

SUPPLEMENTAL DIGITAL CONTENT

Table S1. International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes used to define medical diagnoses from billing claims data.

Diagnosis	ICD-9-CM Diagnostic Codes
Hypotension	458, 458.9
Acute MI	410
Stroke	430, 431, 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 432, 433, 434, 434.01, 434.91, 434.11, 436, 997.02
Hypercapnia	276.4
Fungal Pneumonia	112.4, 114.0, 115.5, 484.6, 484.7, 039.1, 136.3, 021.2
Aspiration pneumonia	507.0, 507.1, 507.8, 997.32
Other pneumonia	V12.61, 481, 482, 480.0, 482.1, 482.2, 482.9, 482.8, 482.83, 482.4, 482.41, 482.42, 482.3, 483, 484, 484.8, 485, 486, 136.3, 518.3, 039.1, 130.4, 011.6, 513.0, 055.1, 052.1
Alcohol abuse	303.0, 303.9, 305.0, 291.x, 571.0, 571.2, 571.3, 535.3
Other drug abuse	304.2, 304.0, 304.7, 304.3, 304.1, 304.4, 304.5, 304.6, 304.8, 304.9, 305.6, 305.5, 305.2, 305.3, 305.4, 305.7, 305.8, 305.9, 292.x
Noncompliance	V158.1
Mental status changes	780.0, 780.01, 780.02, 780.03, 780.09, 800.x, 801.x, 803.x, 804.x, 850.x
Delusion	297, 297.0, 297.1, 297.2, 297.3, 297.8, 297.9,
Psychosis	298, 298.0, 298.1, 298.2, 298.3, 298.4, 298.8, 298.9, 293, 294
Schizophrenia	V11.0, 295.8, 295.0, 295.5, 295.9, 295, 295.7, 297, 295.4
Depression	V79.0, 296.2, 300.4, 296.3, 311, 309.28, 307.44, 309.0, 309.1
Accidents	E806, E807, E826, E827, E829, E830, E831, E836, E838, E841, E842, E844, E845, E916, E918, E921, E928, E928.x, E929, E929.x, V714
Fractures	V15.51, V13.51, V13.52, V67.4, 733.95, 823, 733.1, 800, 801, 802, 803, 804, 805, 806, 807, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829

Table S2. Adjusted associations of CODA with risks of DCGF, death, and ACGF in the first year posttransplant and >1 to 3 years after kidney transplant.

