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Quality of prescribing in chronic kidney disease and type 2 diabetes

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Appendix 1: Supplemental data chapter 2

Table S2.1: Search strategy

Database	Search terms
<i>Pubmed</i>	
Quality of Health Care	((process[tw] OR quality[tw] OR performance[tw] OR safety[tw]) AND (screen*[tw] OR monitor*[tw] OR care[tw] OR treatment[tw] OR therapy[tw] OR prescri*[tw] OR medicat*[tw])) OR "Quality of Health Care"[Mesh:noexp])
Quality Indicators	AND (assess*[tw] OR measur*[tw] OR indicator*[tw] OR criteria[tw] OR "Quality Indicators, Health Care"[Mesh:noexp])
Chronic kidney disease	AND (("Kidney Diseases"[Mesh:noexp] OR "Diabetic Nephropathies"[Mesh] OR "Hypertension, Renal"[Mesh] OR "Renal Insufficiency"[Mesh] OR "Renal Insufficiency, Chronic"[Mesh] OR kidney disease*[tw] OR renal disease*[tw] OR renal insufficiency[tw] OR nephropathy[tw]) NOT "Kidney Neoplasms"[Mesh])
<i>Embase</i>	
Quality of Health Care	((process:ab,ti OR quality:ab,ti OR performance:ab,ti OR safety:ab,ti) AND (screen*:ab,ti OR monitor*:ab,ti OR care:ab,ti OR treatment:ab,ti OR therapy:ab,ti OR prescri*:ab,ti OR medicat*:ab,ti)) OR 'health care quality'/de)
Quality Indicators	AND (assess*:ab,ti OR measur*:ab,ti OR indicator*:ab,ti OR criteria:ab,ti)
Chronic kidney disease	AND (('kidney disease'/de OR 'kidney dysfunction'/exp OR 'kidney failure'/de OR 'chronic kidney disease'/exp OR 'diabetic nephropathy'/exp OR 'chronic kidney failure'/exp OR 'kidney disease':ab,ti OR 'renal disease':ab,ti OR nephropathy:ab,ti OR 'renal insufficiency':ab,ti OR 'kidney insufficiency':ab,ti OR 'renal diseases':ab,ti OR 'kidney diseases':ab,ti) NOT 'kidney tumor'/exp)

Table S2.2: Definitions of all indicators with their scoring on face, content, operational and predictive validity

Indicators

Monitoring

Measuring kidney function

GFR/eGFR in CKD patients

- The percentage of patients with stage 3-4 CKD annually tested for eGFR¹
- The percentage of patients with stage 3 CKD with a measurement of eGFR every 6 months²
- The percentage of patients with stage 4 CKD with a measurement of eGFR every 3 months²
- The percentage of patients with CKD stage 3-4 with annual serum eGFR test³

Serum creatinine in CKD patients

- The percentage of patients with CKD with screening for creatinine⁴

Serum albumin in CKD patients

- The percentage of patients with CKD stage 3-5 that had their albumin level tested⁵
- The percentage of patients with CKD stage 3-5 and routine determination of serum albumin⁶
- The percentage of patients with two serum creatinine levels ≥ 1.7 mg/dl and CrCl < 50 ml/min with measurements of serum albumin levels⁷
- The percentage of patients with CRI with screening of albumin⁸

ACR in CKD patients

- The percentage of patients with CKD stage 3-5 that had their ACR tested⁵
- The percentage of patients on the CKD register who have a record of urine albumin: creatinine ratio (or protein: creatinine ratio) test in the previous 15 months⁹

Urinary protein in CKD patients

- The percentage of patients with stage 3-4 CKD annually tested for urine protein¹
- The percentage of patients with CKD stage 3-5 and routine determination of daily urinary measurements⁶
- The percentage of patients with two serum creatinine levels ≥ 1.7 mg/dl with a measurement of dipstick urinalysis for protein⁷
- The percentage of patients with two serum creatinine levels ≥ 1.7 mg/dl with measurement of urinary protein quantification⁷
- The percentage of patients with two eGFR < 60 ml/min/1.73m² that had urine microalbumin measured at least annually¹⁰
- The percentage of patients with CKD with quantified proteinuria¹¹
- The percentage of patients with eGFR < 45 ml/min/1.73m² with urinary albumin tested at least once within 6 months following index eGFR < 45 ml/min/1.73m²¹²
- The percentage of patients with CKD stage 3-4 with an annual urine albumin/protein test³

Urinary protein in CKD patients with comorbidities

- The percentage of patients with diabetes, ischaemic heart disease, hypertension and stage 3 CKD with a measurement of proteinuria¹³
- The percentage of patients with CKD and diabetes with screening for microalbumin⁴
- The percentage of patients with eGFR < 60 ml/min/1.73m² with proteinuria monitored annually²

