time in minutes divided by 1.5, divide reported time by 10 to determine number of 15-minute anesthesia time units
 - iii. Add base and time units for each line item, multiply by \$20.03 (un-weighted mean of locality conversion factors, number needs to be revised once national CF available); If applicable, anesthesia modifier QK reduces total AVUs by 50% of allowed rate for medical direction of multiple procedures
 - iv. Sum anesthesia line item costs by patient
- c. Other Services - apply method to all non-anesthesia Part B line items
 - i. Merge line item CPT with AMA CPT/RVU list (2008 file) to determine RVU for each
 - ii. Using place of service codes, determine whether facility or non-facility RVU is appropriate – for this cost estimate, treat outpatient hospitals as “non-facility” sites of care to adjust for facility component of service costs
 - iii. Multiply RVUs by line item service count (=1 in 99% of non-anesthesia cases)
 - iv. Multiply total RVUs by conversion factor (\$38.09 in 2008)
 - v. Sum line item costs by patient

3. Time Frame Under Assessment for Resource Utilization-based Cost Accounting:

- a. In-hospital costs account for all patient claims during the time period of the index hospitalization
- b. 365-day costs account for all in-hospital costs, plus any other bills (ER visits, and any bills in the Outpatient and Carrier/Part B files) that occurred within 365 days of admission, and any bills accrued during the entirety of any readmission that began within 365 days of admission.

See next page for summary equation of the cost calculation

4. Summary Equation:

$$C_{itx} = (D_{inp}^{CC} * 3,913.15 + D_{inp}^{NCC} * 1,282.51) + (T_{OR} * 18.03) + AU * 20.03 + ED * 415.39 + \sum RVU_j * 38.09$$

where:

D_{inp}^{CC} = number of days in Critical Care

D_{inp}^{NCC} = number of days on hospital floor

T_{OR} = number of minutes in operating room

AU = number of Anesthesia Units

ED = number of emergency department (ED) visits

RVU_j = number of all j RVUs from all bills over the defined time period that includes all outpatient visits

$$C_{itx,365} = C_{itx} + FC$$

where:

C_{itx} = index transplant hospitalization cost as defined above

$FC = FC$ = post-transplant costs, including future hospitalizations accounted as the transplant hospitalization was above, as well as subsequent ED visits, outpatient visits, and physician bills

5. Payments calculation steps:

Inpatient Hospital (Part A) File

- **Components**
 - Payment Made by Medicare: Claim Payment Amount (SAS alias: PMT_AMT) + (Claim Pass Through Per Diem Amount (SAS alias: PER_DIEM) * Claim Utilization Day Count (SAS alias: UTIL_DAY))
 - Payment Made by Beneficiary: NCH Beneficiary Inpatient Deductible Amount (SAS alias: DED_AMT) + NCH Beneficiary Part A Coinsurance Liability Amount (SAS alias: COIN_AMT) + NCH Beneficiary Blood Deductible Liability Amount (SAS alias: BLDDDEDAM)
 - Payment Made by Primary Payer: NCH Primary Payer Claim Paid Amount (SAS alias: PRPAYAMT)
- **Inpatient Payment = PMT_AMT + (PER_DIEM*UTIL_DAY) + DED_AMT + COIN_AMT + BLDDDEDAM + PRPAYAMT**

Outpatient File

- **Components**
 - Payment Made by Medicare: Claim Payment Amount (SAS alias: PMT_AMT)
 - Payment Made by Beneficiary: NCH Beneficiary Part B Coinsurance Liability Amount (SAS alias: PTB_COIN) + NCH Beneficiary Part B Deductible Amount (SAS alias: PTB_DED) + NCH Beneficiary Blood Deductible Liability Amount (SAS alias: BLDDDEDAM)
 - Payment Made by Primary Payer: NCH Primary Payer Claim Paid Amount (SAS alias: PRPAYAMT)
- **Outpatient Payment = PMT_AMT + PTB_COIN + PTB_DED +BLDDDEDAM + PRPAYAMT**

Physician/Carrier (Part B) File

- **Components**
 - Payment Made by Medicare: Claim Payment Amount (SAS alias: PMT_AMT)
 - Payment Made by Beneficiary: Carrier Claim Cash Deductible Applied Amount (SAS alias: DEDAPPLY) + SUM of Line Coinsurance Amount (SAS alias: COINAMT)
 - Payment Made by Primary Payer: Carrier Claim Payer Paid Amount (SAS alias: PRPAYAMT)
- **Part B Payment = PMT_AMT + DEDAPPLY + (sum of COINAMT lines 1 to 13) + PRPAYAMT**

Final Total Payments

- Merge together the IP, OP, and PB payment amounts for each patient and take the sum
- Inflate payments to 2008 dollars

APPENDIX IV. Supplemental Tables and Figures

TABLE S1. Complete matching characteristics

Alemtuzumab Match								
Covariate	All Alemtuzumab Cases N = 5,332	Matched Alemtuzumab Cases N = 5,330	Matched rATG Controls N = 5,330	All rATG Controls N = 21,168	Standardized Difference before Match	P-value before Match	Standardized Difference after Match	P-value after Match
Mean Age	50.5	50.5	50.6	50.2	0.03	0.068	0.00	0.854
Age 65-90 (%)*	858 (16)	857 (16)	857 (16)	3324 (16)	0.01	0.488	0.00	1.000
Male (%)	3186 (60)	3185 (60)	3201 (60)	12489 (59)	0.02	0.319	-0.01	0.767
Black race (%)*	1384 (26)	1382 (26)	1382 (26)	6431 (30)	-0.10	< 0.001	0.00	1.000
Median neighborhood income (\$)	42763	42766	42103	42519	0.02	0.566	0.04	0.460
Prior Kidney Transplant (%)*	604 (11)	603 (11)	603 (11)	3228 (15)	-0.12	< 0.001	0.00	1.000
Peak PRA (%)*								
0-20%	3489 (65)	3489 (65)	3489 (65)	13417 (63)	0.04	0.005	0.00	1.000
20-80%	608 (11)	608 (11)	608 (11)	2915 (14)	-0.07	< 0.001	0.00	1.000
80-100%	458 (9)	458 (9)	458 (9)	2452 (12)	-0.10	< 0.001	0.00	1.000
Missing	777 (15)	775 (15)	775 (15)	2384 (11)	0.10	< 0.001	0.00	1.000
HLA mismatch (%)*	4773 (90)	4772 (90)	4772 (90)	19134 (90)	-0.03	0.056	0.00	1.000
Transplant Year	2006.5	2006.5	2006.5	2006.2	0.17	< 0.001	0.01	0.779
Recipient BMI	27.7	27.7	27.6	27.6	0.03	0.193	0.02	0.903
Weight (kg)	81.0	81.0	80.8	80.4	0.03	0.076	0.01	0.872
Missing BMI (%)*	238 (4)	236 (4)	236 (4)	1944 (9)	-0.19	< 0.001	0.00	1.000
Missing Weight (%)	116 (2)	115 (2)	112 (2)	969 (5)	-0.13	< 0.001	0.00	0.893
Missing BMI & Weight (%)*	113 (2)	112 (2)	112 (2)	965 (5)	-0.14	< 0.001	0.00	1.000
Time on Dialysis (%)								
0-1 years	1084 (20)	1083 (20)	1118 (21)	3573 (17)	0.09	< 0.001	-0.02	0.416
1-3 years	1426 (27)	1426 (27)	1388 (26)	5181 (24)	0.05	< 0.001	0.02	0.416
3-6 years	1300 (24)	1300 (24)	1306 (25)	5531 (26)	-0.04	0.009	0.00	0.910
6-10 years	451 (8)	451 (8)	464 (9)	1825 (9)	-0.01	0.722	-0.01	0.678
>10 years	98 (2)	98 (2)	81 (2)	534 (3)	-0.05	0.003	0.02	0.228
Missing	973 (18)	972 (18)	973 (18)	4524 (21)	-0.08	< 0.001	0.00	1.000
Cause of ESRD (%)								
Glomerulonephritis	1040 (20)	1040 (20)	1035 (19)	4034 (19)	0.01	0.459	0.00	0.922
HTN	1079 (20)	1078 (20)	1041 (20)	4365 (21)	-0.01	0.544	0.02	0.382
PKD	410 (8)	410 (8)	382 (7)	1463 (7)	0.03	0.049	0.02	0.319
Congenital	77 (1)	77 (1)	65 (1)	336 (2)	-0.01	0.496	0.02	0.353
Other	1441 (27)	1440 (27)	1494 (28)	6506 (31)	-0.08	< 0.001	-0.02	0.250
Diabetes (%)	1769 (33)	1768 (33)	1771 (33)	6549 (31)	0.05	0.002	-0.00	0.967
Hepatitis C+ (%)	172 (3)	172 (3)	162 (3)	1230 (6)	-0.12	< 0.001	0.01	0.617
Donor type								
Living (%)	1858 (35)	1856 (35)	1880 (35)	6192 (29)	0.12	< 0.001	-0.01	0.641
Deceased (%)	2703 (51)	2703 (51)	2734 (51)	12186 (58)	-0.14	< 0.001	-0.01	0.561
Extended Criteria (%)	771 (14)	771 (15)	716 (13)	2790 (13)	0.04	0.015	0.03	0.131
Propensity score for receipt of Alemtuzumab	0.221	0.221	0.218	0.196	0.40	< 0.001	0.04	0.366
Immunosuppression (not used for match)								
MMF or Mycophenolate sodium	4532 (85)	4530 (85)	5070 (95)	20135 (95)	-0.34	< 0.001	-0.34	< 0.001

