

Figure S1. Cohort Creation

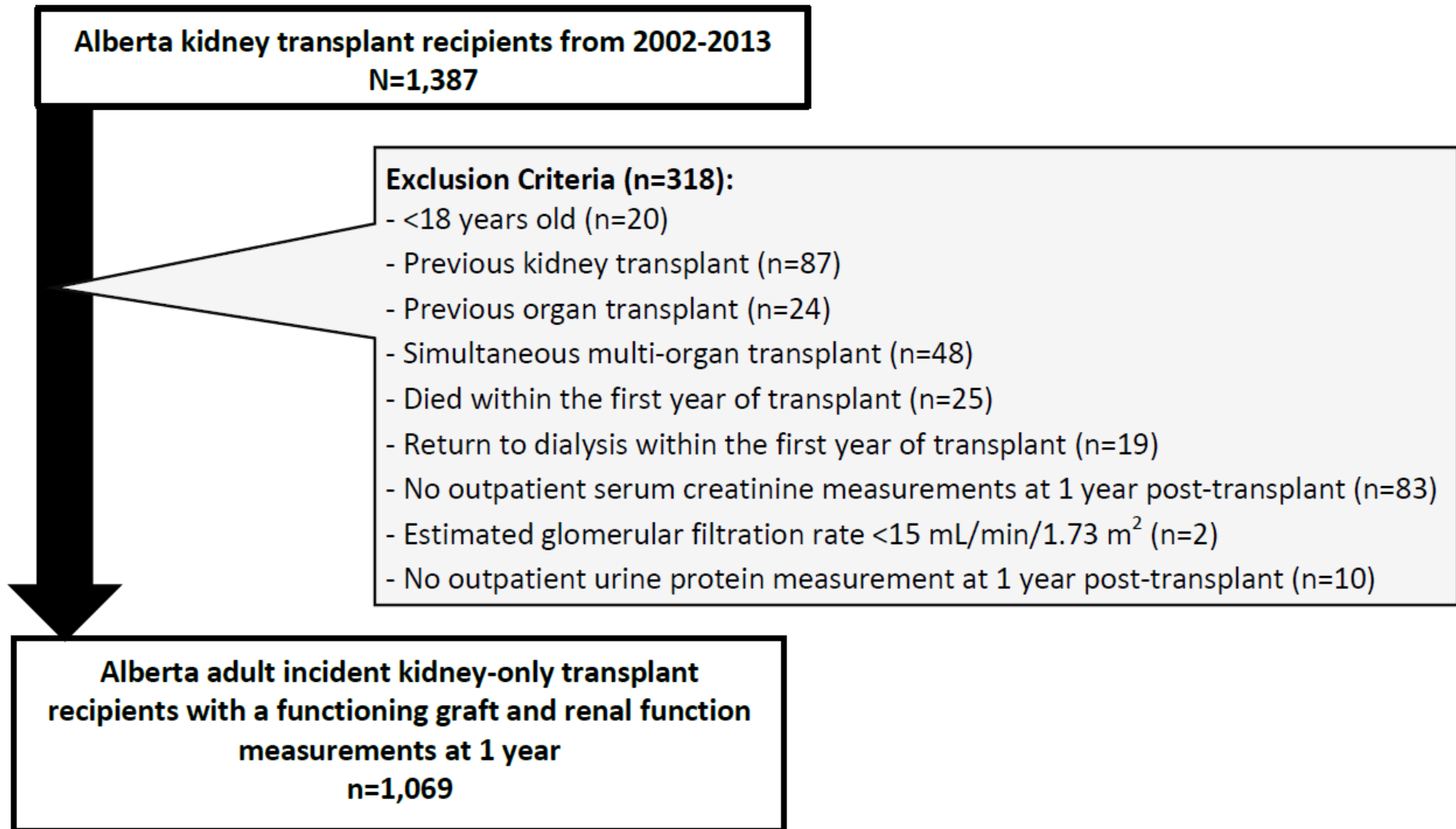
