

Supplementary Material

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Figure S1. Cohort Creation

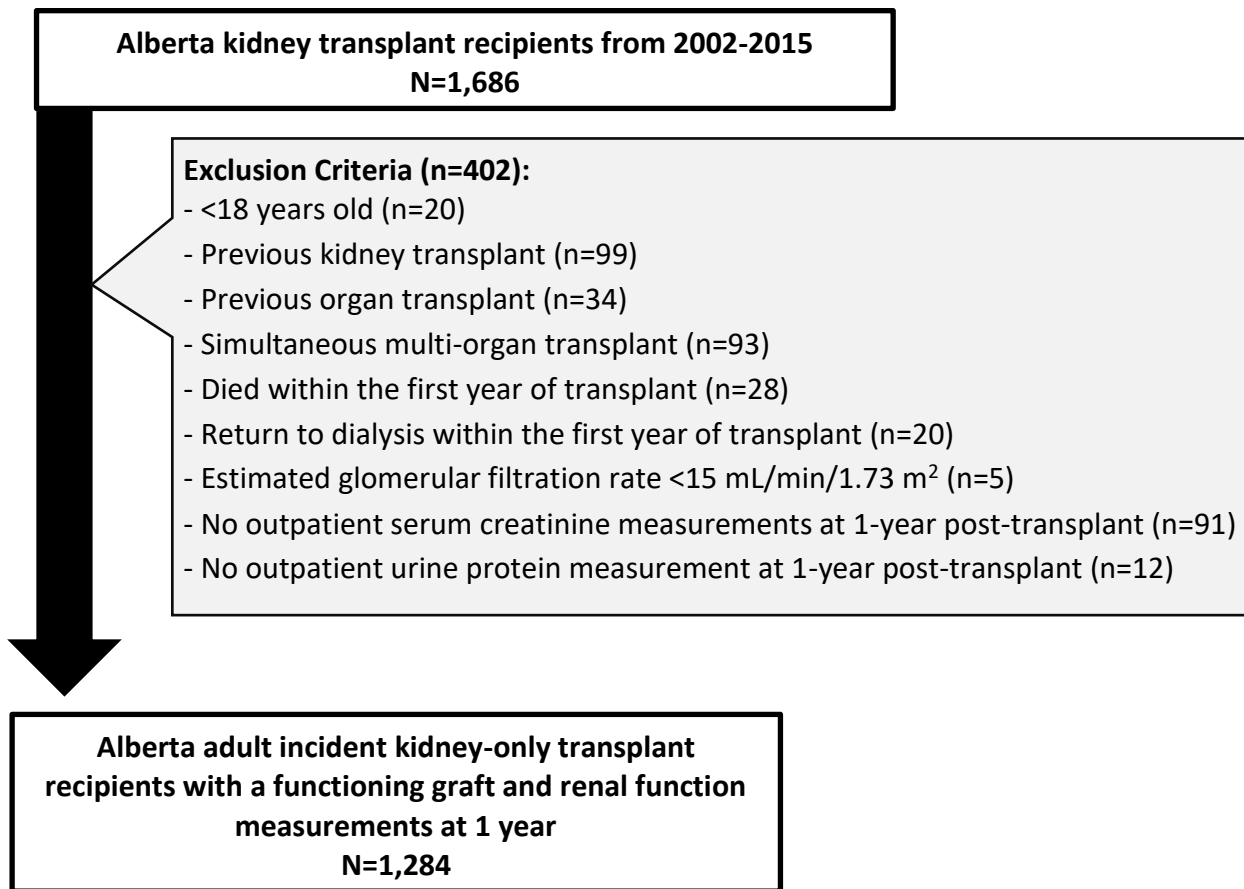
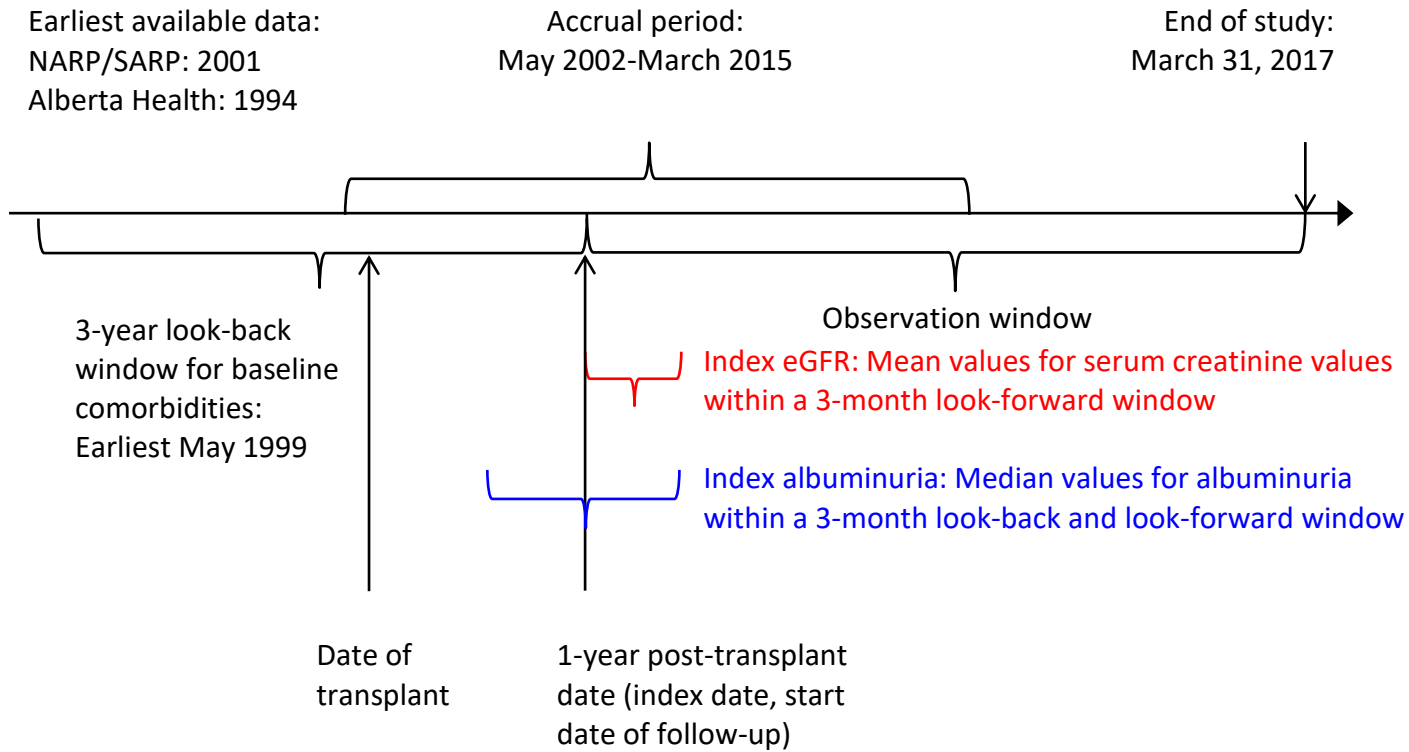


