

Online Supplementary Material**Supplementary Table 1** – ICD-9-CM and ICD-10-CM diagnosis codes for the definition of type 1 and type 2 diabetes and comorbidities

	ICD-9-CM (Jan2000-Sept 2010)	ICD-10-CM (Oct 2015-Aug 2018)
Type 1 Diabetes (T1D)	250.01, 250.03, 250.11, 250.13, 250.21, 250.23, 250.31, 250.33, 250.41, 250.43, 250.51, 250.53, 250.61, 250.63, 250.71, 250.73, 250.81, 250.83, 250.91, 250.93	E10
Type 2 Diabetes (T2D)	250.00, 250.02, 250.10, 250.12, 250.20, 250.22, 250.30, 250.32, 250.40, 250.42, 250.50, 250.52, 250.60, 250.62, 250.70, 250.72, 250.80, 250.82, 250.90, 250.92	E11
<i>Comorbidities</i>		
Smoking	V15.82	Z87.891
CHF	428	I50
Stroke	430-438	I60-I69
COPD	491; 492; 494, 496, 506	J40-J44; J47
PVD	443.9	I73.9
Cancer	140-209	C00-C96

T1D and T2D are defined as primary cause of end-stage renal disease (ESKD) from form CMS2728. For comorbidities, form CMS2728 is supplemented with the diagnosis codes indicated above from hospitalizations occurring within 30 days of transplant date.

Supplementary Table 2 Proportion of missing data (N and %) among characteristics of US transplant recipients at time of kidney transplant, by primary cause of ESKD

	Total	Cause of ESKD		
		T1D	T2D	Non-Diabetes
<i>Patient Characteristics</i>				
Sex	0 (0)	0 (0)	0 (0)	0 (0)
Age	0 (0)	0 (0)	0 (0)	0 (0)
Race	1,170 (0.5)	58 (0.3)	119 (0.2)	993 (0.6)
ESKD duration ^a	0 (0)	0 (0)	0 (0)	0 (0)
Transplant Year	0 (0)	0 (0)	0 (0)	0 (0)
Health insurance status	19,055 (7.5)	9,114 (44.8)	5,156 (8.7)	4,785 (2.7)
BMI (kg/m ²)	9,943 (3.9)	724 (3.6)	1,312 (2.2)	7,904 (4.5)
History of smoking	11,120 (4.4)	606 (3.0)	1,120 (1.9)	9,394 (5.4)
Comorbidities				
CHF	11,101 (4.4)	603 (3.0)	1,113 (1.9)	9,385 (5.4)
Stroke	11,119 (4.4)	606 (3.0)	1,120 (1.9)	9,393 (5.4)
COPD	11,121 (4.4)	606 (3.0)	1,121 (1.9)	9,394 (5.4)
PVD	11,120 (4.4)	606 (3.0)	1,120 (1.9)	9,394 (5.4)
Cancer				
<i>Donor Characteristics</i>				
Age	3,820 (1.5)	226 (1.1)	734 (1.2)	2,860 (1.7)
Sex	3,438 (1.4)	203 (1.0)	647 (1.1)	1,588 (1.5)
Race	59,938 (21.6)	2,200 (10.8)	12,308 (20.7)	40,430 (23.2)
Cold ischemic time ^b	44,644 (17.6)	2,059 (17.9)	10,020 (16.9)	23,732 (13.6)
Donor risk level ^{b,c}	8,080 (5.2)	351 (5.7)	1,982 (5.0)	5,747 (5.3)
Simultaneous kidney/pancreas	0 (0)	0 (0)	0 (0)	0 (0)

^aESKD duration prior to transplant date; ^bProportion missing is estimated among kidney only recipients (not simultaneous kidney and pancreas transplants). ^cDonor risk level is defined using KDPI. KDPI is estimated among DD only and is defined as low risk (KDPI=0-20), moderate risk (KDPI>20-85) or high risk (KDPI >85); Abbreviations: BMI: Body Mass Index, CHF: congestive heart failure, COPD: chronic obstructive pulmonary disease; DD: deceased donor; ESKD: end-stage kidney disease; LD: living donor; KDPI: kidney donor profile index; ND: no diabetes; PVD: peripheral vascular disease; T1D: type 1 diabetes; T2D: type 2 diabetes

Supplementary Table 3 – Hazard ratios (HR) and 95%CI for mortality among transplant recipients, by primary cause of ESKD (non-diabetes, T1D or T2D) and graft failure status