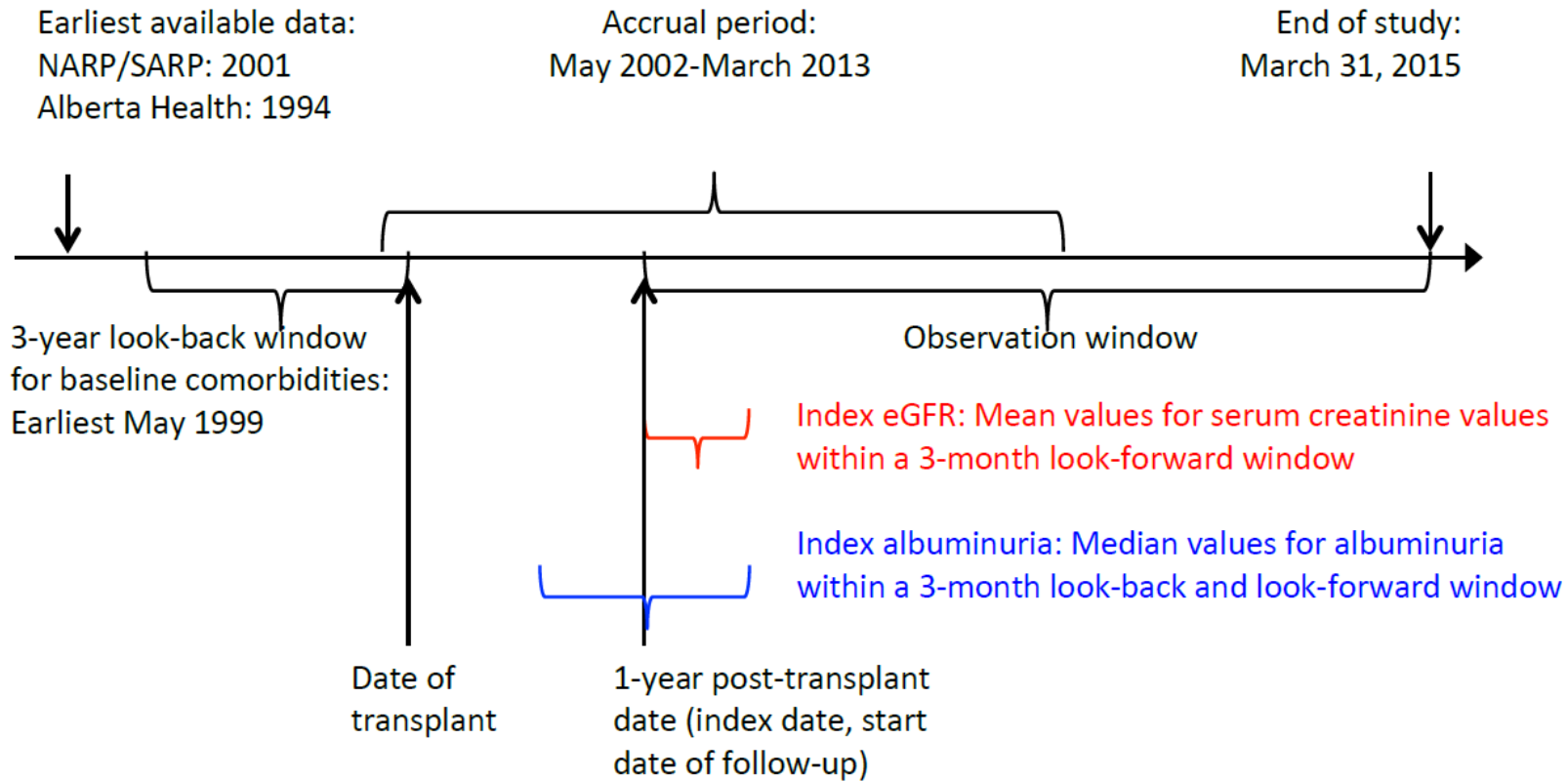