Figure S2. Study Design



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

Table S1. STROBE Checklist ¹			
	Item	Recommendation	Section
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	Title Page
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	Abstract
Introduction			
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
Methods			
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	Methods 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

Table S1. STROBE Checklist (continued)			
	Item	Recommendation	Section
Results			
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	Methods
		(b) Give reasons for non-participation at each stage	Methods
		(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	Results Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Table 1
		(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 Figure 3
		(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	Not applicable
Other analyses	17	Report other analyses done—e.g. analyses of subgroups and interactions, and sensitivity analyses	Results Figure 1 Figure 2
Discussion			
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
Other information			
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

Table S2. Databases and Coding Definitions for Inclusion/Exclusion Criteria, Baseline Characteristics, and Outcome Measurements			
Variable	Database	Codes	
Inclusion Criteria			
Kidney transplantation	NARP, SARP		
Exclusion Criteria			
Age	AH	Population Registry	
Kidney transplantation (prior to May 2002)	NARP, SARP		
	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: 1OJ85 ICD-9-CM: 528 (includes 5280, 5281, 5282, 5283, 5284, 5285, 5286) CCP: 64.8
		Liver transplant	CCI: 1OA85 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: 375 CCP: 49.5
Graft failure (dialysis)	NARP, SARP		
Mortality	AH	Alberta Vital Statistics	
Laboratory investigation	AKDN	Serum creatinine Urinalysis, Albumin-creatinine ratio, Protein-creatinine ratio	