	Total population ^b		No Graft Failure		Graft failure	
	Unadjusted HR (95%CI)	Adjusted HR ^a (95%CI)	Unadjusted HR (95%CI)	Adjusted HR ^a (95%CI)	Unadjusted HR (95%CI)	Adjusted HR ^a (95%CI)
Non-diabetes	<i>1.0 (reference)</i>		<i>1.0 (reference)</i>		<i>1.0 (reference)</i>	
T1D	1.35 (1.32-1.39)	1.95 (1.88-2.03)	1.34 (1.30-1.38)	2.16 (2.06-2.26)	1.36 (1.30-1.41)	1.64 (1.54-1.74)
T2D	2.26 (2.22-2.29)	1.65 (1.62-1.69)	2.45 (2.40-2.50)	1.81 (1.76-1.85)	1.78 (1.73-1.83)	1.38 (1.34-1.43)

^aAdjusted for recipient characteristics of age, sex, race/ethnicity, insurance status, ESKD duration prior to transplant, smoking history, BMI, and comorbidities, as well as donor characteristics of type, age, sex, race/ethnicity, cold ischemic time, and donor risk level. ^bTotal population was also adjusted for graft failure and donor risk level in adjusted HR models. Abbreviations: BMI: body mass index; CI: confidence interval DD: deceased donor; ESKD: end-stage kidney disease; HR: hazard ratio; T1D: type 1 diabetes; T2D: type 2 diabetes

Supplementary Table 4 –Hazard ratios (HR) and 95%CI for mortality and graft failure in US transplant recipients (2000-2018), by diabetes and donor status (DD vs. LD), excluding simultaneous kidney and pancreas transplant recipients (N=13,682, 5.4% of total population)

	Total Population		Living Donor (LD)		Deceased Donor (DD)	
	Unadjusted HR (95%CI)	Adjusted HR ^a (95%CI)	Unadjusted HR ^a (95%CI)	Adjusted HR ^a (95%CI)	Unadjusted HR(95%CI)	Adjusted HR ^a (95%CI)
Mortality						
No diabetes	<i>1.0 (reference)</i>		<i>1.0 (reference)</i>		<i>1.0 (reference)</i>	
T1D	1.73 (1.67-1.78)	1.95 (1.88-2.03)	1.91 (1.82-2.00)	2.04 (1.92-2.17)	1.83 (1.76-1.91)	1.91 (1.82-2.00)
T2D	2.39 (2.35-2.42)	1.65 (1.62-1.69)	2.81 (2.72-2.90)	1.74 (1.67-1.82)	2.14 (2.10-2.18)	1.62 (1.59-1.66)
Graft Failure						
No diabetes	<i>1.0 (reference)</i>		<i>1.0 (reference)</i>		<i>1.0 (reference)</i>	
T1D	1.08 (1.04-1.11)	1.24 (1.18-1.31)	1.36 (1.27-1.46)	1.30 (1.19-1.42)	1.24 (1.17-1.31)	1.22 (1.14-1.30)
T2D	1.38 (1.35-1.41)	1.32 (1.28-1.36)	1.53 (1.46-1.60)	1.51 (1.41-1.60)	1.31 (1.28-1.35)	1.27 (1.23-1.31)

^aAdjusted for recipient characteristics of age, sex, race/ethnicity, insurance status, ESKD duration prior to transplant, smoking history, BMI, comorbidities and graft failure status (where appropriate), as well as donor characteristics of age, sex, race/ethnicity, cold ischemic time, and donor risk level. Abbreviations: CI: confidence interval; ESKD: end-stage kidney disease; HR: hazard ratio; T1D: type 1 diabetes; T2D: type 2 diabetes

Supplementary Table 5 Crude mortality rates, age-standardized mortality rates (ASMR, per 1,000 persons), and standardized mortality ratios (SMR), by primary cause of ESKD, in the USRDS transplant population, 2000-2017