Figure S2. Study Design



Abbreviations: eGFR, estimated glomerular filtration rate; NARP/SARP, Northern and Southern Alberta Renal Program.

**Figure S3a. Rates of Clinical Outcomes by Level of eGFR and Albuminuria (by ACR or PCR) in Kidney Transplant Recipients, per 1,000 Person-years**

eGFR	All-cause Mortality and Cardiovascular Events <sup>a</sup> (N=725)				Death-censored Cardiovascular Events <sup>a</sup> (N=725)			
	Albuminuria (ACR or PCR)							
	Overall	Normal	Mild	Heavy	Overall	Normal	Mild	Heavy
<b>≥60 mL/min/1.73 m<sup>2</sup></b>								
Events, n	53	23	26	4	37	18	17	2
Patients, n	368	214	142	12	368	214	142	12
Unadjusted	29.3 (22.2, 37.4)	21.7 (13.6, 30.9)	37.5 (25.2, 51.8)	78.5 (15.9, 175.3)	20.5 (14.1, 27.1)	17.0 (9.4, 25.3)	24.6 (13.3, 36.6)	39.2 (0, 122.3)
Adjusted <sup>b</sup>	31.1 (23.0, 43.2)	25.8 (16.3, 42.0)	35.2 (24.2, 55.4)	69.7 (19.0, 306.8)	23.2 (16.5, 34.6)	20.5 (11.5, 37.9)	26.0 (14.9, 43.6)	33.6 (0, 228.8)
<b>45-59 mL/min/1.73 m<sup>2</sup></b>								
Events, n	29	13	13	3	17	8	7	2
Patients, n	216	118	87	11	216	118	87	11
Unadjusted	28.0 (18.6, 38.9)	23.3 (12.3, 36.8)	30.4 (14.5, 48.8)	61.0 (0, 176.8)	16.4 (9.1, 24.7)	14.3 (5.6, 25.1)	16.4 (6.3, 31.0)	40.7 (0, 128.5)
Adjusted <sup>b</sup>	28.4 (18.0, 43.7)	24.0 (12.4, 44.2)	32.5 (14.9, 56.6)	39.9 (0, 222.8)	17.6 (9.0, 28.3)	15.2 (5.4, 31.3)	18.4 (5.4, 37.1)	34.5 (0, 191.5)
<b>30-44 mL/min/1.73 m<sup>2</sup></b>								
Events, n	28	9	17	2	18	5	12	1
Patients, n	107	34	64	9	107	34	64	9
Unadjusted	51.8 (35.7, 73.0)	49.3 (20.3, 84.9)	55.0 (31.9, 86.1)	40.9 (0, 136.9)	33.3 (20.0, 49.4)	27.4 (5.8, 51.3)	38.8 (19.7, 64.7)	20.5 (0, 83.1)
Adjusted <sup>b</sup>	46.6 (31.3, 69.0)	44.3 (21.0, 81.1)	49.2 (28.6, 81.4)	47.4 (0, 141.1)	32.2 (19.4, 50.6)	25.5 (6.9, 52.5)	37.4 (19.4, 67.3)	25.8 (0, 108.0)
<b>15-29 mL/min/1.73 m<sup>2</sup></b>								
Events, n	13	1	8	4	4	0	3	1
Patients, n	34	5	21	8	34	5	21	8
Unadjusted	72.2 (36.8, 115.4)	36.9 (0, 143.9)	76.0 (32.6, 135.0)	84.0 (12.5, 211.8)	22.2 (4.5, 51.1)	0 (0, 0)	28.5 (0, 69.1)	21.0 (0, 111.9)
Adjusted <sup>b</sup>	53.7 (27.7, 109.0)	19.0 (0, 110.9)	54.9 (17.6, 134.1)	102.8 (16.7, 479.8)	19.8 (3.8, 59.9)	0 (0, 0)	22.7 (0, 77.3)	31.2 (0, 285.9)

Data is presented as rate (95% confidence interval).

<sup>a</sup> Cardiovascular event was defined as a hospitalization for myocardial infarction or ischemic stroke or a procedural code for PCI or CABG.

<sup>b</sup> Adjusted for age, sex, SES, urban residence, pre-transplant dialysis modality, dialysis duration, year of transplant, and a pre-transplant history of hypertension, diabetes mellitus, myocardial infarction, PCI or CABG surgery, heart failure, atrial fibrillation, stroke/TIA, and PVD.

For all-cause mortality and cardiovascular events and death-censored cardiovascular events, test results for linear trend were not significant across albuminuria categories. Colors represent the ranking of adjusted rates (ranked from 1 [lowest] to 12 [highest]). The categories with rank numbers 1-3 are green, 4-6 are yellow, 7-9 are orange, and 10-12 are red.<sup>1</sup> Colors reflect the KDIGO categories of risk (green: low risk; yellow: moderately increased risk; orange: high risk; red: very high risk).<sup>2</sup>

Abbreviations: CABG, coronary artery bypass graft; eGFR, estimated glomerular filtration rate; KDIGO, Kidney Disease: Improving Global Outcomes; PCI, percutaneous coronary intervention; PVD, peripheral vascular disease; SES, socio-economic status.; TIA, transient ischemic attack.