Prednisone use	1544 (29)	1543 (29)	3529 (66)	14685 (69)	-0.88	< 0.001	-0.81	< 0.001
Calcineurin or mTOR use								
Tacrolimus (%)	4516 (85)	4514 (85)	4590 (86)	17929 (85)	0.00	1.000	-0.04	0.040
Cyclosporine (%)	345 (6)	345 (7)	411 (8)	1876 (9)	-0.09	< 0.001	-0.05	0.014
Sirolimus (%)	74 (1)	74 (1)	122 (2)	499 (2)	-0.07	< 0.001	-0.07	< 0.001
None (%)	397 (7)	397 (7)	207 (4)	864 (4)	0.14	< 0.001	0.15	< 0.001

* Variable matched exactly

Abbreviations: rATG – rabbit antithymocyte globulin. PRA – Panel reactive antibody; HLA – human leukocyte antibody; BMI – body mass index; ESRD – end-stage renal disease; MMF – mycophenolate mofetile; mTOR – mammalian target of rapamycin

Basiliximab Match								
Covariate	All Basiliximab Cases N = 9,391	Matched Basiliximab Cases N = 9,378	Matched rATG Controls N = 9,378	All rATG Controls N = 21,168	Standardized Difference before Match	P-value before Match	Standardized Difference after Match	P-value after Match
Mean Age	51.3	51.3	51.3	50.2	0.08	< 0.001	0.00	0.884
Age 65-90 (%)*	1763 (19)	1755 (19)	1755 (19)	3324 (16)	0.08	< 0.001	0.00	1.000
Male (%)	6000 (64)	5993 (64)	5928 (63)	12489 (59)	0.10	< 0.001	0.01	0.332
Black race (%)*	1787 (19)	1781 (19)	1781 (19)	6431 (30)	-0.27	< 0.001	0.00	1.000
Median neighborhood income (\$)	42813	42798	43198	42519	0.02	0.107	-0.03	0.097
Prior Kidney Transplant (%)*	643 (7)	640 (7)	640 (7)	3228 (15)	-0.27	< 0.001	0.00	1.000
Peak PRA (%)*								
0-20%	6937 (74)	6931 (74)	6931 (74)	13417 (63)	0.23	< 0.001	0.00	1.000
20-80%	879 (9)	879 (9)	879 (9)	2915 (14)	-0.14	< 0.001	0.00	1.000
80-100%	401 (4)	400 (4)	400 (4)	2452 (12)	-0.27	< 0.001	0.00	1.000
Missing	1174 (13)	1168 (12)	1168 (12)	2384 (11)	0.04	0.002	0.00	1.000
HLA mismatch (%)*	8335 (89)	8330 (89)	8330 (89)	19134 (90)	-0.05	< 0.001	0.00	1.000
Transplant Year	2005.9	2005.9	2006.0	2006.2	-0.17	< 0.001	-0.02	0.232
Recipient BMI	27.4	27.4	27.4	27.6	-0.03	0.153	0.00	0.538
Weight (kg)	80.5	80.5	80.5	80.4	0.01	0.204	0.00	0.996
Missing BMI (%)*	583 (6)	573 (6)	573 (6)	1944 (9)	-0.11	< 0.001	0.00	1.000
Missing Weight (%)	215 (2)	210 (2)	212 (2)	969 (5)	-0.13	< 0.001	0.00	0.961
Missing BMI & Weight (%)*	215 (2)	210 (2)	210 (2)	965 (5)	-0.13	< 0.001	0.00	1.000
Time on Dialysis (%)								
0-1 years	2011 (21)	2010 (21)	2043 (22)	3573 (17)	0.12	< 0.001	-0.01	0.570
1-3 years	2623 (28)	2618 (28)	2650 (28)	5181 (24)	0.08	< 0.001	-0.01	0.615
3-6 years	2144 (23)	2143 (23)	2180 (23)	5531 (26)	-0.08	< 0.001	-0.01	0.533
6-10 years	573 (6)	572 (6)	577 (6)	1825 (9)	-0.10	< 0.001	0.00	0.903
>10 years	126 (1)	126 (1)	126 (1)	534 (3)	-0.09	< 0.001	0.00	1.000
Missing	1914 (20)	1909 (20)	1802 (19)	4524 (21)	-0.02	0.052	0.03	0.052
Cause of ESRD (%)								
Glomerulonephritis	1842 (20)	1841 (20)	1844 (20)	4034 (19)	0.01	0.257	0.00	0.971
HTN	1764 (19)	1764 (19)	1785 (19)	4365 (21)	-0.05	< 0.001	-0.01	0.709
PKD	777 (8)	776 (8)	769 (8)	1463 (7)	0.05	< 0.001	0.00	0.873
Congenital	166 (2)	166 (2)	156 (2)	336 (2)	0.01	0.262	0.01	0.613
Other	2680 (29)	2673 (29)	2644 (28)	6506 (31)	-0.05	< 0.001	0.01	0.650
Diabetes (%)	3037 (32)	3032 (32)	3042 (32)	6549 (31)	0.03	0.015	0.00	0.888
Hepatitis C+ (%)	494 (5)	494 (5)	486 (5)	1230 (6)	-0.02	0.056	0.00	0.818
Donor type								
Living (%)	3368 (36)	3364 (36)	3336 (36)	6192 (29)	0.14	< 0.001	0.01	0.681
Deceased (%)	5050 (54)	5042 (54)	5018 (54)	12186 (58)	-0.08	< 0.001	0.01	0.736
Extended Criteria (%)	973 (10)	972 (10)	1024 (11)	2790 (13)	-0.09	< 0.001	-0.02	0.227
Propensity score for receipt of basiliximab	0.348	0.348	0.346	0.289	0.56	< 0.001	0.02	0.160
Immunosuppression (not used for match)								
MMF or Mycophenolate sodium	8848 (94)	8836 (94)	8932 (95)	20135 (95)	-0.04	0.001	-0.05	0.002
Prednisone use	8152 (87)	8143 (87)	6177 (66)	14685 (69)	0.43	< 0.001	0.52	< 0.001
Calcineurin or mTOR use								
Tacrolimus (%)	6491 (69)	6482 (69)	7792 (83)	17929 (85)	-0.38	< 0.001	-0.34	< 0.001
Cyclosporine (%)	1974 (21)	1972 (21)	970 (10)	1876 (9)	0.35	< 0.001	0.30	< 0.001
Sirolimus (%)	415 (4)	414 (4)	235 (3)	499 (2)	0.11	< 0.001	0.11	< 0.001

None (%)	511 (5)	510 (5)	381 (4)	864 (4)	0.06	< 0.001	0.06	< 0.001
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* Variable matched exactly

Abbreviations: rATG – rabbit antithymocyte globulin. PRA – Panel reactive antibody; HLA – human leukocyte antibody; BMI – body mass index; ESRD – end-stage renal disease; MMF – mycophenolate mofetile; mTOR – mammalian target of rapamycin

TABLE S2. Outcomes after kidney transplantation comparing elderly (age ≥ 65) matched pairs to non-elderly matched pairs; rabbit antithymocyte globulin (rATG) is the reference group

Hazard Ratio = Alemtuzumab vs. rATG or Basiliximab vs. rATG	Elderly Patients		Non-elderly Patients		Elderly vs. Non-elderly Interaction	
	Hazard Ratio (95% CI)	Paired Cox Model P- value	Hazard Ratio (95% CI)	Paired Cox Model P- value	Paired Cox Model Interaction Hazard Ratio (95% CI)	Paired Cox Model P- value
Alemtuzumab-rATG Matches						
Death	1.24 (1.02, 1.50)	0.030	1.11 (0.98, 1.25)	0.088*	1.12 (0.89, 1.40)	0.333
Death or allograft failure	1.25 (1.04, 1.51)	0.016	1.17 (1.06, 1.28)	0.001	1.08 (0.88, 1.32)	0.483
Death or sepsis	1.14 (0.95, 1.37)	0.171	0.89 (0.81, 0.98)	0.016	1.28 (1.04, 1.57)	0.021
Death or lymphoma	1.34 (1.04, 1.72)	0.023	1.09 (0.93, 1.27)	0.310*	1.23 (0.92, 1.66)	0.168
Death or melanoma	1.40 (1.09, 1.81)	0.009	1.08 (0.91, 1.27)	0.375*	1.30 (0.96, 1.76)	0.089
Basiliximab-rATG Matches						
Death	1.01 (0.89, 1.15)	0.869	1.11 (1.02, 1.21)	0.012	0.91 (0.78, 1.06)	0.222
Death or allograft failure	0.95 (0.84, 1.07)	0.397	1.06 (0.99, 1.14)	0.075*	0.89 (0.78, 1.03)	0.110
Death or sepsis	0.99 (0.87, 1.12)	0.844	1.07 (1.00, 1.15)	0.064	0.92 (0.80, 1.07)	0.291
Death or lymphoma	1.04 (0.87, 1.23)	0.694	1.15 (1.03, 1.30)	0.015	0.90 (0.73, 1.10)	0.302
Death or melanoma	1.01 (0.85, 1.2)	0.931	1.15 (1.02, 1.30)	0.021	0.88 (0.71, 1.08)	0.212
<p>Reference group = rATG Hazard ratios, 95% confidence intervals, and P-values computed using a paired Cox proportional hazards model. The paired Cox model interaction test adds an interaction term for elderly status and reports the outcome hazard for elderly patients vs. non-elderly patients. Outcomes that include those derived from Medicare claims (those using sepsis, lymphoma, melanoma) are censored at 3 years post-transplant * Subsequent analyses suggested that hazards were not proportional over time (see Kaplan-Meier figures). For alemtuzumab-rATG pairs, the five-year differences between pairs in death was 0.3% (-1.1%, 1.7%), while the three year differences between pairs in death or lymphoma were 0.8% (-0.5%, 2.2%) and five-year differences in death or melanoma were 0.6% (-0.8%, 2.1%). For basiliximab-rATG, the five-year differences between pairs in death or allograft failure was 1.3% (-0.1%, 2.6%). Confidence intervals were derived using bootstrapping.</p>						