Table S2. Databases and Coding Definitions for Inclusion/Exclusion Criteria, Baseline Characteristics, and Outcome Measurements (continued)			
Variable	Database	Codes	
Baseline Characteristics – Demographics			
Age, Sex, SES, Rural	AH	Population Registry	
Baseline Characteristics – Kidney-related Characteristics			
Dialysis modality	NARP, SARP	Variable: Modality = Hemodialysis, Peritoneal dialysis, Pre-care (Pre-emptive)	
	AH	≥2 outpatient claims 90 days apart: CCP: 13.99A, 13.99B, 13.99C, 13.99D, 13.99O, 13.99OA Hemodialysis: if the last hospitalization or claim before initial renal transplantation CCI: 1PZ21HQBR, 1PZ21HQBS CCP: 51.95 (must be outpatient) Peritoneal dialysis: if the last hospitalization or claim before initial renal transplantation CCI: 1PZ21HPD4 CCP: 66.98 (must be outpatient)	
Dialysis/Transplant duration	NARP, SARP		
Site of transplantation	NARP, SARP		
Baseline Co-morbidities	Database	Codes	Validation
Hypertension ²	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% ³
Diabetes mellitus ⁴	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 ⁵	AH	1 most responsible hospitalization: ICD-9-CM: 410 ICD-10: I21, I22	ICD-9-CM: Sn 89%, PPV 89%
Percutaneous coronary intervention ⁶	AH	CCP: 51.59C, 51.59D, 51.59E, 51.59F ICD-9-CM (procedure): 0066, 3601, 3602, 3603, 3605, 3606 CCI: 1IJ50, 1IJ54GQ-AZ, 1IJ57GQ	CCI: PPV 94-96%
Coronary artery bypass graft surgery ⁶	AH	CCP: 48.11, 48.12, 48.13, 48.14, 48.15, 48.19 ICD-9-CM (procedure): 361, 362 CCI: 1IJ76	CCI: PPV 97-98%

Table S2. Databases and Coding Definitions for Inclusion/Exclusion Criteria, Baseline Characteristics, and Outcome Measurements (continued)			
Baseline Co-morbidities	Database	Codes	Validation
Heart failure ^{3,7}	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 ⁸	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/Transient ischemic attack ⁹	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%
Peripheral vascular disease ¹⁰	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%
Cancer, lymphoma ³	AH	1 hospitalization or 2 claims in 2 years or less: ICD-9-CM: 200-202, 203.0, 238.6 ICD-10: C81-C85, C88, C90.0, C90.2, C96	ICD-9-CM: Sn 66%, PPV 73% ICD-10: Sn 63%, PPV 79%
Cancer, solid tumor without metastasis ³	AH	1 hospitalization or 2 claims in 2 years or less: ICD-9-CM: 140-172, 174-195 ICD-10: C00-C26, C30-C34, C37-C41, C43, C45-C58, C60-C76, C97	ICD-9-CM: Sn 44%, PPV 57% ICD-10: Sn 46%, PPV 59%
Cancer, metastatic ³	AH	1 hospitalization or 2 claims in 2 years or less: ICD-9-CM: 196-199 ICD-10: C77-C80	ICD-9-CM: Sn 83%, PPV 89% ICD-10: Sn 81%, PPV 87%
Hemorrhage	AH	See below	
Venous thromboembolism	AH	See below	