**Figure S3b. Rates of Clinical Outcomes by Level of eGFR and Albuminuria (by ACR or PCR) in Kidney Transplant Recipients, per 1,000 Person-years**

eGFR	All-cause Mortality and Heart Failure (N=725)				Death-censored Heart Failure (N=725)			
	Albuminuria (ACR or PCR)							
	Overall	Normal	Mild	Heavy	Overall	Normal	Mild	Heavy
<b>≥60 mL/min/1.73 m<sup>2</sup></b>								
Events, n	40	17	20	3	29	12	15	2
Patients, n	368	214	142	12	368	214	142	12
Unadjusted	21.8 (15.7, 28.6)	15.5 (8.9, 23.1)	28.8 (17.4, 42.6)	64.2 (0, 177.6)	15.8 (10.6, 21.9)	11.0 (5.4, 17.5)	21.6 (11.8, 34.2)	42.8 (0, 130.2)
Adjusted <sup>a</sup>	21.0 (14.8, 30.9)	17.1 (9.5, 29.2)	23.4 (14.1, 40.8)	86.9 (0, 307.7)	15.4 (9.9, 25.3)	11.6 (5.0, 25.0)	19.1 (11.3, 41.2)	48.0 (0, 256.5)
<b>45-59 mL/min/1.73 m<sup>2</sup></b>								
Events, n	24	11	9	4	15	7	5	3
Patients, n	216	118	87	11	216	118	87	11
Unadjusted	23.1 (13.9, 32.1)	19.6 (8.5, 31.0)	20.5 (8.1, 35.2)	94.6 (17.7, 334.5)	14.4 (7.5, 22.0)	12.5 (3.9, 22.2)	11.4 (2.4, 23.4)	70.9 (0, 269.6)
Adjusted <sup>a</sup>	24.4 (15.0, 39.9)	19.9 (8.9, 40.1)	24.3 (10.0, 46.1)	72.3 (10.7, 436.9)	15.5 (8.2, 30.3)	13.1 (4.6, 32.4)	11.9 (2.6, 29.1)	88.4 (0, 490.3)
<b>30-44 mL/min/1.73 m<sup>2</sup></b>								
Events, n	26	5	18	3	15	1	13	1
Patients, n	107	34	64	9	107	34	64	9
Unadjusted	48.3 (30.7, 69.3)	25.6 (6.1, 49.8)	60.2 (34.2, 91.2)	68.5 (0, 174.8)	27.9 (15.0, 43.1)	5.1 (0, 17.4)	43.5 (21.9, 70.8)	22.8 (0, 101.8)
Adjusted <sup>a</sup>	49.8 (31.2, 84.4)	27.7 (6.9, 66.6)	62.8 (34.0, 119.5)	62.5 (0, 252.0)	31.5 (16.6, 67.1)	5.1 (0, 23.6)	52.7 (25.2, 144.2)	21.6 (0, 217.2)
<b>15-29 mL/min/1.73 m<sup>2</sup></b>								
Events, n	13	1	8	4	4	0	2	2
Patients, n	34	5	21	8	34	5	21	8
Unadjusted	71.9 (36.7, 113.5)	36.9 (0, 143.9)	74.9 (32.5, 131.1)	85.4 (12.6, 216.9)	22.1 (4.3, 49.2)	0 (0, 0)	18.7 (0, 49.7)	42.7 (0, 156.0)
Adjusted <sup>a</sup>	53.0 (27.1, 112.3)	14.6 (0, 96.2)	57.5 (20.0, 144.7)	107.8 (12.2, 586.9)	18.6 (3.5, 60.6)	0 (0, 0.6)	15.0 (0, 55.9)	59.5 (0, 577.7)

Data is presented as rate (95% confidence interval).

<sup>a</sup> Adjusted for age, sex, SES, urban residence, pre-transplant dialysis modality, dialysis duration, year of transplant, and a pre-transplant history of hypertension, diabetes mellitus, myocardial infarction, PCI or CABG surgery, heart failure, atrial fibrillation, stroke/TIA, and PVD.

For all-cause mortality and heart failure, test results for linear trend were significant across the overall eGFR categories (p=0.001) and mild albuminuria categories (p=0.004).