Year	T1D			T2D			ND		
	Crude Rate	ASMR (95%CI)	SMR (95%CI)	Crude Rate	ASMR (95%CI)	SMR (95%CI)	Crude Rate	ASMR (95%CI)	SMR (95%CI)
2000	30.21	83.53 (59.08-114.75)	7.78 (5.50-10.68)	47.27	61.60 (49.95-75.17)	5.74 (4.65-7.00)	33.78	55.88 (49.05-63.41)	5.20 (4.57-5.90)
2001	38.43	105.16 (85.07-128.58)	9.79 (7.92-11.97)	51.63	64.58 (56.29-73.75)	6.01 (5.24-6.87)	29.51	46.41 (42.11-51.03)	4.32 (3.92-4.75)
2002	40.73	104.95 (88.77-123.24)	9.77 (8.27-11.47)	47.67	57.66 (51.43-64.44)	5.37 (4.79-6.00)	26.72	39.93 (36.75-43.30)	3.72 (3.42-4.03)
2003	33.87	84.60 (71.92-98.88)	7.88 (6.70-9.21)	50.88	57.96 (52.73-63.57)	5.40 (4.91-5.92)	27.13	38.46 (35.84-41.23)	3.58 (3.34-3.84)
2004	32.81	81.01 (69.82-93.50)	7.54 (6.50-8.71)	54.64	58.68 (54.14-63.50)	5.46 (5.04-5.91)	27.29	36.97 (34.73-39.31)	3.44 (3.23-3.66)
2005	40.32	94.48 (83.54-106.45)	8.80 (7.78-9.91)	56.55	57.52 (53.56-61.71)	5.36 (4.99-5.75)	28.18	35.92 (33.98-37.95)	3.35 (3.16-3.53)
2006	36.96	82.42 (73.05-92.67)	7.68 (6.80-8.63)	58.81	56.75 (53.22-60.47)	5.29 (4.96-5.63)	26.82	32.44 (30.78-34.16)	3.02 (2.87-3.18)
2007	38.84	82.33 (73.67-91.73)	7.67 (6.86-8.54)	53.41	48.82 (45.83-51.96)	4.55 (4.27-4.84)	28.30	32.51 (31.00-34.08)	3.03 (2.89-3.17)
2008	35.32	72.16 (64.55-80.42)	6.72 (6.01-7.49)	52.82	45.66 (43.00-48.44)	4.25 (4.00-4.51)	27.40	30.04 (28.70-31.43)	2.80 (2.67-2.93)
2009	40.30	79.02 (71.52-87.10)	7.36 (6.66-8.11)	57.48	46.82 (44.33-49.41)	4.36 (4.13-4.60)	28.13	29.45 (28.22-30.72)	2.74 (2.63-2.86)
2010	36.85	69.14 (62.50-76.30)	6.44 (5.82-7.11)	58.23	45.30 (43.00-47.68)	4.22 (4.00-4.44)	28.80	28.88 (27.74-30.05)	2.69 (2.58-2.80)
2011	40.30	72.37 (65.90-79.31)	6.74 (6.14-7.39)	62.27	46.57 (44.37-48.85)	4.34 (4.13-4.55)	29.00	27.96 (26.91-29.04)	2.60 (2.51-2.70)
2012	38.98	66.77 (60.82-73.15)	6.22 (5.66-6.81)	61.75	43.94 (41.92-46.03)	4.09 (3.90-4.29)	30.70	28.28 (27.28-29.30)	2.63 (2.54-2.73)
2013	38.48	63.87 (58.27-69.88)	5.95 (5.43-6.51)	60.07	41.13 (39.26-43.05)	3.83 (3.66-4.01)	29.42	26.09 (25.18-27.03)	2.43 (2.35-2.52)
2014	45.26	72.38 (66.60-78.52)	6.74 (6.20-7.31)	63.11	41.41 (39.63-43.25)	3.86 (3.69-4.03)	30.33	26.06 (25.19-26.95)	2.43 (2.35-2.51)
2015	45.79	69.89 (64.41-75.71)	6.51 (6.00-7.05)	65.97	41.81 (40.09-43.59)	3.89 (3.73-4.06)	31.85	26.72 (25.88-27.59)	2.49 (2.41-2.57)
2016	43.33	64.28 (59.17-69.71)	5.99 (5.51-6.49)	68.23	42.06 (40.39-43.78)	3.92 (3.76-4.08)	31.13	25.58 (24.78-26.39)	2.38 (2.31-2.46)
2017	49.10	70.34 (65.16-75.82)	6.55 (6.07-7.06)	67.83	41.07 (39.47-42.72)	3.82 (3.68-3.98)	31.94	25.57 (24.81-26.35)	2.38 (2.31-2.45)