Table S2. Databases and Coding Definitions for Inclusion/Exclusion Criteria, Baseline Characteristics, and Outcome Measurements (continued)			
Outcomes	Database	Codes	Validation
Hemorrhage ¹¹	AH	1 hospitalization Subarachnoid hemorrhage: ICD-9-CM: 430 ICD-10: I60	ICD-9-CM: PPV 94%
		Intracerebral hemorrhage: ICD-9-CM: 431 ICD-10: I61	
		Other non-traumatic intracranial hemorrhage: ICD-9-CM: 432 ICD-10: I62	
		Upper gastrointestinal bleed: ICD-9-CM: 456.0, 456.2, 530.7, 530.8, 531.0, 531.2, 531.4, 531.6, 532.0, 532.2, 532.4, 532.6, 533.0, 533.2, 533.4, 533.6, 534.0, 534.2, 534.4, 534.6, 535.01, 535.11, 535.21, 535.31, 535.41, 535.51, 535.61, 537.8 ICD-10: I85.0, I98.3, K22.6, K22.8, K25.0, K25.2, K25.4, K25.6, K26.0, K26.2, K26.4, K26.6, K27.0, K27.2, K27.4, K27.6, K28.0, K28.2, K28.4, K28.6, K29, K31.8	ICD-9-CM: PPV 90%
Lower gastrointestinal bleed (excluding hemorrhoids): ICD-9-CM: 562.02, 562.03, 568.81, 569.3, 569.85, 578 ICD-10: K55.2, K57.0, K57.1, K66.1, K62.5, K92.0, K92.1, K92.2			

Table S2. Databases and Coding Definitions for Inclusion/Exclusion Criteria, Baseline Characteristics, and Outcome Measurements (continued)			
Outcomes	Database	Codes	Validation
Venous thromboembolism ¹²	AH	1 diagnostic code for PE or DVT and 1 imaging code in one hospitalization or in 30 days or less for ER/outpatients: Pulmonary embolism: ICD-9-CM: 415.0, 415.1 ICD-10: I26.0, I26.9	ICD-9-CM/ICD-10: Sn 75%, Sp 94%, PPV 73%, NPV 94%
		Deep vein thrombosis: ICD-9-CM: 451.1, 451.2, 451.8, 451.9, 453.2, 453.8, 453.9 ICD-10: I80.1, I80.2, I80.3, I80.8, I80.9, I82.8, I82.9, O22.3, O22.9, O87.1	
		Imaging: ICD-9-CM (procedure): 88.40, 88.41, 88.43, 88.44, 88.49, 88.77, 88.79, 92.15, CCI: 3GT20, 3GT70, 3KR30, 3IM10, 3IM12, 3JY10, 3JY12, 3JY20, 3KR10, 3KR12, 3KX10, 3KX12, 3KX30 CCP: 50.83, 50.84, 50.89, X123, X158, X333	
Abbreviations: ACCS, Ambulatory Care Classification System; AH, Alberta Health; AKDN, Alberta Kidney Disease Network; CCI, Canadian Classification of Health Interventions; CCP, Canadian Classification of Diagnostic, Therapeutic, and Surgical Procedures; DVT, deep vein thrombosis; 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; NPV, negative predictive value; PE, pulmonary embolism; PPV, positive predictive value; SARP, Southern Alberta Renal Program; SES, socio-economic status; Sn, sensitivity; Sp, specificity.			