TABLE S3. Outcomes after kidney transplantation, non-black matched pairs; rATG is the reference group

Subset of Matched Non-black Patients Only	Hazard Ratio	95% CI Lower	95% CI Upper	Paired Cox Model P-value
Alemtuzumab-rATG Match (N = 3,948 non-black matched pairs)				
Death	1.16	1.04	1.30	0.009
Death or allograft failure	1.25	1.14	1.38	<0.001
Death or sepsis	0.98	0.89	1.08	0.634
Death or lymphoma	1.14	0.98	1.34	0.089
Death or melanoma	1.15	0.98	1.34	0.091
Basiliximab-rATG Matches (N = 7,597 non-black matched pairs)				
Death	1.06	0.98	1.15	0.159
Death or allograft failure	1.00	0.94	1.07	0.917
Death or sepsis	1.05	0.98	1.12	0.209*
Death or lymphoma	1.12	1.01	1.25	0.036
Death or melanoma	1.11	1.00	1.24	0.056
Reference group = rATG Outcomes that include those derived from Medicare claims (those using sepsis, lymphoma, melanoma) are censored at 3 years post-transplant Hazard ratios, 95% confidence intervals, and P-values computed using a paired Cox proportional hazards model * Subsequent analyses suggested the possibility that hazards were non-proportional over time (see Table S6. The three-year difference with a bootstrapped confidence interval was 1.9% (0.3%, 3.2%).				

TABLE S4. The following grids show the counts among the alemtuzumab-rATG and basiliximab-rATG pairs for various combinations of the composite death, allograft failure, and acute rejection variable by one year.

The Stuart -Maxwell test was used to compare *any* differences in outcomes between the two agents across the grid.

McNemar's tests were performed on two additional outcomes derived from these grids: 1) any outcome versus healthy and alive without rejection or graft failure and 2) any acute rejection

These McNemar's tests showed that relative to rATG recipients, alemtuzumab and basiliximab recipients had significantly higher risk of any acute rejection after one year. Alemtuzumab patients also had significantly lower probability of being alive and healthy relative to rATG patients. The results for these analyses are included in the *Results* section of the main manuscript.

Odds of Rejection vs. No Rejection

Match	N Pairs	Case Rate (%)	Matched Control Rate (%)	Odds Ratio	Lower 95% CI	Upper 95% CI	P-value
Alemtuzumab to rATG	5,330	9.9	7.7	1.31	1.14	1.51	< 0.001
Basiliximab to rATG	9,378	8.1	7.1	1.16	1.04	1.30	0.007

P-values calculated using the McNemar test.

Compared to alemtuzumab and basiliximab matched pairs, rATG patients showed statistically different risk of the composite death, allograft failure, or acute rejection (Stuart-Maxwell $p < 0.01$). Alemtuzumab patients were 0.83 times less likely to be alive with no rejection or graft failure at one-year post-transplant relative to rATG patients (95% CI = 0.74, 0.93; $p < 0.01$). Relative to rATG recipients, alemtuzumab and basiliximab patients had higher odds of acute rejection by one year (alemtuzumab OR = 1.31; 95% CI = 1.14, 1.51, $p < 0.01$; basiliximab OR = 1.16; 95% CI = 1.04, 1.30, $p < 0.01$).

Composite Outcome	Alemtuzumab Cases N = 5,330	Matched rATG Controls N = 5,330	P-value*	Alemtuzumab Cases N = 5,330	Matched rATG Controls N = 5,330
Alive, Healthy (without Allograft Failure or Rejection)	4,495	4,618	>0.001	84.3%	86.6%
Alive + Rejection (without Allograft Failure)	403	347	0.038	7.6%	6.5%
Alive + Allograft Failure	237	183	0.007	4.4%	3.4%
Death (regardless of Allograft Failure or Rejection status)	195	182	0.523	3.7%	3.4%
Composite Outcome P-value[^]	0.004			100.0%	100.0%

* P-values for paired differences in the row's outcome were calculated using the McNemar test.

[^] The P-value for paired differences across all composite outcomes was calculated using the Stuart-Maxwell test.

Composite Outcome	Basiliximab Cases N = 9,378	Matched rATG Controls N = 9,378	P-value*	Basiliximab Cases N = 9,378	Matched rATG Controls N = 9,378
Alive, Healthy (without Allograft Failure or Rejection)	8,066	8,105	0.420	86.0%	86.4%
Alive + Rejection (without Allograft Failure)	642	570	0.035	6.8%	6.1%
Alive + Allograft Failure	270	318	0.049	2.9%	3.4%
Death (regardless of Allograft Failure or Rejection status)	400	385	0.607	4.3%	4.1%
Composite Outcome P-value[^]	0.036			100.0%	100.0%

* P-values for paired differences in the row's outcome were calculated using the McNemar test.

[^] The P-value for paired differences across all composite outcomes was calculated using the Stuart-Maxwell test.

TABLE S5. Time to outcome summary

	Alemtuzumab events N (%)	rATG events N (%)	Median Alemtuzumab follow-up days	Median rATG follow-up days
Alemtuzumab-rATG Match				
Death	944 (18%)	843 (16%)	1804	1818
Death or allograft failure	1501 (28%)	1305 (24%)	1654	1706
Death or sepsis	1289 (24%)	1340 (25%)	853.5	841
Death or lymphoma	531 (10%)	482 (9%)	1037	1057
Death or melanoma	506 (9%)	459 (9%)	1044	1060.5
Basiliximab-rATG Matches				
	Basiliximab events N (%)	rATG events N (%)	Median Basiliximab follow-up days	Median rATG follow-up days
Death	1902 (20%)	1753 (19%)	1996	2013
Death or allograft failure	2717 (29%)	2602 (28%)	1862	1867
Death or sepsis	2521 (27%)	2367 (25%)	980.5	991
Death or lymphoma	1023 (11%)	913 (10%)	1095.75	1095.75
Death or melanoma	979 (10%)	875 (9%)	1095.75	1095.75
Outcomes that include those derived from Medicare claims (those using sepsis, lymphoma, melanoma) are censored at 3 years post-transplant				
Number of days for follow-up reflect either an event or censor time for each outcome.				

TABLE S6. Cox proportional hazards models adjusting for case effect and adding case x time interactions to test non-proportionality

