**Supplemental Material**

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**Supplementary Table 1**. List of candidate predictors

|  |  |  |
| --- | --- | --- |
| Category | Description | % Missing |
| Recipient Demographics | Recipient Age (yrs) | 0% |
| Recipient Gender | 0% |
| Recipient Ethnicity Category | 0% |
| Body Mass Index (kg/m2) | 0.1% |
| Recipient Highest Educational Level at Registration | 4.9% |
| Recipient Functional Status at Transplant | 2.7% |
| Recipient Primary Payment Source at Transplant | 0.1% |
| Recipient Work for Income at Transplant? | 0.3% |
| Recipient Medical | Total Days on Kidney Waiting List | 0% |
| Total Days on Dialysis | 10.7% |
| Recipient CMV Status at Transplant | 1.4% |
| Recipient Epstein Barr Virus Status at Transplant | 0% |
| Recipient Hepatitis B-Core Antibody | 0% |
| Recipient Hep B Surface Antigen | 0% |
| Recipient HBV Surface Antibody Total at Transplant | 62.0% |
| Recipient Hep C Status | 0% |
| Recipient HIV Serostatus at Transplant | 0% |
| Any Previous Malignancy? | 0% |
| Recipient Peripheral Vascular Disease at Registration | 0.3% |
| Recipient Diabetes at Registration | 0% |
| Recipient Total Serum Albumin at Registration (g/dL) | 7.5% |
| Number Previous Kidney Transplants | 0% |
| Kidney Recipient Primary Diagnosis at Transplant | 0% |
| Candidate Most Recent Calculated PRA | 0% |
| Recipient Serum Creatinine at Time of Transplant (mg/dL) | 0.8% |
| Recipient Pretransplant Dialysis at Transplant | <0.1% |
| Donor | Donor Gender | 0% |
| Deceased Donor-History of Cigarettes in Past (>20 pack Yrs) | 0% |
| Deceased Donor-History of Cocaine Use in Past | <0.1% |
| Deceased Donor-History of Other Drug Use in Past | <0.1% |
| Deceased Donor-History of Diabetes | 0% |
| Deceased Donor-History of Cancer | 0% |
| Deceased Donor-History of Hypertension | 0% |
| Deceased Donor-Antihypertensives within 24 Hrs Pre-Cross Clamp | <0.1% |
| Deceased Donor-Was Donor Given Insulin within 24 Hrs Pre Cross Clamp | <0.1% |
| Deceased Donor-Terminal Blood Urea Nitrogen (mg/dL) | 0% |
| Deceased Donor-Synthetic Anti Diuretic Hormone (DDAVP) | <0.1% |
| Deceased Donor Inotropic Medication at Procurement  | <0.1% |
| Deceased Donor Protein in Urine | 0% |
| Deceased Donor-Diuretics B/N Brain Death W/In 24 Hrs of Procurement | <0.1% |
| Deceased Donor-Steroids B/N Brain Death W/In 24 Hrs of Procurement | <0.1% |
| Deceased Donor-Vasodilators within 24hrs Pre-Cross Clamp | <0.1% |
| Deceased Donor-Was Donor Given Arginine Vasopressin within 24 Hrs Pre Cross Clamp? | <0.1% |
| Donor Serology Anti CMV | 0% |
| Deceased Donor Epstein Barr Virus by IgM Test Result | 0% |
| Deceased Donor Epstein Barr Virus by IgG Test Result | 0% |
| Deceased Donor HBsAb Test Result | <0.1% |
| Donor HBV Core Antibody | 0% |
| Donor Hep B Surface Antigen | 0% |
| Deceased Donor-Triiodothyronine-T3 B/N Brain Death W/In 24 Hrs of Procurement (Y/N) | <0.1% |
| Deceased Donor-Thyroxine-T4 B/N Brain Death W/In 24 Hrs of Procurement (Y/N) | <0.1% |
| Deceased Donor-RPR-VDRL Result | 0% |
| Expanded Criteria Donor | 0% |
| Deceased Donor-Terminal SGOT/AST (IU/L) | 0% |
| Deceased Donor-Terminal SGPT/ALT (IU/L) | 0% |
| AST/ALT Ratio | 0% |
| Deceased Donor-Terminal Total Bilirubin (mg/dL) | 0% |
| Transplant | HLA Mismatch Level | 0% |
| KDRI | 0.3% |
| Candidate Tested for Anti HLA Antibodies | 53.2% |
| Cold Ischemic Time (Hours) | 0% |
| Deceased Donor-Left/Right Kidney %Glomerulosclerosis at Recovery | 0.9% |
| Distance From Donor Hosp to Transplant Center (Nautical Miles) | 0% |
| Allocation Type-Local/Regional/National | 0% |
| Kidney Received on Ice Or Pump | 0% |
| Kidney Transplant Procedure Type | 0% |