For death-censored heart failure, test results for linear trend were significant across albuminuria categories for eGFR category 30-44 mL/min/1.73 m<sup>2</sup> (p=0.04).

Colors represent the ranking of adjusted rates (ranked from 1 [lowest] to 12 [highest]). The categories with rank numbers 1-3 are green, 4-6 are yellow, 7-9 are orange, and 10-12 are red.<sup>1</sup> Colors reflect the KDIGO categories of risk (green: low risk; yellow: moderately increased risk; orange: high risk; red: very high risk).<sup>2</sup>

Abbreviations: CABG, coronary artery bypass graft; eGFR, estimated glomerular filtration rate; KDIGO, Kidney Disease: Improving Global Outcomes; PCI, percutaneous coronary intervention; PVD, peripheral vascular disease; SES, socio-economic status.; TIA, transient ischemic attack.

<b>Table S1. STROBE Checklist<sup>3</sup></b>			
	<b>Item</b>	<b>Recommendation</b>	<b>Section</b>
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	Abstract
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	Abstract
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Introduction
Objectives	3	State specific objectives, including any prespecified hypotheses	Introduction
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	Methods
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Methods
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	Methods
		(b) For matched studies, give matching criteria and number of exposed and unexposed	Not applicable
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Methods
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Methods
Bias	9	Describe any efforts to address potential sources of bias	Methods
Study size	10	Explain how the study size was arrived at	Figure S1
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Methods
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Methods
		(b) Describe any methods used to examine subgroups and interactions	Methods
		(c) Explain how missing data were addressed	Methods
		(d) If applicable, explain how loss to follow-up was addressed	Methods
		(e) Describe any sensitivity analyses	Methods



<b>Table S1. STROBE checklist (continued)</b>			
	<b>Item</b>	<b>Recommendation</b>	<b>Section</b>
<b>Results</b>			
Participants	13	(a) Report numbers of individuals at each stage of study—e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Figure S1
		(b) Give reasons for non-participation at each stage	Figure S1
		(c) Consider use of a flow diagram	Figure S1
Descriptive data	14	(a) Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Methods
		(c) Summarise follow-up time (e.g. average and total amount)	Results
Outcome data	15	Report numbers of outcome events or summary measures over time	Results
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g. 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Results Figure 1 Figure 2
		(b) Report category boundaries when continuous variables were categorized	Results
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Results
Other analyses	17	Report other analyses done—e.g. analyses of subgroups and interactions, and sensitivity analyses	Results Figure S3
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	Discussion
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Discussion
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Discussion
Generalisability	21	Discuss the generalisability (external validity) of the study results	Discussion
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Disclosures

<b>Table S2. Databases and Coding Definitions for Inclusion/Exclusion Criteria, Baseline Characteristics, and Outcome Measurements</b>			
<b>Variable</b>	<b>Database</b>	<b>Codes</b>	
<b>Inclusion Criteria</b>			
Kidney transplantation	NARP, SARP	Variables: Modality = Transplant Incident = 1 Numinctrans = 1 Transdate1 = Date of first transplant	
Laboratory investigation	AKDN	Serum creatinine Urinalysis, Albumin-creatinine ratio, Protein-creatinine ratio	
<b>Exclusion Criteria</b>			
Kidney transplantation (prior to May 2002)	NARP, SARP (since 2001)	Variable: Trans2001	
	AH (since 1994)	CCI code: 1PC85 ICD-9-CM: 5569 CCP codes: 67.4, 67.59, 67.5	
Other organ transplant	AH	Pancreas transplant	CCI: 10J85 ICD-9-CM: 528 (includes 5280, 5281, 5282, 5283, 5284, 5285, 5286) CCP: 64.8
		Liver transplant	CCI: 10A85 ICD-9-CM: 505 (includes 5051, 5059) CCP: 62.49, 62.4
		Bowel transplant	CCI: 1NK85, 1NP85 ICD-9-CM: 4697 CCP: 58.99
		Multi-visceral transplant	CCI: 1HY85, 1OK85 ICD-9-CM: 336 CCP: 45.6
		Lung transplant	CCI: 1GR85, 1GT85 ICD-9-CM: 335 (includes 3350, 3351, 3352) CCP: 45.5
		Heart transplant	CCI: 1HZ85 ICD-9-CM: 3751 CCP: 49.5

