

## Objective

We aim to characterize CKD prevalence, diagnostic testing and referral in a region-representative registry of individuals accessing healthcare.

## Introduction

Chronic kidney disease [CKD] is common, but the frequency of albuminuria testing and referral to nephrology care across the full spectrum of disease has been difficult to measure. Recently, a large disparity in CKD prevalence was reported among selected European countries [1]; differences in study design, biomarker assays, estimating equations, and population representativeness may influence these estimates. Altogether, there is a need for reliable and contemporary estimates of CKD prevalence connected to existing practice pattern to inform CKD management and prevention planning locally and globally.

## Methods

From the Stockholm CREATinine Measurements [SCREAM] project [2] we included all individuals accessing healthcare in Stockholm with at least one serum creatinine measurement during 2006-2011. We obtained complete linkage with regional and national administrative databases. We defined CKD as eGFR <60 ml/min per 1.73 m<sup>2</sup> using - when available - the average of two eGFR assessments 3 to 12 months apart and the 2009 CKD-EPI<sub>creatinine</sub> equation to estimate GFR. eGFR groups were defined according to KDIGO guidelines [3], and end-stage renal disease [ESRD] was defined by ongoing dialysis or history of kidney transplantation. Comorbidities were defined by Charlson score [4] using ICD-10 diagnoses up to 5 years from cohort entry, enriching the definition of diabetes mellitus with the use of anti-diabetic drugs and defining hypertension status by ICD-10 codes or use of antihypertensive medication. Albuminuria monitoring was defined by presence of at least one testing for albuminuria ±12 months from inclusion date. Nephrology referral was defined as attendance to an outpatient nephrology consultation, inclusion in the Swedish Renal Registry [SNR] or purchase of drugs prescribed by a nephrologist. Physician diagnosis of CKD was defined by the presence of relevant ICD-10 codes. Age-gender standardization of prevalence was performed using the direct method, with the EU27 adult population as of January 1<sup>st</sup>, 2012 as standard populations.

## Conclusion

An estimated 6% of the adult Stockholm population accessing healthcare has CKD, but the frequency of albuminuria testing, consultations by nephrologists, and registration of CKD diagnoses was suboptimal despite universal care. Improving provider awareness of CKD and its treatment could have significant public health impact.

## Results

A total of 1,334,190 individuals underwent at least one creatinine measurement in the region of Stockholm during 2006-2011, with median age of 50.5 (inter-quartile interval [IQI]: 36.2-64.4), 46% men, and median estimated GFR of 95.9 ml/min/1.73m<sup>2</sup> (IQI: 82.2-109.0). 28.4% of individuals had hypertension, 6.6% had diabetes, and 7.0% had history of cardio-vascular disease. 68,894 individuals had CKD, for a crude CKD prevalence of 6.11 (95% confidence interval [CI]: 6.07%-6.16%, Table) and a prevalence standardized to the European population of 5.38% (5.33%-5.42%). CKD was more prevalent among the elderly (30% prevalence >75 years old, Figure), women (6.85 vs 5.24% in men), and individuals with diabetes (17%), hypertension (17%), or cardiovascular disease (31%). The frequency of albuminuria monitoring was low, with 38% of all diabetics and 27% of CKD individuals undergoing albuminuria testing over a 2-year time period (Table). Less than 10% of identified CKD cases were seen by a nephrologist; of the 16,383 individuals satisfying selected KDIGO criteria for nephrology referral, 23% visited a nephrologist. Only 12% of CKD patients carried an ICD-10 diagnostic code of CKD. Although CKD diagnosis was more common among individuals with comorbid conditions (diabetes, CVD and hypertension), it did not surpass 22% in any of these populations.

Figure: prevalence of CKD, stratified by age, gender, and selected comorbidities.