Pretransplant CODA and outcomes first year posttransplant				First year posttransplant and outcomes >1 to 3 years posttransplant		
	DCGF aHR (95%)	Death aHR (95%)	ACGF aHR (95%)	DCGF aHR (95%)	Death aHR (95%)	ACGF aHR (95%)
CDOA	1.00 (0.54–1.87)	1.09 (0.49–2.44)	1.10 (0.67–1.80)	2.29 (1.59–3.32)‡	1.79 (1.06–3.04)*	2.09 (1.50–2.91)‡
Age (years)						
≤18	1.04 (0.67–1.62)	0.67 (0.28–1.60)	0.86 (0.58–1.27)	1.25 (0.99–1.58)	0.55 (0.35–0.88)*	1.02 (0.84–1.25)
19-30	Reference	Reference	Reference	Reference	Reference	Reference
31-44	0.79 (0.64–0.97)*	1.73 (1.16–2.57)*	0.94 (0.78–1.13)	0.51 (0.45–0.59)‡	1.14 (0.88–1.48)	0.59 (0.52–0.67)‡
45-59	0.83 (0.67–1.03)	2.65 (1.79–3.92)‡	1.11 (0.92–1.34)	0.32 (0.27–0.37)‡	2.03 (1.58–2.60)‡	0.55 (0.48–0.62)‡
≥60	0.91 (0.61–1.36)	5.72 (3.40–9.61)‡	1.65 (1.21–2.25)*	0.23 (0.18–0.29)‡	3.59 (2.66–4.84)‡	0.74 (0.61–0.89)*
Male	1.00 (0.87–1.14)	1.02 (0.88–1.17)	1.02 (0.92–1.12)	0.96 (0.86–1.06)	0.92 (0.83–1.01)	0.93 (0.87–1.01)
Race						
White	Reference	Reference	Reference	Reference	Reference	Reference
Black	1.18 (1.05–1.32)*	0.83 (0.73–0.94)*	1.04 (0.95–1.14)	1.69 (1.52–1.88)‡	0.74 (0.67–0.82)‡	1.12 (1.04–1.21)*
Hispanic	0.88 (0.75–1.03)	0.66 (0.56–0.78)‡	0.78 (0.69–0.88)‡	0.87 (0.77–1.00)*	0.61 (0.54–0.68)‡	0.73 (0.66–0.80)‡
Other	0.86 (0.66–1.13)	0.79 (0.61–1.03)	0.83 (0.68–1.01)	0.73 (0.60–0.90)*	0.58 (0.49–0.69)‡	0.63 (0.55–0.72)‡
BMI (kg/m ²)						
<18.5	0.96 (0.68–1.34)	1.66 (1.20–2.30)*	1.23 (0.96–1.57)	0.87 (0.70–1.08)	1.26 (0.99–1.61)	0.96 (0.81–1.14)
18.5-24.9	Reference	Reference	Reference	Reference	Reference	Reference
25-30	1.22 (1.07–1.39)*	0.97 (0.85–1.11)	1.07 (0.97–1.18)	1.11 (1.00–1.23)	0.87 (0.79–0.95)*	0.97 (0.90–1.05)
>30	1.48 (1.27–1.72)‡	1.04 (0.89–1.23)	1.24 (1.11–1.39)†	1.19 (1.06–1.32)*	0.91 (0.83–1.01)	1.04 (0.96–1.12)
Unknown	1.17 (0.85–1.63)	1.56 (1.14–2.12)*	1.37 (1.09–1.73)*	0.99 (0.78–1.26)	0.88 (0.72–1.08)	0.97 (0.82–1.14)
Cause of ESRD						
Diabetes	0.88 (0.74–1.05)	1.03 (0.88–1.22)	0.97 (0.86–1.10)	0.93 (0.76–1.14)	1.29 (1.09–1.52)*	1.09 (0.95–1.25)
Glomerulonephritis	0.98 (0.85–1.12)	0.74 (0.62–0.88)†	0.89 (0.80–1.00)*	Reference	Reference	Reference
Hypertension	Reference	Reference	Reference	1.07 (0.95–1.20)	1.34 (1.19–1.52)‡	1.16 (1.06–1.26)*
Polycystic kidney disease	0.63 (0.50–0.80)†	0.59 (0.45–0.76)‡	0.63 (0.52–0.75)‡	0.70 (0.58–0.85)†	0.81 (0.69–0.97)*	0.74 (0.65–0.85)‡
Other	0.95 (0.81–1.12)	0.96 (0.81–1.15)	0.95 (0.84–1.08)	0.80 (0.70–0.92)*	1.11 (0.96–1.28)	0.86 (0.78–0.96)*
Dialysis duration (months)						
None	0.57 (0.43–0.76)†	0.61 (0.47–0.80)†	0.62 (0.51–0.76)‡	0.70 (0.60–0.82)‡	0.78 (0.68–0.89)†	0.76 (0.69–0.85)‡

Table S2, continued. Adjusted associations of CODA with risks of DCGF, death, and ACGF in the first year posttransplant and >1 to 3 years after kidney transplant.