<b>Table S2. Databases and Coding Definitions for Inclusion/Exclusion Criteria, Baseline Characteristics, and Outcome Measurements (continued)</b>			
<b>Variable</b>	<b>Database</b>	<b>Codes</b>	
<b>Baseline Characteristics – Demographics</b>			
Age, Sex, Aboriginal, SES, Rural	AH	Population Registry	
<b>Baseline Characteristics – Kidney-related Characteristics</b>			
Dialysis modality	NARP, SARP	Variable: Modality = Hemodialysis, Peritoneal dialysis, Pre-care (Pre-emptive)	
Dialysis duration	NARP, SARP	Variable: Duration	
Site of transplantation	NARP, SARP	Variable: Program (SARP = 0, NARP = 1)	
<b>Baseline Co-morbidities</b>			
<b>Database</b>	<b>Codes</b>		
Hypertension <sup>4</sup>	AH	1 hospitalization or 2 claims in 2 years or less: ICD-9-CM: 401-405 ICD-10: I10-I13, I15	ICD-9-CM: Sn 79%, PPV 95% ICD-10: Sn 68%, PPV 93% <sup>5</sup>
Diabetes mellitus <sup>6</sup>	AH	1 hospitalization or 2 claims in 2 years or less: ICD-9-CM: 250 ICD-10: E10-E14	ICD-9-CM: Sn 86%, PPV 80%
Myocardial infarction <sup>7</sup>	AH	1 hospitalization: ICD-9-CM: 410 ICD-10: I21, I22	ICD-9-CM: Sn 89%, PPV 89%
PCI <sup>8</sup>	AH	CCI: 1IJ50, 1IJ54GQAZ, 1IJ57GQ, 1IL35 CCP: 51.59C, 51.59D, 51.59E, 51.59F	CCI: PPV 94-96%
CABG <sup>8</sup>	AH	CCP: 48.11, 48.12, 48.13, 48.14, 48.15, 48.19 CCI: 1IJ76	CCI: PPV 97-98%
Heart failure <sup>5,9</sup>	AH	1 hospitalization or 2 claims in 2 years or less: ICD-9-CM: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 425.4-425.9, 428 ICD-10: I09.9, I25.5, I42.0, I42.5-I42.9, I43, I50	ICD-9-CM: Sn 72%, PPV 91% ICD-10: Sn 69%, PPV 90%
Atrial fibrillation <sup>10</sup>	AH	1 hospitalization or 2 claims in 2 years or less: ICD-9 CM: 427.3 ICD-10: I48.0	ICD-9-CM: Sn 84%, PPV 89%
Stroke/TIA <sup>11</sup>	AH	1 most responsible or post-admittance hospitalization or 1 claim or 1 most emergency department ACCS: ICD-9-CM: 362.3, 430, 431, 433.x1, 434.x1, 435, 436 ICD-10: G45.0-G45.3, G45.8-G45.9, H34.1, I60, I61, I63, I64	ICD-9-CM: PPV 90% ICD-10: PPV 92%
PVD <sup>12</sup>	AH	1 hospitalization or 1 claim or 1 ACCS: ICD-9-CM: 440.2 ICD-10: I70.2	ICD-9-CM: Sn 77%, PPV 94%



<b>Table S2. Databases and Coding Definitions for Inclusion/Exclusion Criteria, Baseline Characteristics, and Outcome Measurements (continued)</b>		
<b>Variable</b>	<b>Database</b>	<b>Codes</b>
<b>Outcomes</b>		
Cardiovascular event	AH	Myocardial infarction: ICD-9-CM: 410, ICD-10: I21, I22 PCI: CCI: 1IJ50, 1IJ54GQAZ, 1IJ57GQ, 1IL35, CCP: 51.59C, 51.59D, 51.59E, 51.59F CABG: CCP: 48.11, 48.12, 48.13, 48.14, 48.15, 48.19, CCI: 1IJ76 Ischemic stroke: ICD-9: 434, 436, ICD-10: H34.1, I63.0, I63.1, I63.2, I63.3, I63.4, I63.5, I63.8, I63.9, I64
Heart failure	AH	ICD-9-CM: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 425.4-425.9, 428 ICD-10: I09.9, I25.5, I42.0, I42.5-I42.9, I43, I50
Abbreviations: ACCS, Ambulatory Care Classification System; AH, Alberta Health; AKDN, Alberta Kidney Disease Network; CABG, coronary artery bypass graft; CCI, Canadian Classification of Health Interventions; CORR, Canadian Organ Replacement Register; ESRD, end-stage renal disease; ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification; ICD-10, International Statistical Classification of Diseases, Tenth Revision; NARP, Northern Alberta Renal Program; PCI, percutaneous coronary intervention; PPV, positive predictive value; PVD, peripheral vascular disease; SARP, Southern Alberta Renal Program; SES, socio-economic status; Sn, sensitivity; TIA, transient ischemic attack.		