**Supplementary Table 2**. Risk adjusted models using the current SRTR 1-year graft failure endpoint and the proposed composite endpoint of either 1-year graft failure and/or eGFR <30 ml/min.

|  |  |  |
| --- | --- | --- |
| Variable | Current SRTR 1-year graft failure model | Proposed composite metric of 1-year graft failure and eGFR <30 ml/min |
| Coefficient | OR (95% CI) | P | Coefficient | OR (95% CI) | P |
| Age (years) | 0.0111 | 1.01 (1.01, 1.01) | <.0001 | 0.00884 | 1.01 (1.01, 1.01) | <.0001 |
| Race/Ethnicity |  |  |   |  |  |   |
|  NHW vs. Hispanics | 0.2236 | 1.25 (1.15, 1.37) | <.0001 | 0.3116 | 1.37 (1.27, 1.47) | <.0001 |
|  Black vs. Hispanics | 0.2344 | 1.26 (1.16, 1.38) | <.0001 | 0.2909 | 1.34 (1.25, 1.44) | <.0001 |
|  Other vs.Hispanics | 0.0524 | 1.05 (0.93, 1.19) | 0.41 | 0.0476 | 1.05 (0.95, 1.16) | 0.36 |
| BMI | 0.0153 | 1.02 (1.01, 1.02) | <.0001 | 0.0302 | 1.03 (1.03, 1.03) | <.0001 |
| Function Status |  |  |   |  |  |   |
|  Effort vs. Normal | 0.0275 | 1.03 (0.96, 1.10) | 0.42 | 0.0442 | 1.05 (0.99, 1.10) | 0.10 |
|  Dependent vs. Normal | 0.2445 | 1.28 (1.16, 1.40) | <.0001 | 0.1893 | 1.21 (1.12, 1.30) | <.0001 |
|  Disabled vs. Normal | 0.4921 | 1.64 (1.39, 1.93) | <.0001 | 0.3745 | 1.45 (1.26, 1.67) | <.0001 |
| Insurance |  |  |   |  |  |   |
|  Public vs. Private/Self | 0.2204 | 1.25 (1.15, 1.35) | <.0001 | 0.187 | 1.21 (1.13, 1.28) | <.0001 |
| Work for Income |  |  |   |  |  |   |
|  No vs. Yes | 0.1960 | 1.22 (1.13, 1.31) | <.0001 | 0.0996 | 1.10 (1.04, 1.17) | 0.001 |
|  Unknown vs. Yes | 0.1854 | 1.20 (1.05, 1.38) | 0.008 | 0.0256 | 1.03 (0.92, 1.15) | 0.65 |
| Recipient HBsAb |  |  |   |  |  |   |
|  Negative vs. Positive | 0.0800 | 1.08 (0.98, 1.20) | 0.12 | 0.0828 | 1.09 (1.01, 1.17) | 0.037 |
|  Unknown vs. Positive | 0.3650 | 1.44 (1.34, 1.55) | <.0001 | 0.2681 | 1.31 (1.24, 1.38) | <.0001 |
| Recipient History of PVD |  |  |   |  |  |   |