Analysis	Match (Case Group)	Outcome	N Pairs	Case x Time Interaction Hazard ratio	95% CI Lower	95% CI Upper	Paired Cox Model P-value
Primary Analysis	Alemtuzumab	Death	5330	1.05	0.98	1.13	0.162
Primary Analysis	Alemtuzumab	Death or allograft failure	5330	1.00	0.97	1.04	0.875
Primary Analysis	Alemtuzumab	Death or sepsis	5330	1.02	0.99	1.05	0.128
Primary Analysis	Alemtuzumab	Death or lymphoma	5330	1.09	1.01	1.17	0.020
Primary Analysis	Alemtuzumab	Death or melanoma	5330	1.08	0.98	1.19	0.117
Primary Analysis	Basiliximab	Death	9378	1.02	0.97	1.07	0.530
Primary Analysis	Basiliximab	Death or allograft failure	9378	1.03	1.00	1.05	0.041
Primary Analysis	Basiliximab	Death or sepsis	9378	1.02	1.00	1.05	0.028
Primary Analysis	Basiliximab	Death or lymphoma	9378	1.01	0.97	1.06	0.678
Primary Analysis	Basiliximab	Death or melanoma	9378	1.03	0.97	1.10	0.390
Both Prednisone	Alemtuzumab	Death	513	1.11	0.85	1.45	0.461
Both Prednisone	Alemtuzumab	Death or allograft failure	513	0.94	0.83	1.08	0.391
Both Prednisone	Alemtuzumab	Death or sepsis	513	1.07	0.96	1.19	0.238
Both Prednisone	Alemtuzumab	Death or lymphoma	513	0.99	0.69	1.43	0.971
Both Prednisone	Alemtuzumab	Death or melanoma	513	1.01	0.69	1.48	0.964
Both Prednisone	Basiliximab	Death	2882	0.91	0.82	1.01	0.075
Both Prednisone	Basiliximab	Death or allograft failure	2882	1.01	0.96	1.06	0.823
Both Prednisone	Basiliximab	Death or sepsis	2882	1.03	1.00	1.07	0.092
Both Prednisone	Basiliximab	Death or lymphoma	2882	0.92	0.83	1.01	0.090
Both Prednisone	Basiliximab	Death or melanoma	2882	0.82	0.70	0.96	0.015
Neither Prednisone	Alemtuzumab	Death	973	0.78	0.58	1.03	0.080
Neither Prednisone	Alemtuzumab	Death or allograft failure	973	0.90	0.79	1.03	0.123
Neither Prednisone	Alemtuzumab	Death or sepsis	973	0.97	0.90	1.05	0.442
Neither Prednisone	Alemtuzumab	Death or lymphoma	973	0.80	0.58	1.10	0.173
Neither Prednisone	Alemtuzumab	Death or melanoma	973	0.67	0.44	1.02	0.061
Neither Prednisone	Basiliximab	Death	299	1.08	0.60	1.96	0.795
Neither Prednisone	Basiliximab	Death or allograft failure	299	0.85	0.64	1.12	0.242
Neither Prednisone	Basiliximab	Death or sepsis	299	0.97	0.84	1.13	0.703
Neither Prednisone	Basiliximab	Death or lymphoma	299	0.40	0.13	1.18	0.095
Neither Prednisone	Basiliximab	Death or melanoma	299	0.51	0.20	1.32	0.164
Elderly	Alemtuzumab	Death	857	0.94	0.82	1.07	0.360
Elderly	Alemtuzumab	Death or allograft failure	857	0.96	0.90	1.04	0.325
Elderly	Alemtuzumab	Death or sepsis	857	1.00	0.95	1.07	0.902
Elderly	Alemtuzumab	Death or lymphoma	857	1.04	0.93	1.16	0.484
Elderly	Alemtuzumab	Death or melanoma	857	0.97	0.82	1.15	0.726
Elderly	Basiliximab	Death	1755	1.07	0.97	1.17	0.185
Elderly	Basiliximab	Death or allograft failure	1755	1.01	0.96	1.06	0.800
Elderly	Basiliximab	Death or sepsis	1755	1.04	1.00	1.09	0.052
Elderly	Basiliximab	Death or lymphoma	1755	1.08	0.97	1.21	0.176
Elderly	Basiliximab	Death or melanoma	1755	1.07	0.95	1.22	0.282
Non-Elderly	Alemtuzumab	Death	4473	1.11	1.02	1.22	0.020
Non-Elderly	Alemtuzumab	Death or allograft failure	4473	1.01	0.98	1.05	0.487
Non-Elderly	Alemtuzumab	Death or sepsis	4473	1.03	1.00	1.07	0.078
Non-Elderly	Alemtuzumab	Death or lymphoma	4473	1.13	1.02	1.24	0.016
Non-Elderly	Alemtuzumab	Death or melanoma	4473	1.15	1.01	1.30	0.031
Non-Elderly	Basiliximab	Death	7623	1.00	0.94	1.05	0.905
Non-Elderly	Basiliximab	Death or allograft failure	7623	1.03	1.00	1.06	0.030
Non-Elderly	Basiliximab	Death or sepsis	7623	1.02	0.99	1.04	0.163
Non-Elderly	Basiliximab	Death or lymphoma	7623	1.00	0.95	1.05	0.910
Non-Elderly	Basiliximab	Death or melanoma	7623	1.01	0.94	1.09	0.716
Non-Black	Alemtuzumab	Death	3948	1.06	0.97	1.15	0.194

Analysis	Match (Case Group)	Outcome	N Pairs	Case x Time Interaction Hazard ratio	95% CI Lower	95% CI Upper	Paired Cox Model P-value
Non-Black	Alemtuzumab	Death or Allograft Failure	3948	1.00	0.96	1.04	0.841
Non-Black	Alemtuzumab	Death or Sepsis	3948	1.02	0.98	1.05	0.321
Non-Black	Alemtuzumab	Death or Lymphoma	3948	1.08	1.00	1.16	0.053
Non-Black	Alemtuzumab	Death or Melanoma	3948	1.05	0.95	1.17	0.346
Non-Black	Basiliximab	Death	7597	1.01	0.96	1.07	0.633
Non-Black	Basiliximab	Death or Allograft Failure	7597	1.02	1.00	1.05	0.099
Non-Black	Basiliximab	Death or Sepsis	7597	1.03	1.01	1.06	<i>0.011</i>
Non-Black	Basiliximab	Death or Lymphoma	7597	1.01	0.96	1.06	0.771
Non-Black	Basiliximab	Death or Melanoma	7597	1.04	0.97	1.12	0.268

Hazard ratios, 95% confidence intervals, and P-values computed using a paired Cox proportional hazards model
Outcomes that include those derived from Medicare claims (those using sepsis, lymphoma or melanoma) are censored at 3 years post-transplant

TABLE S7. Three-year and five-year outcome estimates and bootstrapped differences

The table below presents outcome estimates derived from the Kaplan-Meier estimator and bootstrapped differences at five years for death and death or allograft failure and three years for Medicare-derived outcomes. Where Cox models did not meet the proportional hazards assumption, the Prentice-Wilcoxon test is also reported, using all available data for death and death or allograft failure and at 3 years of follow-up for Medicare outcomes. Neither the Prentice-Wilcoxon test nor time-specific estimates rely on the proportional hazards assumption.

Analysis	Match (Case Group)	Outcome	N Pairs	Time Point Assessed	Case Estimate (%)	Control Estimate (%)	Difference in % and Bootstrapped 95% CI	Paired Cox Model P-value	Prentice-Wilcoxon P-value*
Primary Analysis	Alemtuzumab	Death	5330	5 years	15.2	14.5	0.7 (-0.7, 2.1)	<0.01	
Primary Analysis	Alemtuzumab	Death or Allograft Failure	5330	5 years	25.9	22.9	3.0 (1.3, 4.7)	<0.001	
Primary Analysis	Alemtuzumab	Death or Sepsis	5330	3 years	27.8	28.6	-0.8 (-2.7, 1.0)	0.127	
Primary Analysis	Alemtuzumab	Death or Lymphoma	5330	3 years	12.4	11.0	1.3 (-0.1, 2.7)	0.037	0.102
Primary Analysis	Alemtuzumab	Death or Melanoma	5330	3 years	11.9	10.7	1.2 (0.0, 2.5)	0.029	
Primary Analysis	Basiliximab	Death	9378	5 years	16.3	15.2	1.2 (0.1, 2.2)	0.028	
Primary Analysis	Basiliximab	Death or Allograft Failure	9378	5 years	24.7	23.6	1.1 (-0.1, 2.4)	0.251	0.106
Primary Analysis	Basiliximab	Death or Sepsis	9378	3 years	29.7	27.8	1.9 (0.4, 3.2)	0.126	0.036
Primary Analysis	Basiliximab	Death or Lymphoma	9378	3 years	12.6	11.2	1.4 (0.4, 2.4)	0.025	
Primary Analysis	Basiliximab	Death or Melanoma	9378	3 years	12.1	10.8	1.3 (0.3, 2.3)	0.052	
Both Prednisone	Alemtuzumab	Death	513	5 years	14.7	12.4	2.3 (-2.2, 6.4)	0.072	
Both Prednisone	Alemtuzumab	Death or Allograft Failure	513	5 years	25.1	21.1	4.0 (-1.4, 9.3)	0.026	
Both Prednisone	Alemtuzumab	Death or Sepsis	513	3 years	31.5	26.3	5.2 (-1.0, 11.4)	0.460	
Both Prednisone	Alemtuzumab	Death or Lymphoma	513	3 years	10.3	10.1	0.2 (-3.9, 3.9)	0.821	
Both Prednisone	Alemtuzumab	Death or Melanoma	513	3 years	9.5	9.3	0.2 (-3.9, 4.1)	0.718	
Both Prednisone	Basiliximab	Death	2882	5 years	16.5	15.7	0.8 (-1.2, 2.8)	0.562	
Both Prednisone	Basiliximab	Death or Allograft Failure	2882	5 years	24.7	23.9	0.8 (-1.6, 3.2)	0.623	
Both Prednisone	Basiliximab	Death or Sepsis	2882	3 years	30.2	29.3	0.9 (-1.6, 3.5)	0.575	
Both Prednisone	Basiliximab	Death or Lymphoma	2882	3 years	12.1	12.4	-0.3 (-2.3, 1.5)	0.756	
Both Prednisone	Basiliximab	Death or Melanoma	2882	3 years	11.6	11.7	-0.1 (-1.9, 1.8)	0.783	0.907
Neither Prednisone	Alemtuzumab	Death	973	5 years	11.8	11.7	0.1 (-3.2, 3.2)	0.576	
Neither Prednisone	Alemtuzumab	Death or Allograft Failure	973	5 years	19.8	18.4	1.5 (-2.1, 5.1)	0.183	
Neither Prednisone	Alemtuzumab	Death or Sepsis	973	3 years	25.1	23.9	1.2 (-3.2, 5.6)	0.866	
Neither Prednisone	Alemtuzumab	Death or Lymphoma	973	3 years	11.3	10.0	1.3 (-2.2, 4.8)	0.167	