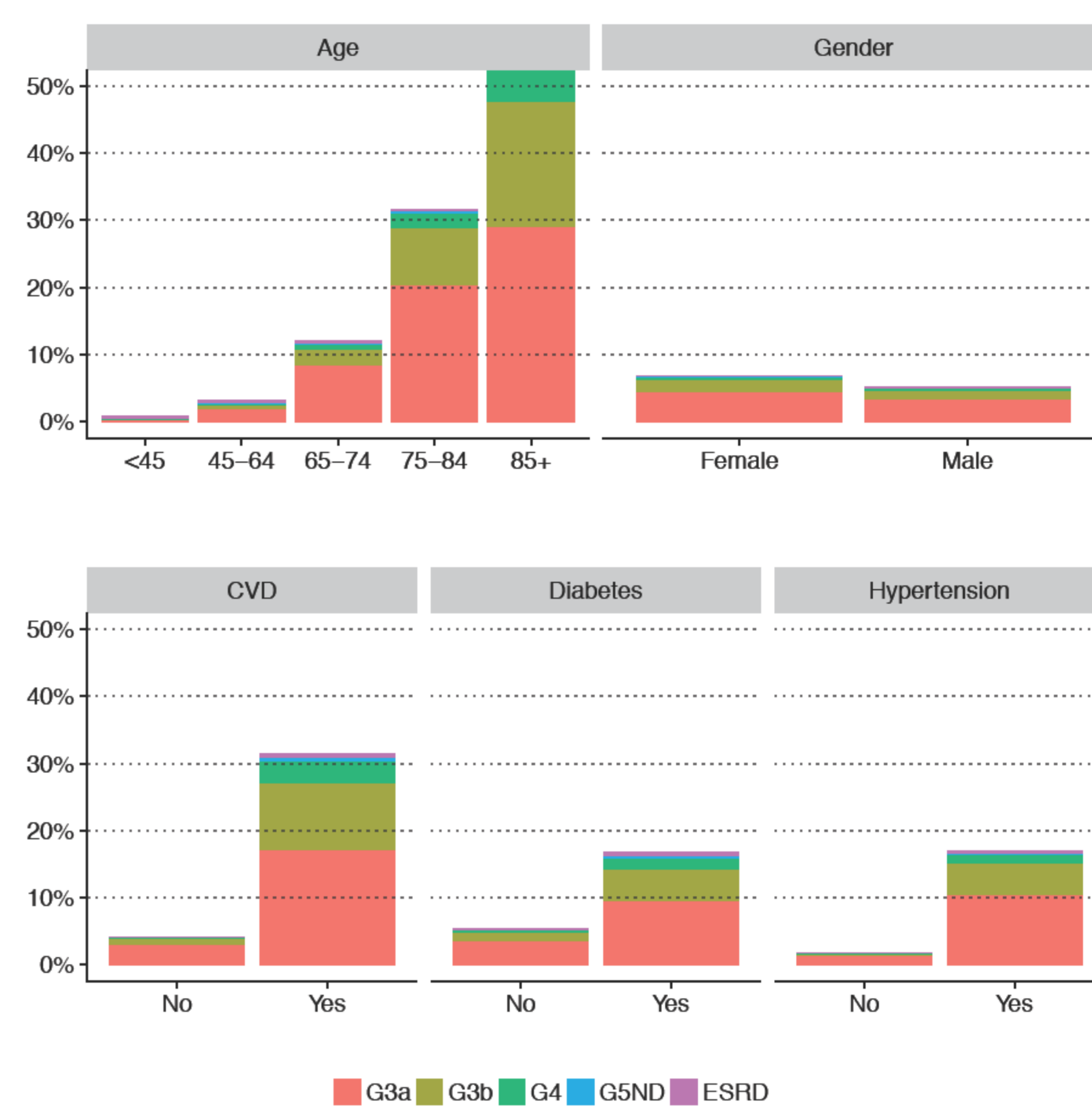


Table: albuminuria monitoring, referral to nephrology care and diagnosis of CKD by eGFR stage.

	eGFR Stage									Overall
	G1	G2	G3a	G3b	G4	G5ND	ESRD	G3+		
<b>Albuminuria monitoring:</b>										
Overall (n = 1,128,058)	92,242 (13.21%)	69,778 (19.33%)	11,119 (24.82%)	4,709 (27.51%)	1,771 (36.27%)	417 (54.65%)	787 (56.38%)	18,803 (27.26%)	180,823 (16.03%)	
In diabetic patients (n = 73,873)	11,863 (37.12%)	11,316 (38.30%)	2,796 (39.91%)	1,428 (40.43%)	581 (47.35%)	132 (58.67%)	180 (47.62%)	5,117 (41.38%)	28,296 (38.30%)	
In non-diabetic, hypertensive patients (n = 269,886)	16,387 (17.64%)	26,850 (20.08%)	6,156 (22.62%)	2,837 (24.74%)	1,079 (33.72%)	260 (55.56%)	540 (61.78%)	10,872 (25.15%)	54,109 (20.05%)	
In non-diabetic, CVD patients (n = 62,643)	1,787 (13.93%)	5,341 (17.15%)	2,037 (19.46%)	1,183 (20.20%)	500 (26.33%)	88 (42.51%)	81 (33.20%)	3,889 (20.82%)	11,017 (17.59%)	
<b>Referral to nephrology care :</b>										
Overall (n=68,964)	-	-	1,601 (3.57%)	1,525 (8.91%)	1,489 (30.49%)	567 (74.31%)	1,396 (100.00%)	6,578 (9.54%)	-	
<b>KDIGO criteria for referral:</b>										
Individuals with eGFR < 30 ml/min (n = 5,646)	-	-	-	-	1,489 (30.49%)	567 (74.31%)	-	-	2,056 (36.42%)	
Individuals with albuminuria > 30 mg/mmol (n = 3,720)	267 (22.92%)	237 (20.81%)	122 (26.35%)	174 (44.16%)	247 (78.66%)	149 (94.90%)	88 (100.00%)	-	1,284 (34.52%)	
Individuals with eGFR <60 ml/min and refractory hypertension (n = 16,383)	-	-	282 (6.08%)	399 (14.02%)	474 (42.82%)	205 (89.13%)	273 (100.00%)	-	1,633 (17.96%)	
Any KDIGO criteria (n = 16,383)	267 (22.92%)	237 (20.81%)	368 (7.37%)	503 (16.16%)	1,489 (30.49%)	567 (74.31%)	325 (100.00%)	-	3,756 (22.93%)	
<b>Physician diagnosis of CKD:</b>										
Overall (n=68,964)	-	-	1,343 (3.00%)	2,439 (14.25%)	2,313 (47.37%)	650 (85.19%)	1,384 (99.14%)	8,129 (11.79%)	10,231 (0.91%)	
In diabetic patients (n = 73,873)	-	-	351 (5.01%)	717 (20.30%)	722 (58.84%)	203 (90.22%)	374 (98.94%)	2,367 (19.14%)	2,667 (3.61%)	
In hypertensive patients (n = 320,332)	-	-	1,144 (3.41%)	2,212 (14.94%)	2,143 (48.99%)	609 (88.91%)	1,215 (99.26%)	7,323 (13.40%)	8,621 (2.69%)	
In CVD patients (n = 78,451)	-	-	594 (4.42%)	1,323 (16.98%)	1,262 (47.55%)	283 (84.23%)	436 (99.77%)	3,898 (15.81%)	4,244 (5.41%)	

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