|  Yes vs. No | 0.2684 | 1.31 (1.20, 1.43) | <.0001 | 0.1334 | 1.14 (1.06, 1.23) | 0.0003 |
| Recipient History of Diabetes |  |  |   |  |  |   |
|  Yes vs. No | 0.1619 | 1.18 (1.11, 1.25) | <.0001 |  |  |   |
|  Unknown vs. No | 0.18 | 1.20 (0.98, 1.46) | 0.07 |   |   |   |
| Serum Album (g/dL) | -0.1201 | 0.89 (0.84, 0.93) | <.0001 | -0.1076 | 0.90 (0.86, 0.93) | <.0001 |
| Previous Kidney Transplant |  |  |   |  |  |   |
|  Yes vs. No | 0.3289 | 1.39 (1.28, 1.51) | <.0001 |   |   |   |
| Pre-Transplant Dialysis |  |  |   |  |  |   |
|  Yes vs. No | 0.3998 | 1.49 (1.33, 1.67) | <.0001 | 0.2198 | 1.25 (1.14, 1.36) | <.0001 |
| Donor Smoking Status |  |  |   |  |  |   |
|  Yes vs. No |   |   |   | 0.0875 | 1.09 (1.04, 1.15) | 0.001 |
| Donor History of Drug Use |  |  |   |  |  |   |
|  No vs. Yes |   |   |   | 0.169 | 1.18 (1.13, 1.24) | <.0001 |
| Donor History of Diabetes |  |  |   |  |  |   |
|  Yes vs. No | 0.121 | 1.13 (1.03, 1.24) | 0.01 | 0.0463 | 1.05 (0.97, 1.13) | 0.22 |
| Donor History of HTN |  |  |   |  |  |   |
|  Yes vs. No |   |   |   | 0.0633 | 1.07 (1.01, 1.13) | 0.02 |
| Donor BUN (mg/dL) |   |   |   | 0.00591 | 1.01 (1.00, 1.01) | <.0001 |
| Donor Arginine |  |  |   |  |  |   |
|  No vs. Yes | 0.1096 | 1.12 (1.06, 1.18) | 0.0001 | 0.1693 | 1.18 (1.13, 1.24) | <.0001 |
| Donor ALT (log10) |   |   |   | -0.1913 | 0.83 (0.78, 0.87) | <.0001 |
| KDRI | 0.9191 | 2.51 (2.29, 2.74) | <.0001 | 1.2818 | 3.60 (3.29, 3.95) | <.0001 |
| Cold Ischemic Hours | 0.0135 | 1.01 (1.01, 1.02) | <.0001 | 0.0142 | 1.01 (1.01, 1.02) | <.0001 |
| Glomerulosclerosis% |  |  |   |  |  |   |
| <10 vs. Indeterminate |  |  |   | 0.1061 | 1.11 (1.05, 1.18) | 0.0003 |
| ≥10 vs. Indeterminate |   |   |   | 0.4241 | 1.53 (1.40, 1.67) | <.0001 |
| Procedure Type |  |  |   |  |  |   |
|  Unilateral vs. Sequential |  |  |   | 0.7276 | 2.07 (1.68, 2.55) | <.0001 |
|  EN-BLOC vs. Sequential |   |   |   | 0.4756 | 1.61 (1.23, 2.11) | 0.0006 |