Abbreviations: ASMR: age-standardized mortality rate; ESKD: end-stage kidney disease; ND: No diabetes; SMR: standardized mortality ratio; T1D: type 1 diabetes; T2D: type 2 diabetes; USRDS: United States Renal Data System

Supplementary Table 6 Characteristics among US transplant recipients at time of transplant (2000-2005 vs. 2010-2015), by cause of ESKD (non-diabetes, T1D and T2D)

	2000-2005			2010-2015		
	Non-diabetes	T1D	T2D	Non-diabetes	T1D	T2D
<i>Patient Characteristics</i>						
N (%)	53,667 (66.9)	6,905 (8.6)	19,685 (24.5)	48,117 (69.1)	5,037 (7.2)	16,466 (23.7)
Sex, Male (%)	59.7	59.3	65.7	59.5	59.5	68.4
Age, Mean (SD)	49.9 (13.4)	43.9 (10.2)	57.1 (9.8)	51.5 (14.2)	45.6 (11.4)	58.4 (10.1)
Race (%)						
Non-Hispanic White	53.1	74.2	44.4	58.9	67.0	45.3
Non-Hispanic Black	25.9	13.9	26.5	20.6	17.0	24.1
Hispanic	14.5	9.6	21.1	13.9	12.7	22.2
Other	6.6	2.4	8.0	6.7	3.3	8.3
ESKD duration ^a , Mean (SD)	3.1 (3.1)	2.0 (2.2)	3.2 (2.6)	2.0 (2.0)	1.7 (1.7)	2.5 (1.9)
Health insurance status (%)						
Medicare	54.2	47.6	63.5	50.5	51.4	64.4
Medicaid	4.6	4.4	3.8	4.5	3.9	3.6
Private	39.9	47.0	31.3	43.3	43.2	30.2
Other	1.4	1.0	1.4	1.7	1.5	1.9
BMI (kg/m ²), Mean (SD)	27.4 (6.5)	26.2 (5.5)	29.4 (6.3)	28.2 (6.5)	27.3 (5.9)	30.5 (6.4)
History of smoking (%)	9.4	6.6	6.7	13.2	14.4	15.6
<i>Comorbidities</i>						
CHF (%)	10.4	14.9	23.5	6.8	9.0	16.3
Stroke (%)	2.9	4.0	5.5	2.4	3.8	5.1
COPD (%)	3.2	1.6	3.4	2.3	1.5	3.1
PVD (%)	2.6	8.9	10.6	1.8	5.8	7.3
Cancer (%)	2.5	0.6	1.5	3.1	1.1	2.2
<i>Donor Characteristics</i>						
Age, Mean (SD)	39.4 (14.8)	34.2 (14.1)	40.4 (15.5)	40.0 (14.8)	33.2 (14.2)	41.6 (15.0)
Sex, Male (%)	51.8	57.6	53.5	50.9	58.8	51.8
Race (%)						
Non-Hispanic White	69.6	75.6	66.8	71.4	68.2	65.6
Non-Hispanic Black	13.1	10.8	13.5	12.0	15.5	14.1
Hispanic	13.5	11.2	15.7	12.5	13.2	15.8

Other	3.8	2.4	4.0	4.1	3.1	4.6
Cold ischemic time, Median (25-75 th percentile)	12.8 (2.5-20)	9.1 (1.2-19)	14.8 (6-21.5)	9.3 (1.3-17.8)	6.9 (1.1-16.5)	12.4 (2.4-20.5)
High-risk donor (%) ^b						
LD	39.8	52.8	26.6	43.4	54.5	33.1
Low risk (0-20)	13.4	12.0	13.3	13.3	7.2	6.8
Moderate risk (>20-85)	41.1	30.7	45.5	37.7	37.5	49.7
High risk (>85-100)	6.8	4.5	11.6	5.6	3.9	10.4
Simultaneous kidney/pancreas (%)	0.4	40.8	7.1	0.6	49.6	6.9

^aESKD duration prior to transplant date; ^bDonor risk level is defined using KDPI for DD and is defined as low risk (KDPI=0-20), moderate risk (KDPI>20-85) or high risk (KDPI >85). Abbreviations: BMI: Body Mass Index, CHF: congestive heart failure, COPD: chronic obstructive pulmonary disease, DD: deceased donor; ESKD: end-stage kidney disease; LD: living donor; PVD: peripheral vascular disease; T1D: type 1 diabetes; T2D: type 2 diabetes