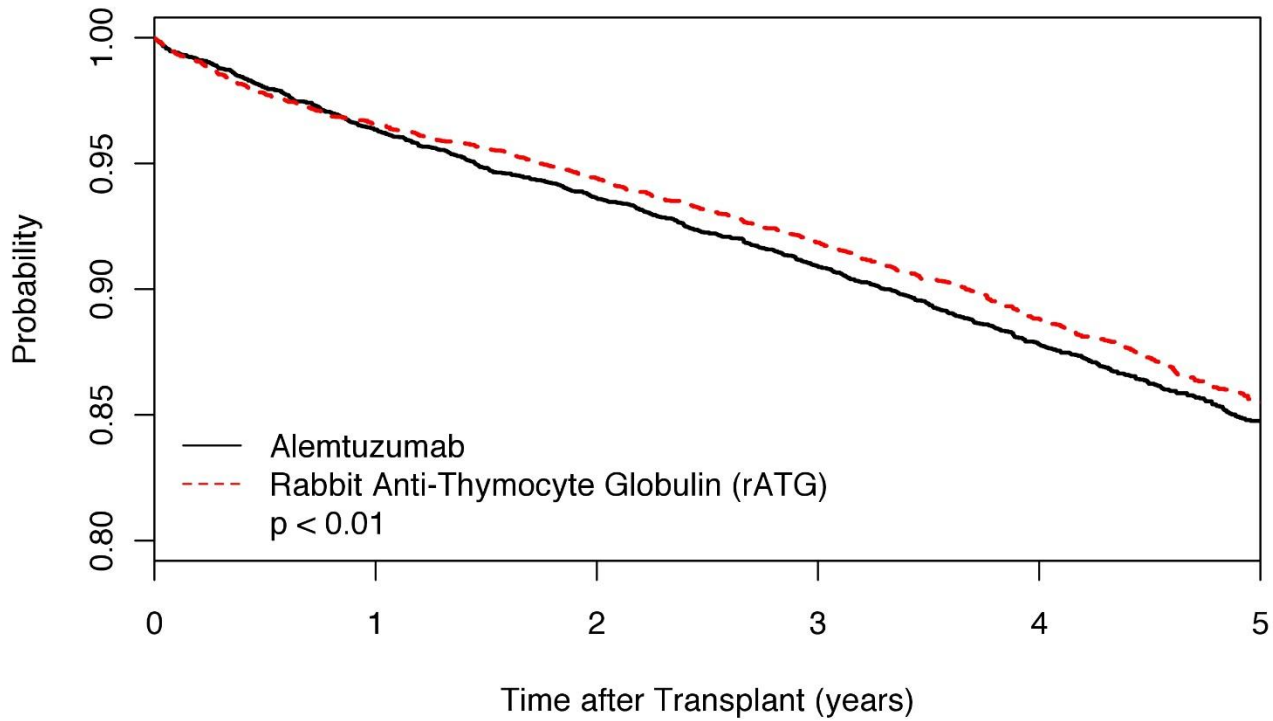
Analysis	Match (Case Group)	Outcome	N Pairs	Time Point Assessed	Case Estimate (%)	Control Estimate (%)	Difference in % and Bootstrapped 95% CI	Paired Cox Model P-value	Prentice-Wilcoxon P-value*
Neither Prednisone	Alemtuzumab	Death or Melanoma	973	3 years	10.5	9.6	0.8 (-2.4, 4.2)	0.245	
Neither Prednisone	Basiliximab	Death	299	5 years	14.1	12.7	1.3 (-4.6, 7.5)	0.553	
Neither Prednisone	Basiliximab	Death or Allograft Failure	299	5 years	19.0	16.6	2.4 (-4.0, 9.6)	0.357	
Neither Prednisone	Basiliximab	Death or Sepsis	299	3 years	24.8	19.3	5.5 (-1.6, 13.2)	0.916	
Neither Prednisone	Basiliximab	Death or Lymphoma	299	3 years	12.5	9.4	3.1 (-2.7, 8.1)	0.869	
Neither Prednisone	Basiliximab	Death or Melanoma	299	3 years	12.3	11.1	1.1 (-4.5, 7.1)	0.528	
Elderly	Alemtuzumab	Death	857	5 years	28.5	25.3	3.2 (-1.2, 7.7)	0.030	
Elderly	Alemtuzumab	Death or Allograft Failure	857	5 years	33.8	28.9	4.9 (0.6, 9.2)	0.016	
Elderly	Alemtuzumab	Death or Sepsis	857	3 years	38.2	35.8	2.5 (-2.7, 7.3)	0.171	
Elderly	Alemtuzumab	Death or Lymphoma	857	3 years	23.2	19.1	4.2 (-0.1, 8.6)	0.023	
Elderly	Alemtuzumab	Death or Melanoma	857	3 years	23.4	18.9	4.5 (0.0, 8.9)	0.009	
Elderly	Basiliximab	Death	1755	5 years	29.2	27.8	1.4 (-1.7, 4.7)	0.869	
Elderly	Basiliximab	Death or Allograft Failure	1755	5 years	32.8	32.6	0.2 (-2.9, 3.3)	0.397	
Elderly	Basiliximab	Death or Sepsis	1755	3 years	37.7	36.4	1.3 (-2.3, 4.6)	0.844	
Elderly	Basiliximab	Death or Lymphoma	1755	3 years	21.4	20.7	0.7 (-2.3, 3.5)	0.694	
Elderly	Basiliximab	Death or Melanoma	1755	3 years	21.2	20.7	0.5 (-2.5, 3.4)	0.931	
Non-Elderly	Alemtuzumab	Death	4473	5 years	12.7	12.4	0.3 (-1.1, 1.7)	0.088	0.096
Non-Elderly	Alemtuzumab	Death or Allograft Failure	4473	5 years	24.4	21.7	2.7 (0.7, 4.5)	0.001	
Non-Elderly	Alemtuzumab	Death or Sepsis	4473	3 years	25.8	27.2	-1.5 (-3.4, 0.6)	0.016	
Non-Elderly	Alemtuzumab	Death or Lymphoma	4473	3 years	10.2	9.4	0.8 (-0.5, 2.2)	0.310	0.482
Non-Elderly	Alemtuzumab	Death or Melanoma	4473	3 years	9.6	9.0	0.6 (-0.8, 2.1)	0.375	0.608
Non-Elderly	Basiliximab	Death	7623	5 years	13.4	12.3	1.1 (0.0, 2.2)	0.012	
Non-Elderly	Basiliximab	Death or Allograft Failure	7623	5 years	22.8	21.6	1.3 (-0.1, 2.6)	0.075	0.056
Non-Elderly	Basiliximab	Death or Sepsis	7623	3 years	27.8	25.8	2.0 (0.6, 3.4)	0.064	
Non-Elderly	Basiliximab	Death or Lymphoma	7623	3 years	10.6	9.0	1.6 (0.6, 2.6)	0.015	
Non-Elderly	Basiliximab	Death or Melanoma	7623	3 years	10.0	8.5	1.5 (0.5, 2.6)	0.021	
Non-Black	Alemtuzumab	Death	3948	5 years	15.9	14.7	1.1 (-0.6, 2.8)	0.009	
Analysis	Match (Case Group)	Outcome	N Pairs	Time Point	Case Estimate	Control Estimate	Difference in % and	Paired Cox	Prentice-Wilcoxon

				Assessed	(%)	(%)	Bootstrapped 95% CI	Model P-value	P-value*
Non-Black	Alemtuzumab	Death or Allograft Failure	3948	5 years	25.3	21.0	4.2 (2.4, 6.2)	< 0.001	
Non-Black	Alemtuzumab	Death or Sepsis	3948	3 years	27.8	28.0	-0.2 (-2.3, 1.9)	0.634	
Non-Black	Alemtuzumab	Death or Lymphoma	3948	3 years	12.4	11.0	1.4 (-0.2, 2.9)	0.089	
Non-Black	Alemtuzumab	Death or Melanoma	3948	3 years	12.1	10.9	1.1 (-0.5, 2.6)	0.091	
Non-Black	Basiliximab	Death	7597	5 years	15.7	14.8	0.9 (-0.2, 2.0)	0.159	
Non-Black	Basiliximab	Death or Allograft Failure	7597	5 years	22.5	21.9	0.6 (-0.8, 1.9)	0.917	
Non-Black	Basiliximab	Death or Sepsis	7597	3 years	28.5	26.6	1.9 (0.3, 3.2)	0.209	0.088
Non-Black	Basiliximab	Death or Lymphoma	7597	3 years	12.2	10.7	1.5 (0.3, 2.6)	0.036	
Non-Black	Basiliximab	Death or Melanoma	7597	3 years	11.9	10.4	1.5 (0.4, 2.6)	0.056	

*Presented only for Cox models that did not meet the proportional hazards assumption.

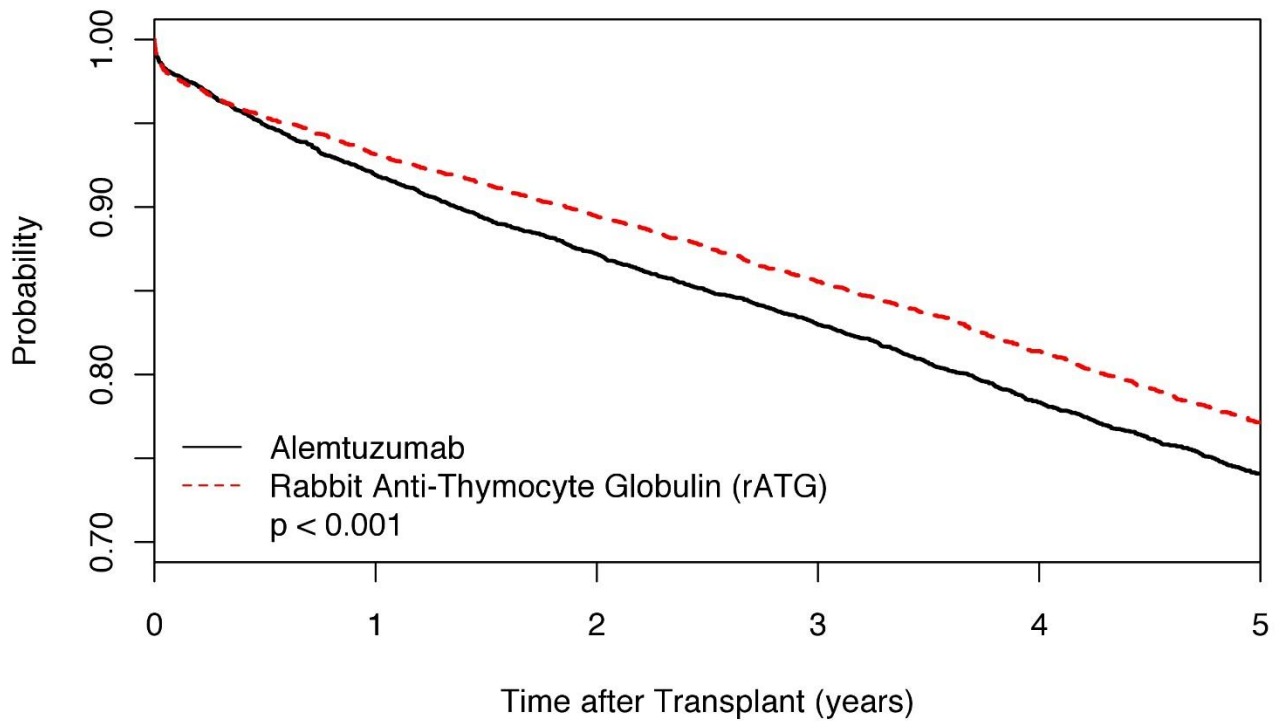
FIGURE S1a. Kaplan-Meier survival estimates alemtuzumab-rATG: survival (A), survival without allograft failure (B), survival without sepsis (C), survival without lymphoma (D), survival without melanoma (E)