**Supplementary Table 3**. Risk prediction model with linear spline in graft failure event

|  |  |  |
| --- | --- | --- |
| Variable | Graft failure model | Graft failure model with linear spline |
| Coefficient | P | Coefficient | P |
| Age, linear | 0.0111 | <.0001 | -0.0257 | <.0001 |
| Apply to > 40 |  |   | 0.0793 | 0.0002 |
| Apply to > 45 |  |   | -0.059 | 0.008 |
| Apply to > 55 |  |   | 0.0383 | 0.03 |
| Apply to > 60 |  |   | -0.009 | 0.51 |
| Race/Ethnicity |   |   |   |   |
|  NHW vs. Hispanics | 0.2236 | <.0001 | 0.2053 | <.0001 |
|  Black vs. Hispanics | 0.2344 | <.0001 | 0.2423 | <.0001 |
|  Other vs. Hispanics | 0.0524 | 0.41 | 0.0429 | 0.5 |
| BMI, linear | 0.0153 | <.0001 | -0.0087 | 0.23 |
| Apply to > 28 |  |   | 0.075 | 0.01 |
| Apply to > 30 |   |   | -0.0413 | 0.15 |
| Function Status |   |   |   |   |
|  Effort vs. Normal | 0.0275 | 0.42 | 0.0306 | 0.37 |
|  Dependent vs. Normal | 0.2445 | <.0001 | 0.2463 | <.0001 |
|  Disabled vs. Normal | 0.4921 | <.0001 | 0.5074 | <.0001 |
| Insurance |   |   |   |   |
|  Public vs. Private/Self | 0.2204 | <.0001 | 0.2041 | <.0001 |
| Work for Income |   |   |   |   |
|  No vs. Yes | 0.196 | <.0001 | 0.168 | <.0001 |
|  Unknown vs. Yes | 0.1854 | 0.008 | 0.1666 | <.0001 |
| Recipient HBsAb |   |   |   |   |
|  Negative vs. Positive | 0.08 | 0.12 | 0.0818 | 0.02 |
|  Unknown vs. Positive | 0.365 | <.0001 | 0.3734 | <.0001 |
| Recipient History of PVD |   |   |   |   |
|  Yes vs. No | 0.2684 | <.0001 | 0.2722 | <.0001 |
| Recipient History of Diabetes |   |   |   |   |
|  Yes vs. No | 0.1619 | <.0001 | 0.1765 | <.0001 |
|  Unknown vs. No | 0.18 | 0.07 | 0.2062 | 0.04 |
| Serum Album, linear | -0.1201 | <.0001 | -0.3948 | 0.0009 |
| Apply to > 3 |  |   | 0.7287 | 0.11 |
| Apply to > 3.2 |  |   | -0.4693 | 0.24 |
| Apply to > 4.6 |  |   | 0.5213 | 0.2 |
| Apply to > 4.8 |   |   | -0.4361 | 0.34 |
| Previous Kidney Transplant |   |   |   |   |
|  Yes vs. No | 0.3289 | <.0001 | 0.3316 | <.0001 |
| Pre-Transplant Dialysis |   |   |   |   |
|  Yes vs. No | 0.3998 | <.0001 | 0.4089 | <.0001 |
| Donor History of Diabetes |   |   |   |   |
|  Yes vs. No | 0.121 | 0.01 | 0.1308 | 0.006 |
| Donor Arginine |   |   |   |   |
|  No vs. Yes | 0.1096 | 0.0001 | 0.1016 | 0.0004 |
| KDRI, linear | 0.9191 | <.0001 | 1.0527 | 0.014 |
| Apply to > 0.8 |  |   | 0.9711 | 0.31 |
| Apply to > 0.9 |  |   | -1.0855 | 0.14 |
| Apply to > 1.3 |  |   | 0.2864 | 0.77 |
| Apply to > 1.4 |  |   | -0.457 | 0.81 |
| Apply to > 1.5 |  |   | -0.5011 | 0.83 |
| Apply to > 1.6 |  |   | -0.1348 | 0.96 |
| Apply to > 1.7 |  |   | 0.7013 | 0.7 |
| Apply to > 2 |  |   | -1.422 | 0.14 |
| Cold Ischemic Hours, linear | 0.0135 | <.0001 | 0.0654 | 0.12 |
| Apply to > 6 |  |   | -0.0397 | 0.4 |
| Apply to > 14 |  |   | -0.0506 | 0.24 |
| Apply to > 16 |  |   | 0.0371 | 0.58 |
| Apply to > 18 |   |   | 0.0015 | 0.97 |