>0-24	Reference	Reference	Reference	Reference	Reference	Reference
25-60	1.24 (1.08–1.42)*	1.23 (1.08–1.42)*	1.24 (1.12–1.37)‡	1.04 (0.93–1.15)	1.20 (1.10–1.32)†	1.11 (1.03–1.20)*
>60	1.62 (1.41–1.87)‡	1.75 (1.51–2.03)‡	1.66 (1.49–1.84)‡	1.03 (0.91–1.17)	1.51 (1.35–1.69)‡	1.23 (1.12–1.34)‡
Missing	4.13 (2.93–5.82)‡	1.55 (0.93–2.59)	2.81 (2.09–3.79)‡	0.73 (0.42–1.24)	1.73 (1.22–2.46)*	1.32 (0.96–1.81)
Comorbid conditions						
Diabetes	0.98 (0.83–1.15)	1.37 (1.17–1.61)‡	1.13 (1.00–1.27) *	0.96 (0.81–1.15)	1.40 (1.22–1.61)‡	1.17 (1.04–1.32)*
Angina	1.11 (0.94–1.32)	1.26 (1.08–1.46)*	1.19 (1.05–1.34) *	1.11 (0.95–1.30)	1.26 (1.13–1.40)‡	1.22 (1.11–1.34)‡
COPD	1.39 (1.00–1.94)*	1.74 (1.31–2.30)†	1.57 (1.26–1.97) ‡	1.38 (0.96–1.97)	1.59 (1.26–2.00)†	1.48 (1.19–1.83)†
Hypertension	0.96 (0.84–1.09)	0.98 (0.86–1.13)	0.96 (0.87–1.06)	0.90 (0.81–1.00)*	0.87 (0.79–0.95)*	0.91 (0.84–0.98)*
Cerebral vascular disease	1.16 (0.91–1.49)	1.02 (0.80–1.30)	1.10 (0.92–1.32)	1.04 (0.81–1.32)	1.30 (1.11–1.53)*	1.15 (0.99–1.33)
Peripheral vascular disease	1.20 (0.97–1.48)	1.37 (1.14–1.64)†	1.29 (1.12–1.50)†	0.97 (0.78–1.22)	1.35 (1.19–1.54)‡	1.24 (1.10–1.40)†
Education Level						
College & higher	Reference	Reference	Reference	Reference	Reference	Reference
Grade/High schools	0.99 (0.89–1.11)	0.91 (0.81–1.02)	0.95 (0.88–1.03)	1.19 (1.06–1.32)*	1.08 (0.98–1.19)	1.14 (1.05–1.23)*
Unknown	0.92 (0.78–1.09)	0.95 (0.80–1.14)	0.96 (0.84–1.08)	1.02 (0.89–1.18)	1.04 (0.92–1.18)	1.03 (0.93–1.14)
Employment						
Working	0.85 (0.72–0.99)*	0.84 (0.71–1.00)*	0.84 (0.75–0.95)*	0.92 (0.83–1.03)	0.72 (0.65–0.81)‡	0.85 (0.78–0.92)‡
Not Working	Reference	Reference	Reference	Reference	Reference	Reference
Unknown	0.96 (0.80–1.15)	0.95 (0.80–1.14)	0.99 (0.86–1.13)	0.81 (0.69–0.95)*	0.89 (0.78–1.02)	0.89 (0.79–0.99)*
Physical Capacity						
No Limit	Reference	Reference	Reference	Reference	Reference	Reference
Limited	1.06 (0.90–1.25)	1.49 (1.29–1.73)‡	1.25 (1.11–1.40)†	1.07 (0.92–1.24)	1.18 (1.05–1.32)*	1.14 (1.03–1.26)*
Unknown	1.08 (0.97–1.20)	1.19 (1.06–1.33)*	1.11 (1.03–1.21)*	0.93 (0.85–1.03)	1.05 (0.96–1.14)	0.99 (0.93–1.06)
Previous transplant	1.37 (1.16–1.62)†	1.36 (1.13–1.63)†	1.35 (1.19–1.54)‡	0.84 (0.61–1.16)	1.66 (1.37–2.02)‡	1.38 (1.16–1.65)†
Most Recent PRA						
0-9	Reference	Reference	Reference	Reference	Reference	Reference
10-79	0.95 (0.84–1.08)	1.01 (0.88–1.15)	0.99 (0.90–1.09)	1.02 (0.91–1.13)	1.00 (0.90–1.10)	0.99 (0.92–1.07)
≥80	1.12 (0.94–1.34)	1.13 (0.92–1.38)	1.10 (0.95–1.26)	1.17 (0.96–1.44)	1.13 (0.95–1.34)	1.11 (0.96–1.28)
Missing	0.80 (0.62–1.05)	0.95 (0.74–1.22)	0.85 (0.70–1.03)	1.22 (0.92–1.62)	0.99 (0.77–1.27)	1.11 (0.91–1.36)

Table S2, continued. Adjusted associations of CODA with risks of DCGF, death and ACGF in the first year posttransplant and >1 to 3 years after kidney transplant.

HLA Mismatch						
Zero A, B, DR				0.63 (0.52–0.77)‡	0.94 (0.82–1.08)	0.82 (0.73–0.93)*
Zero DR				0.79 (0.69–0.90)†	0.85 (0.76–0.96)*	0.84 (0.77–0.93)†
Other MM				Reference	Reference	Reference
Donor Type						
Living				0.79 (0.70–0.89)†	0.87 (0.77–0.97)*	0.80 (0.74–0.88)‡
SCD				Reference	Reference	Reference
ECD				1.75 (1.55–1.97)‡	1.40 (1.28–1.54)‡	1.47 (1.36–1.59)‡
DCD				0.94 (0.82–1.09)	1.08 (0.96–1.21)	1.01 (0.92–1.11)
Year of Transplant						
2007-2010	Reference	Reference	Reference	Reference	Reference	Reference
2011-2015	0.71 (0.65–0.78)‡	0.88 (0.79–0.97)*	0.79 (0.73–0.84)‡	0.75 (0.69–0.82)‡	0.98 (0.91–1.06)	0.88 (0.82–0.93)‡

Abbreviations: BMI, body mass index; CDOA, cannabis dependence or abuse; COPD, chronic obstructive pulmonary disease; DCD, donation after circulatory death; ECD, extended criteria donor; ESRD, end-stage renal disease; HLA, human leukocyte antigen; PRA, panel reactive antibody; SCD, standard criteria donor.

P values: **P* < 0.05–0.002; †*P* = 0.001–0.0001; ‡*P* < 0.0001, for differences of distributions of clinical traits among patients with versus without CDOA.

“Other race” includes Asian, Native American, Pacific Islander, and multiracial.

Table S3. Associations of pretransplant CDOA with risk of DCGF, death, and ACGF in the first year posttransplant, adjusting for pretransplant alcohol abuse, other drug abuse, noncompliance, and other baseline factors.