(A) Survival



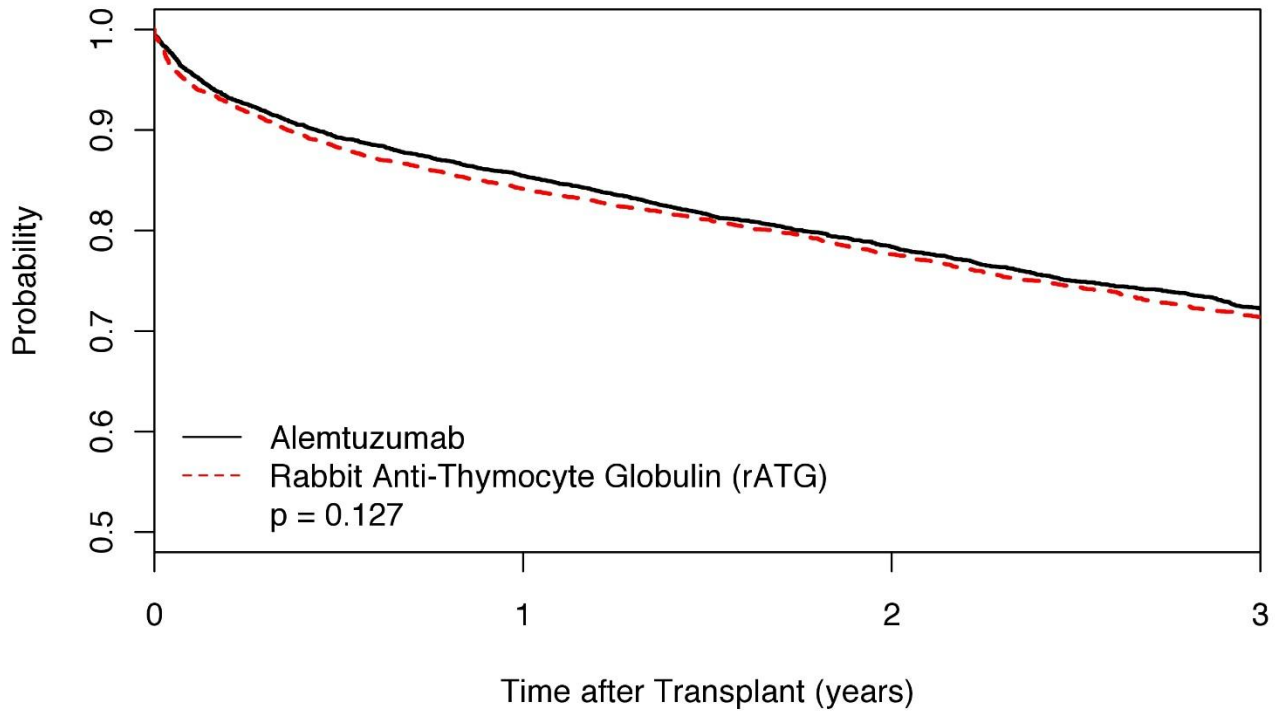
<u>Alemtuzumab</u>					
5330	5136	4991	4846	3613	2616
<u>Rabbit Anti-Thymocyte Globulin (rATG)</u>					
5330	5148	5033	4896	3716	2647

(B) Survival without Allograft Failure



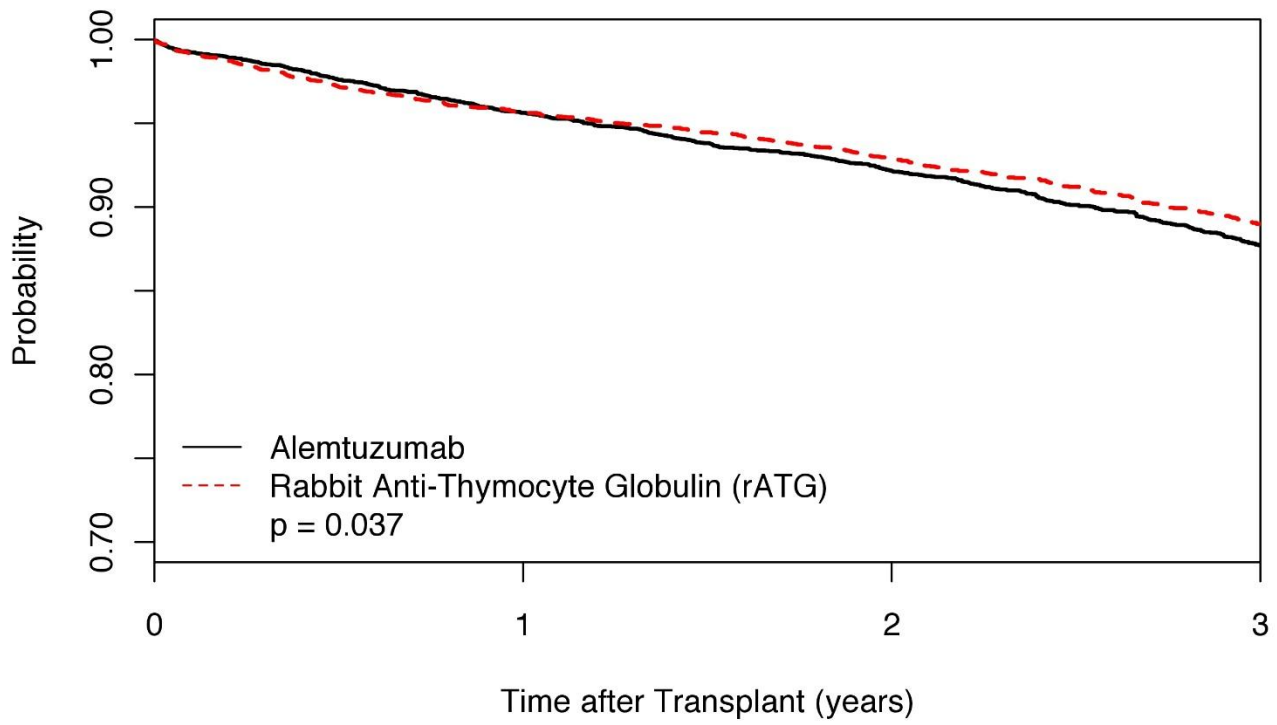
<u>Alemtuzumab</u>					
5330	4900	4649	4424	3200	2243
<u>Rabbit Anti-Thymocyte Globulin (rATG)</u>					
5330	4966	4768	4562	3393	2364