**Table S3. Demographic and Clinical Characteristics of Recipients at 1-Year Post-transplant by Degree of Albuminuria**

Characteristic	Overall, n (%)	Albuminuria (ACR, PCR only)		
		Normal	Mild	Heavy
<b>Recipients (n)</b>	725	371 (51.2)	314 (43.3)	40 (5.5)
<b>Age (years)</b>	53.3 [41.8-61.9]	51.7 [40.5-61.4]	55.5 [44.2-63.0]	49.2 [40.0-59.0]
>65 years	133 (18.3)	67 (18.1)	60 (19.1)	6 (15.0)
<b>Female sex</b>	251 (34.6)	125 (33.7)	111 (35.4)	15 (37.5)
<b>Aboriginal race</b>	48 (6.6)	18 (4.9)	27 (8.6)	3 (7.5)
<b>Socio-economic status<sup>a</sup></b>				
Lowest	167 (23.0)	78 (21.0)	79 (25.2)	10 (25.0)
Middle	159 (21.9)	85 (22.9)	64 (20.4)	10 (25.0)
Highest	129 (17.8)	68 (18.3)	54 (17.2)	7 (17.5)
<b>Urban residence<sup>b</sup></b>	640 (88.3)	333 (89.8)	269 (85.7)	38 (95.0)
<b>Pre-transplant dialysis modality<sup>c</sup></b>				
Hemodialysis	418 (57.7)	211 (56.9)	182 (58.0)	25 (62.5)
Peritoneal	205 (28.3)	108 (29.1)	88 (28.0)	9 (22.5)
Pre-emptive	102 (14.1)	52 (14.0)	44 (14.0)	6 (15.0)
<b>Dialysis duration (years)</b>	1.8 [0.8-3.2]	2.1 [1.2-3.4]	2.5 [1.5-3.9]	2.1 [1.2-3.2]
<b>Northern Alberta</b>	439 (60.6)	230 (62.0)	187 (59.6)	22 (55.0)
<b>Co-morbidities<sup>d</sup></b>				
Hypertension	659 (90.9)	334 (90.0)	285 (90.8)	40 (100.0)
Diabetes mellitus	283 (39.0)	120 (32.3)	140 (44.6)	23 (57.5)
Myocardial infarction	28 (3.9)	11 (3.0)	16 (5.1)	1 (2.5)
PCI/CABG	31 (4.3)	15 (4.0)	16 (5.1)	0 (0)
Heart failure	64 (8.8)	29 (7.8)	32 (10.2)	3 (7.5)
Atrial fibrillation	38 (5.2)	18 (4.9)	18 (5.7)	2 (5.0)
Stroke/TIA	21 (2.9)	12 (3.2)	9 (2.9)	0 (0)
Peripheral vascular disease	49 (6.8)	21 (5.7)	24 (7.6)	4 (10.0)

Data is presented as number (%) except for age and dialysis duration, which are presented as median [interquartile range].

<sup>a</sup> Income was categorized according to fifths of average neighborhood income (first quintile is the lowest and the fifth quintile is the highest).

<sup>b</sup> Urban location indicates a population >10,000 or a population >1,000 with population density >400/km<sup>2</sup>.

<sup>c</sup> Recipients identified as pre-emptive were assessed for the presence of dialysis codes and re-classified as hemodialysis (n=5) or peritoneal dialysis (n=7).

<sup>d</sup> Assessed by the presence of a diagnostic or procedural code in the 3 years prior to the index date except for hypertension and diabetes which are defined by a previously validated algorithm.<sup>4,6</sup>

Abbreviations: ACR, albumin-creatinine ratio; CABG, coronary artery bypass graft; PCI, percutaneous coronary intervention; PCR, protein-creatinine ratio; TIA, transient ischemic attack.

## References

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