Table S3. Demographic Characteristics of Recipients at 1-Year Post-transplant by Degree of Albuminuria Based on ACR and PCR only			
Characteristic	Overall, n (%)	Albuminuria (ACR, PCR only)	
		Absence	Presence
Recipients (n)	939 (100)	479 (51.0)	460 (49.0)
Age (years)	54.1 [41.8-62.5]	52.2 [40.5-61.7]	55.3 [43.8-63.0]
>65 years	178 (19.0)	89 (18.6)	89 (19.3)
Female sex	319 (34.0)	158 (33.0)	161 (35.0)
Socio-economic status^a			
Lowest	210 (22.4)	99 (20.7)	111 (24.1)
Middle	198 (21.1)	104 (21.7)	94 (20.4)
Highest	153 (16.3)	84 (17.5)	69 (15.0)
Urban residence^b	836 (89.0)	434 (90.6)	402 (87.4)
Pre-transplant dialysis modality^c			
Hemodialysis	547 (58.3)	273 (57.0)	274 (59.6)
Peritoneal	260 (27.7)	137 (28.6)	123 (26.7)
Pre-emptive	132 (14.1)	69 (14.4)	63 (13.7)
Dialysis duration (years)	2.5 [1.4-3.8]	2.4 [1.3-3.6]	2.7 [1.6-4.1]
Northern Alberta	561 (59.7)	295 (61.6)	266 (57.8)
Co-morbidities^d			
Hypertension	832 (88.6)	420 (87.7)	412 (89.6)
Diabetes mellitus	353 (37.6)	148 (30.9)	205 (44.6)
Myocardial infarction	18 (1.9)	7 (1.5)	11 (2.4)
PCI/CABG	37 (3.9)	19 (4.0)	18 (3.9)
Heart failure	106 (11.3)	49 (10.2)	57 (12.4)
Atrial fibrillation	49 (5.2)	22 (4.6)	27 (5.9)
Stroke/Transient ischemic attack	41 (4.4)	22 (4.6)	19 (4.1)
Peripheral vascular disease	82 (8.7)	35 (7.3)	47 (10.2)
Cancer	21 (2.2)	12 (2.5)	9 (2.0)
Hemorrhage	65 (6.9)	35 (7.3)	30 (6.5)
VTE	50 (5.3)	21 (4.4)	29 (6.3)
Data is presented as number (%) except for age and dialysis duration, which are presented as median [interquartile range].			
^a Income was categorized according to fifths of average neighborhood income (first quintile is the lowest and the fifth quintile is the highest).			
^b Urban location indicates a population >10,000 or a population >1,000 with population density >400/km ² .			
^c Recipients identified as pre-emptive were assessed for the presence of dialysis codes and re-classified as hemodialysis (n=10) or peritoneal dialysis (n=7).			
^d 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. ^{29,30}			
Abbreviations: ACR, albumin-creatinine ratio; CABG, coronary artery bypass graft; PCI, percutaneous coronary intervention; PCR, protein-creatinine ratio; VTE, venous thromboembolism.			

References

1. von Elm E, Altman DG, Egger M, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *J Clin Epidemiol* 2008; 61: 344–349.
2. Quan H, Khan N, Hemmelgarn BR, et al. Validation of a case definition to define hypertension using administrative data. *Hypertension* 2009; 54: 1423–1428.
3. Quan H, Li B, Duncan Saunders L, et al. Assessing validity of ICD-9-CM and ICD-10 administrative data in recording clinical conditions in a unique dually coded database. *Health Serv Res* 2008; 43: 1424–1441.
4. Hux JE, Ivis F, Flintoft V, et al. Diabetes in Ontario: Determination of prevalence and incidence using a validated administrative data algorithm. *Diabetes Care* 2002; 25: 512–516.
5. Austin PC, Daly PA, Tu J V. A multicenter study of the coding accuracy of hospital discharge administrative data for patients admitted to cardiac care units in Ontario. *Am Heart J* 2002; 144: 290–296.
6. Lee DS, Stitt A, Wang X, et al. Administrative Hospitalization Database Validation of Cardiac Procedure Codes. *Med Care* 2013; 51: e22–e26.
7. Quan H, Sundararajan V, Halfon P, et al. Coding Algorithms for Defining Comorbidities in ICD-9-CM and ICD-10 Administrative Data. *Med Care* 2005; 43: 1130–1139.
8. Alonso A, Agarwal SK, Soliman EZ, et al. Incidence of atrial fibrillation in whites and African-Americans: The Atherosclerosis Risk in Communities (ARIC) study. *Am Heart J* 2009; 158: 111–117.
9. Kokotailo RA, Hill MD. Coding of stroke and stroke risk factors using International Classification of Diseases, revisions 9 and 10. *Stroke* 2005; 36: 1776–1781.
10. Fan J, Arruda-Olson AM, Leibson CL, et al. Billing code algorithms to identify cases of peripheral artery disease from administrative data. *J Am Med Informatics Assoc* 2013; 20: e349–e354.
11. Arnason T, Wells PS, van Walraven C, et al. Accuracy of coding for possible warfarin complications in hospital discharge abstracts. *Thromb Res* 2006; 118: 253–62.
12. Alotaibi GS, Wu C, Senthilselvan A, et al. The validity of ICD codes coupled with imaging procedure codes for identifying acute venous thromboembolism using administrative data. *Vasc Med* 2015; 20: 364–368.