(C) Survival without Sepsis



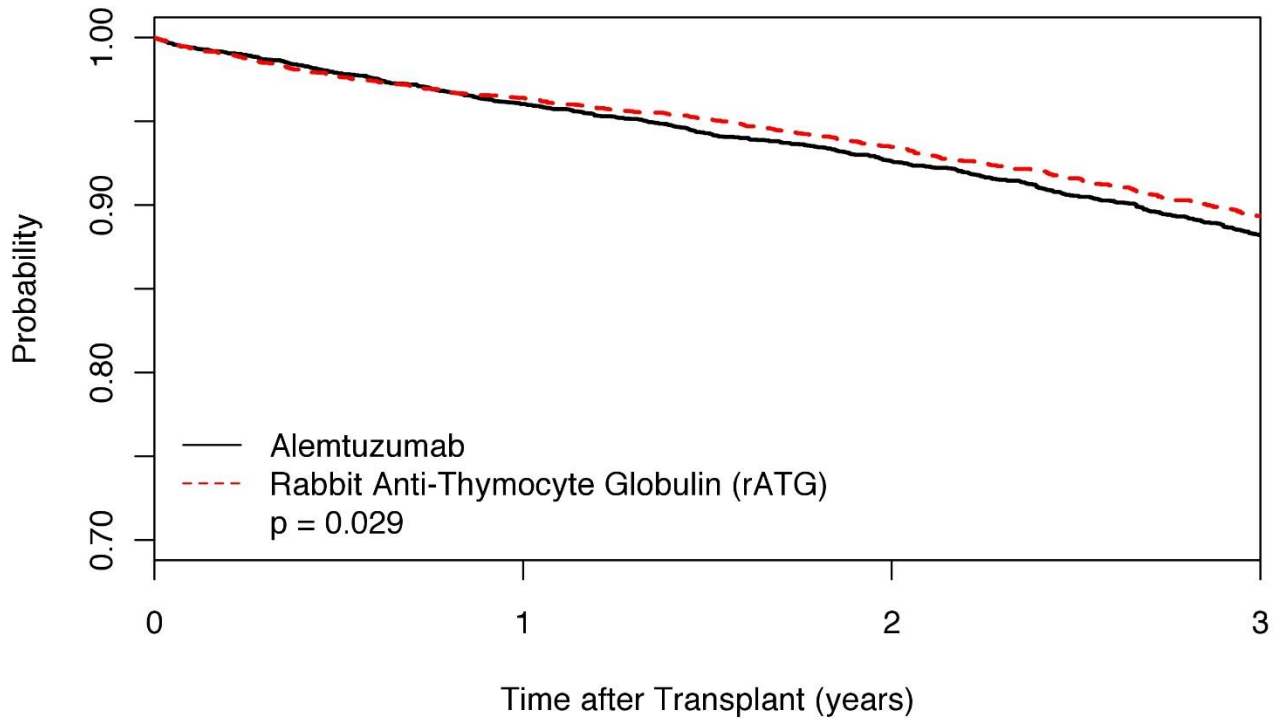
<u>Alemtuzumab</u>			
5330	4384	3003	2049
<u>Rabbit Anti-Thymocyte Globulin (rATG)</u>			
5330	4320	3021	2049

(D) Survival without Lymphoma



<u>Alemtuzumab</u>			
5330	4908	3550	2517
<u>Rabbit Anti-Thymocyte Globulin (rATG)</u>			
5330	4912	3630	2580

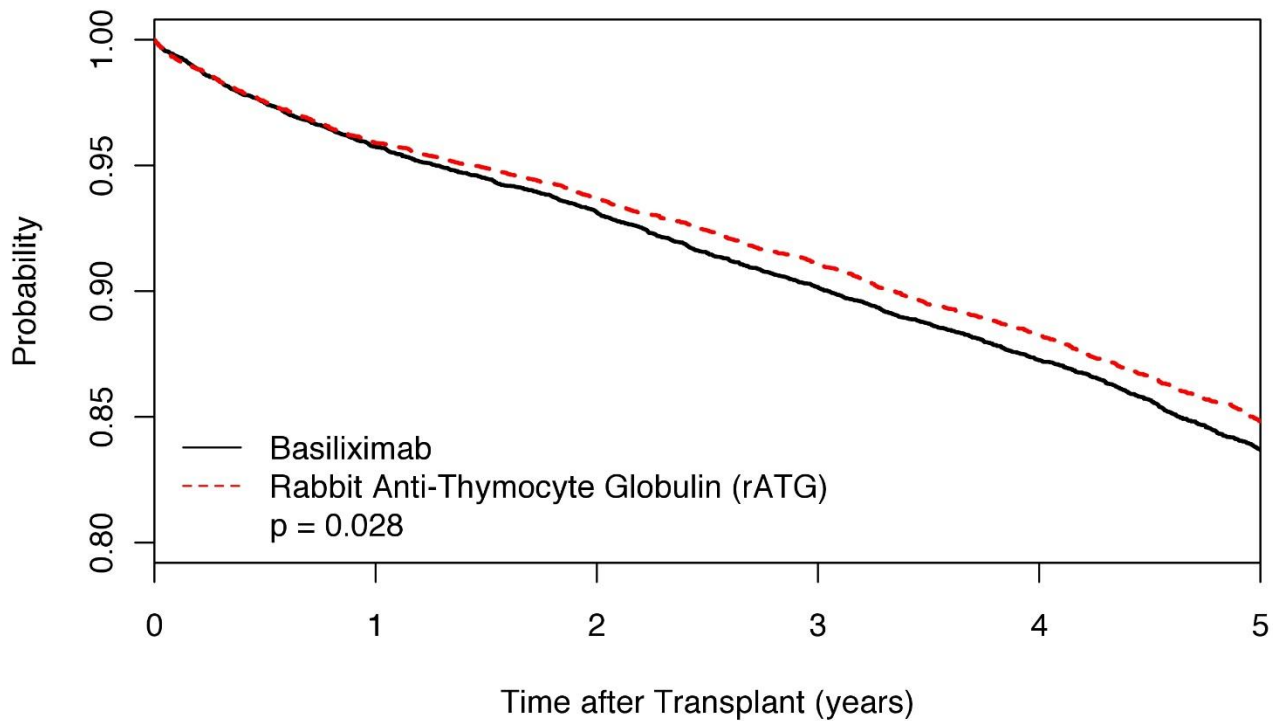
(E) Survival without Melanoma



<u>Alemtuzumab</u>			
5330	4929	3568	2534
<u>Rabbit Anti-Thymocyte Globulin (rATG)</u>			
5330	4949	3654	2590

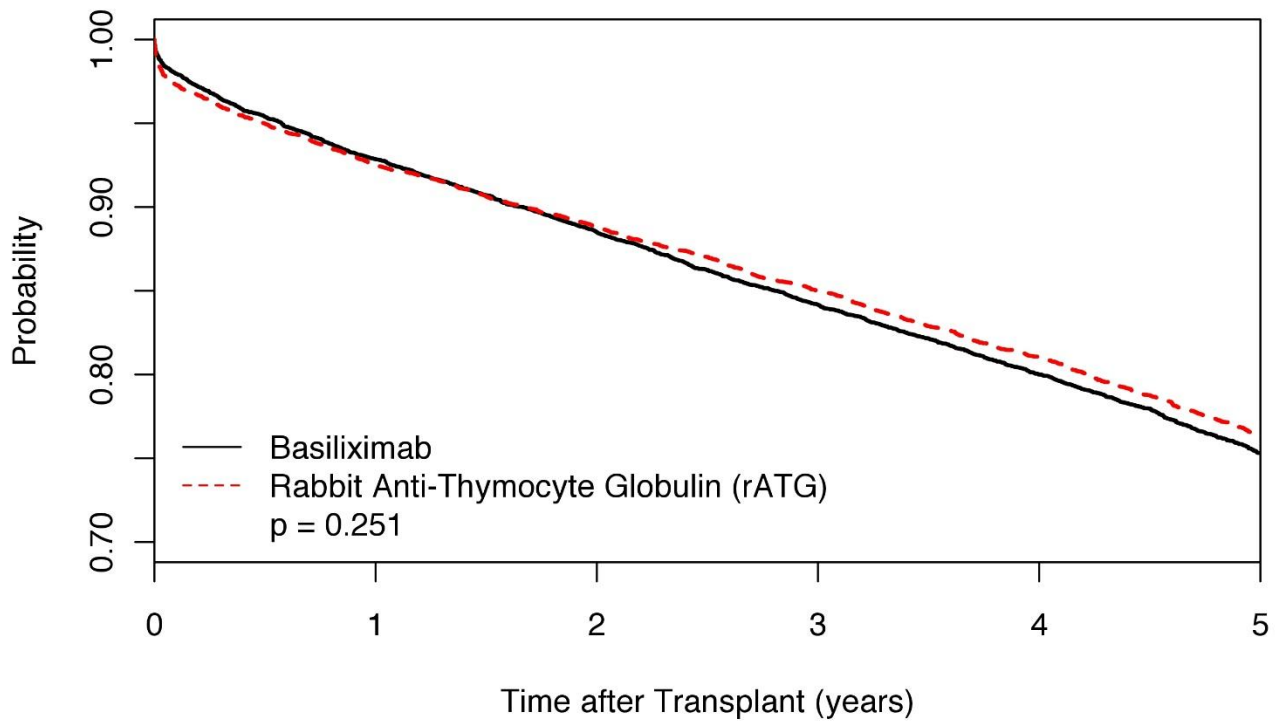
FIGURE S1b. Kaplan-Meier survival estimates Basiliximab-rATG: survival (A), survival without allograft failure (B), survival without sepsis (C), survival without lymphoma (D), survival without melanoma (E)