**Supplementary table 4**. Risk Prediction model with linear spline in Composite metric

|  |  |  |
| --- | --- | --- |
| Variable | Composite Metric | Composite Metric with Linear Spline |
| Coefficient | P | Coefficient | P |
| Age, linear | 0.00884 | <.0001 | -0.0132 | <.0001 |
| Apply to > 40 |  |   | 0.0493 | 0.004 |
| Apply to > 45 |  |   | -0.0408 | 0.02 |
| Apply to > 55 |  |   | 0.0287 | 0.04 |
| Apply to > 60 |   |   | -0.0067 | 0.55 |
| Race/Ethnicity |   |   |   |   |
|  NHW vs. Hispanics | 0.3116 | <.0001 | 0.3004 | <.0001 |
|  Black vs. Hispanics | 0.2909 | <.0001 | 0.2939 | <.0001 |
|  Other vs. Hispanics | 0.0476 | 0.36 | 0.0338 | 0.52 |
| BMI, linear | 0.0302 | <.0001 | 0.0127 | 0.03 |
| Apply to > 28 |  |   | 0.0427 | 0.0687 |
| Apply to > 30 |   |   | -0.0154 | 0.49 |
| Function Status |   |   |   |   |
|  Effort vs. Normal | 0.0442 | 0.1 | 0.0468 | 0.08 |
|  Dependent vs. Normal | 0.1893 | <.0001 | 0.192 | <.0001 |
|  Disabled vs. Normal | 0.3745 | <.0001 | 0.3854 | <.0001 |
| Insurance |   |   |   |   |
|  Public vs. Private/Self | 0.187 | <.0001 | 0.1755 | <.0001 |
| Work for Income |   |   |   |   |
|  No vs. Yes | 0.0996 | 0.001 | 0.0845 | 0.005 |
|  Unknown vs. Yes | 0.0256 | 0.65 | 0.0181 | 0.75 |
| Recipient HBsAb |   |   |   |   |
|  Negative vs. Positive | 0.0828 | 0.037 | 0.0831 | 0.04 |
|  Unknown vs. Positive | 0.2681 | <.0001 | 0.2776 | <.0001 |
| Recipient History of PVD |   |   |   |   |
|  Yes vs. No | 0.1334 | 0.0003 | 0.1381 | 0.0002 |
| Serum Album, linear | -0.1076 | <.0001 | -0.304 | 0.003 |
| Apply to > 3 |  |   | 0.317 | 0.41 |
| Apply to > 3.2 |  |   | -0.0969 | 0.77 |
| Apply to > 4.6 |  |   | 0.1002 | 0.76 |
| Apply to > 4.8 |   |   | -0.1771 | 0.63 |
| Pre-Transplant Dialysis |   |   |   |   |
|  Yes vs. No | 0.2198 | <.0001 | 0.2271 | <.0001 |
| Donor Smoking Status |   |   |   |   |
|  Yes vs. No | 0.0875 | 0.02 | 0.0537 | 0.046 |
| Donor History of Drug Use |   |   |   |   |
|  No vs. Yes | 0.169 | <.0001 | 0.1477 | <.0001 |
| Donor History of Diabetes |   |   |   |   |
|  Yes vs. No | 0.0463 | 0.22 | 0.0656 | 0.078 |
| Donor History of HTN |   |   |   |   |
|  Yes vs. No | 0.0633 | 0.02 | 0.0233 | 0.41 |
| Donor BUN, linear | 0.00591 | <.0001 | 0.0095 | <.0001 |
| Apply to > 30 |   |   | -0.0097 | 0.005 |
| Donor Arginine |   |   |   |   |
|  No vs. Yes | 0.1693 | <.0001 | 0.1604 | <.0001 |
| Donor ALT (log10), linear | -0.1913 | <.0001 | -0.2082 | 0.0023 |
| Apply to > 1.59 |   |   | 0.0253 | 0.7933 |
| KDRI, linear | 1.2818 | <.0001 | 1.741 | <.0001 |
| Apply to > 0.8 |  |  | 0.5773 | 0.48 |
| Apply to > 0.9 |  |  | -0.6322 | 0.3 |
| Apply to > 1.3 |  |  | -0.7559 | 0.3 |
| Apply to > 1.4 |  |  | -0.3095 | 0.83 |
| Apply to > 1.5 |  |  | 1.0813 | 0.55 |
| Apply to > 1.6 |  |  | -1.8874 | 0.34 |
| Apply to > 1.7 |  |  | 0.9685 | 0.49 |
| Apply to > 2 |   |   | -0.7255 | 0.32 |
| Cold Ischemic Hours, linear | 0.0142 | <.0001 | 0.0197 | 0.53 |
| Apply to > 6 |  |   | -0.0042 | 0.91 |
| Apply to > 14 |  |   | 0.0032 | 0.93 |
| Apply to > 16 |  |   | -0.0339 | 0.52 |
| Apply to > 18 |   |   | 0.033 | 0.23 |
| Glomerulosclerosis% |   |   |   |   |
| <10 vs. Indeterminate | 0.1061 | 0.0003 | 0.0473 | 0.11 |
| ≥10 vs. Indeterminate | 0.4241 | <.0001 | 0.3539 | <.0001 |
| Procedure Type |   |   |   |   |
|  Unilateral vs. Sequential | 0.7276 | <.0001 | 0.608 | <.0001 |
|  EN-BLOC vs. Sequential | 0.4756 | 0.0006 | 0.2637 | 0.057 |

**Supplementary Figure 1**. Relationship between the log-odds and each continuous predictor in the risk prediction models.



**Supplementary Figure 2.** Calibration plot comparing observed probabilities vs. predicted probabilities estimated from the model using: a). the traditional endpoint on training data and b). the traditional endpoint on testing data; c). composite endpoint on training data and d). composite endpoint on testing data.

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