Outcome predictors	DCGF aHR (95%)	Death aHR (95%)	ACGF aHR (95%)
CDOA	1.00 (0.54–1.87)	1.09 (0.49–2.44)	1.10 (0.67–1.80)
CDOA	1.00 (0.53–1.86)	1.09 (0.49–2.44)	1.09 (0.67–1.79)
Alcohol abuse	1.39 (0.74–2.58)	1.26 (0.65–2.43)	1.31 (0.81–2.11)
CDOA	1.00 (0.54–1.87)	1.10 (0.49–2.45)	1.10 (0.67–1.80)
Other drug abuse	0.95 (0.54–1.67)	0.83 (0.46–1.50)	0.89 (0.58–1.37)
CDOA	1.00 (0.54–1.87)	1.08 (0.48–2.43)	1.09 (0.67–1.79)
Noncompliance	1.00 (0.78–1.30)	1.21 (0.92–1.60)	1.10 (0.91–1.34)
CDOA	1.00 (0.54–1.87)	1.09 (0.49–2.45)	1.10 (0.67–1.80)
Alcohol abuse	1.39 (0.74–2.59)	1.26 (0.65–2.43)	1.31 (0.81–2.11)
Other drug abuse	0.94 (0.53–1.67)	0.83 (0.46–1.50)	0.89 (0.58–1.37)
CDOA	1.00 (0.54–1.87)	1.08 (0.48–2.42)	1.09 (0.67–1.79)
Alcohol abuse	1.39 (0.74–2.59)	1.26 (0.65–2.43)	1.31 (0.81–2.11)
Other abuse	0.94 (0.53–1.67)	0.83 (0.46–1.49)	0.89 (0.58–1.36)
Noncompliance	1.00 (0.77–1.30)	1.22 (0.92–1.60)	1.10 (0.91–1.34)

Abbreviations: ACGF, all-cause graft failure; aHR, adjusted hazard ratio; CDOA, cannabis dependence or abuse; DCGF, death-censored graft failure.

Models are adjusted for other baseline factors, as in the primary analyses.

P values: **P* < 0.05–0.002; †*P* = 0.001–0.0001; ‡*P* < 0.0001.

Table S4. Associations of posttransplant CDOA with risk of DCGF, death, and ACGF in >1 to 3 years posttransplant, adjusting for posttransplant alcohol abuse, other drug abuse, noncompliance, and other baseline factors.

Outcome predictors	DCGF aHR (95%)	Death aHR (95%)	ACGF aHR (95%)
CDOA	2.32 (1.60–3.36)‡	1.80 (1.06–3.05)*	2.11 (1.51–2.93)‡
CDOA	2.27 (1.57–3.29)‡	1.78 (1.05–3.02)*	2.07 (1.49–2.87)‡
Alcohol abuse	2.04 (1.20–3.46)*	1.91 (1.31–2.81)†	1.96 (1.39–2.76)†
CDOA	2.24 (1.54–3.24)‡	1.58 (0.93–2.68)	1.95 (1.40–2.71)‡
Other drug abuse	1.59 (1.09–2.33)*	2.41 (1.85–3.14)‡	2.06 (1.62–2.61)‡
CDOA	1.88 (1.30–2.73)†	1.50 (0.88–2.55)	1.75 (1.25–2.44)†
Noncompliance	2.42 (2.05–2.84)‡	2.54 (2.19–2.95)‡	2.49 (2.20–2.81)‡
CDOA	2.20 (1.52–3.19)‡	1.57 (0.92–2.67)	1.92 (1.37–2.67)†
Alcohol abuse	1.96 (1.16–3.33)*	1.83 (1.24–2.68)*	1.86 (1.32–2.63)†
Other drug abuse	1.55 (1.05–2.27)*	2.37 (1.82–3.09)‡	2.01 (1.59–2.56)‡
CDOA	1.81 (1.25–2.63)*	1.29 (0.76–2.20)	1.61 (1.15–2.24)*
Alcohol abuse	1.91 (1.13–3.24)*	1.73 (1.18–2.53)*	1.82 (1.29–2.57)†
Other abuse	1.38 (0.94–2.03)	2.26 (1.73–2.95)‡	1.86 (1.47–2.36)‡
Noncompliance	2.39 (2.03–2.81)‡	2.49 (2.15–2.89)‡	2.44 (2.16–2.76)‡

Abbreviations: ACGF, all-cause graft failure; aHR, adjusted hazard ratio; CDOA, cannabis dependence or abuse; DCGF, death-censored graft failure.

Models are adjusted for other baseline factors, as in the primary analyses.

P values: * $P < 0.05$ – 0.002 ; † $P = 0.001$ – 0.0001 ; ‡ $P < 0.0001$.