(A) Survival



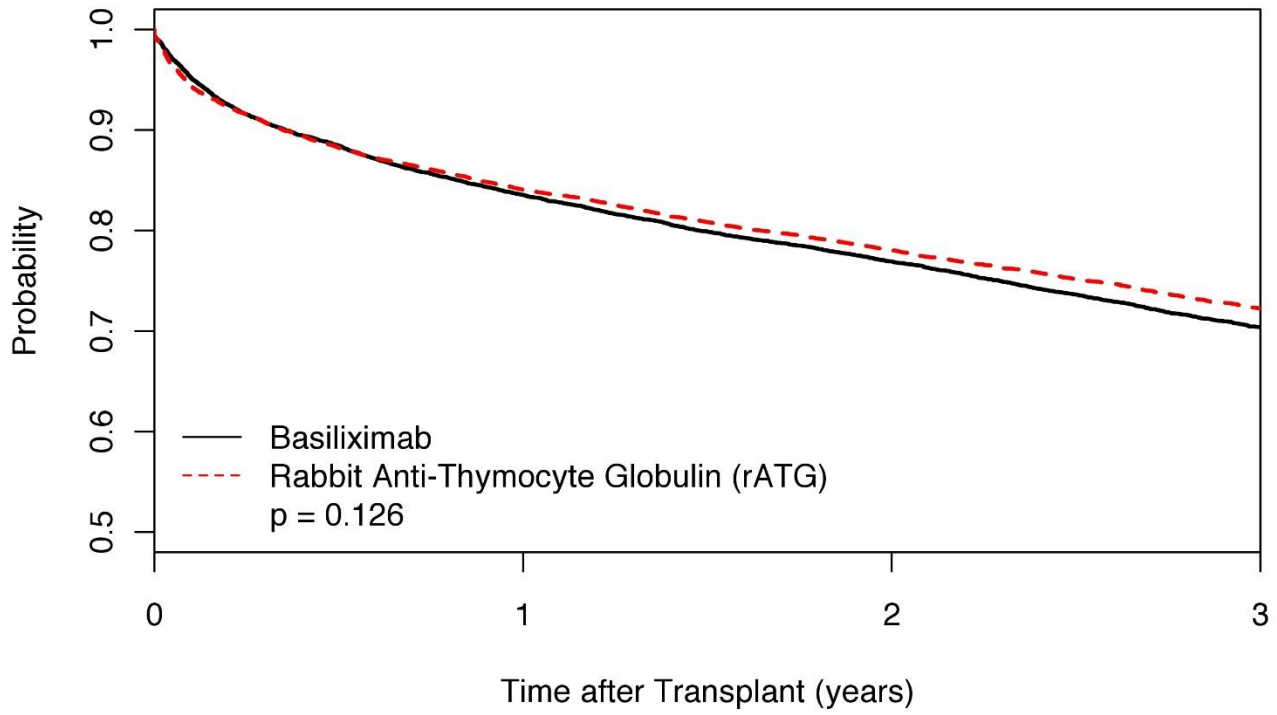
<u>Basiliximab</u>						
9378	8979	8736	8456	6934	5407	
<u>Rabbit Anti-Thymocyte Globulin (rATG)</u>						
9378	8994	8786	8542	7000	5427	

(B) Survival without Allograft Failure



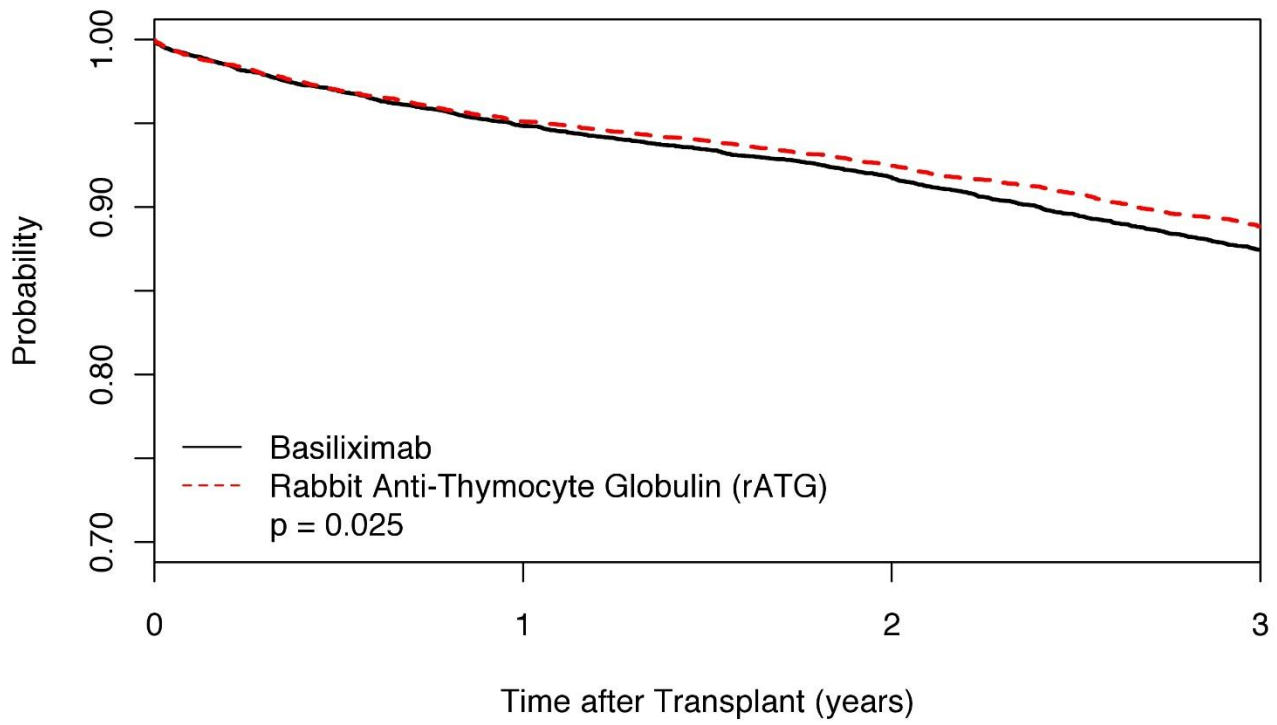
<u>Basiliximab</u>					
9378	8709	8301	7894	6335	4827
<u>Rabbit Anti-Thymocyte Globulin (rATG)</u>					
9378	8676	8328	7972	6398	4835

(C) Survival without Sepsis



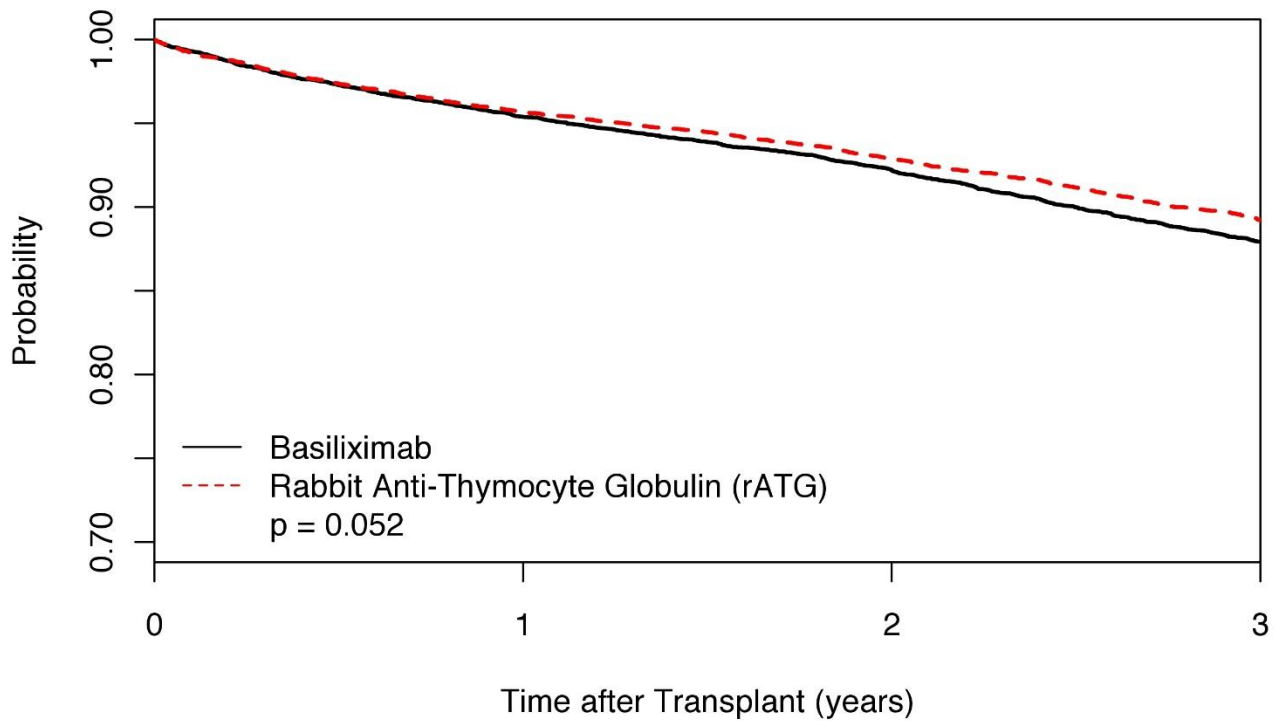
<u>Basiliximab</u>			
9378	7599	5751	4228
<u>Rabbit Anti-Thymocyte Globulin (rATG)</u>			
9378	7649	5815	4284

(D) Survival without Lymphoma



<u>Basiliximab</u>			
9378	8625	6860	5270
<u>Rabbit Anti-Thymocyte Globulin (rATG)</u>			
9378	8649	6905	5314

(E) Survival without Melanoma



<u>Basiliximab</u>			
9378	8676	6895	5304
<u>Rabbit Anti-Thymocyte Globulin (rATG)</u>			
9378	8701	6941	5329

APPENDIX V. Additional Information about Methods

A. Cohort generation: Induction therapies excluded

Patients who received the following induction therapies were excluded from the cohort: alg, anti-cam-1, anti-IL-6, anti-LFA-1, anti-tnf, atg, IL-1-receptor antagonist, okt3, okt4, rituximab, t10b9, xomazymecd5, zenapax, soluble il-1 receptor, nrATGnrats. We also excluded 738 patients for receiving “atg” as their induction therapy, because "atg" was consistent with atgam, a different preparation of anti-thymocyte globulin than rATG^{1,2}

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2. Brennan DC, Flavin K, Lowell JA, et al. A randomized, double-blinded comparison of rATG versus Atgam for induction immunosuppressive therapy in adult renal transplant recipients. *Transplantation*. 1999;67(7):1011-1018.