Inclusion criteria for CKD	Content validity	Face validity	Operational validity	Data source	Predictive validity
CKD 3-4	√	0	√	A	0
CKD 3	√	√	0		0
CKD 4	√	√	0		0
CKD 3-4	+	0	√	A	0
ICD-9-CM	x	0	√	A	0
CKD 3-5	x	0	√	A	0
CKD 3-5	√	∅	√	C	0
Serum creatinine≥1.7 mg/dl and CrCl<50 ml/min	x	0	√	B	0
Serum creatinine≥1.5 mg/dl for women, ≥2.0 mg/dl for men	x	0	√	B	0
CKD 3-5	x	0	√	A	0
CKD 3-5	+	+	√	A	0
CKD 3-4	√	0	√	A	0
CKD 3-5	x	∅	√	C	0
Serum creatinine≥1.7 mg/dl	x	0	√	B	0
Serum creatinine≥1.7 mg/dl	x	0	√	B	0
CKD 3-5	+	0	√	B	0
CKD 3	√	0	√	A	0
CKD 3b-5	√	0	√	A	0
CKD 3-4	+	0	√	A	0
CKD 3	√	0	√	A	0
ICD-9-CM	x	0	√	A	0
CKD 3-5	√	√	0		0

Table S2.2: Definitions of all indicators with their scoring on face, content, operational and predictive validity (continued)

Indicators

Measuring MBD

Serum phosphorus/phosphate

- The percentage of patients with CKD stage 3-5 that had their phosphate level tested⁵
- The percentage of patients with two serum creatinine levels ≥ 1.7 mg/dl and CrCl < 50 ml/min with a measurement of serum phosphate levels⁷
- The percentage of patients with CRI with screening of phosphorus levels⁸
- The percentage of patients with evidence of impaired renal function with phosphorus measurement¹⁴
- The percentage of patients with CKD with phosphorus assessment¹¹
- The percentage of patients with CKD stage 3-4 with an annual serum phosphorus test³

Serum calcium

- The percentage of patients with stage 3-4 CKD annually tested for calcium¹
- The percentage of patients with CKD stage 3-5 that had their calcium level tested⁵
- The percentage of patients with two serum creatinine levels ≥ 1.7 mg/dl and CrCl < 50 ml/min with a measurement of serum calcium levels⁷
- The percentage of patients with CRI with screening of serum calcium⁸
- The percentage of patients with evidence of impaired renal function with calcium measurement¹⁴
- The percentage of patients with CKD with calcium assessment¹¹
- The percentage of patients with CKD stage 3-4 with an annual serum calcium test³

Serum iPTH

- The percentage of patients with stage 3-4 CKD annually tested for parathyroid hormone¹
- The percentage of patients with CKD stage 3-5 that had their PTH level tested⁵
- The percentage of patients with CRI with screening of serum PTH⁸
- The percentage of patients with CKD with screening for PTH⁴
- The percentage of patients with evidence of impaired renal function with PTH measurement¹⁴
- The percentage of patients with CKD with iPTH assessment¹¹
- The percentage of patients with CKD stage 3-4 with an annual serum parathyroid test³

Other

- The percentage of patients with stage 3-4 CKD annually tested for 25-hydroxyvitamin D¹
- The percentage of patients with CKD stage 3-5 that had their vitamin D level tested⁵
- The percentage of patients with CKD with screening for calcium/phosphorus⁴
- The percentage of patients with two eGFR < 45 ml/min/1.73m² that had vitamin D measurement (or vitamin D supplements initiated)¹⁰

Measuring anaemia

Inclusion criteria for CKD	Content validity	Face validity	Operational validity	Data source	Predictive validity
CKD 3-5	x	0	√	A	0
Serum creatinine ≥ 1.7 mg/dl and CrCl < 50 ml/min	x	0	√	B	0
Serum creatinine ≥ 1.5 mg/dl for women, ≥ 2.0 mg/dl for men	x	0	√	B	0
Serum creatinine > 1.3 mg/dl for women, > 1.5 mg/dl for men	x	0	√	B	0
CKD 3	√	0	√	A	0
CKD 3-4	+	0	√	A	0
CKD 3-4	√	0	√	A	0
CKD 3-5	x	0	√	A	0
Serum creatinine ≥ 1.7 mg/dl and CrCl < 50 ml/min	x	0	√	B	0
Serum creatinine ≥ 1.5 mg/dl for women, ≥ 2.0 mg/dl for men	x	0	√	B	0
Serum creatinine > 1.3 mg/dl for women, > 1.5 mg/dl for men	x	0	√	B	0
CKD 3	√	0	√	A	0
CKD 3-4	+	0	√	A	0
CKD 3-4	√	0	√	A	0
CKD 3-5	x	0	√	A	0
Serum creatinine ≥ 1.5 mg/dl for women, ≥ 2.0 mg/dl for men	x	0	√	B	0
ICD-9-CM	x	0	√	A	0
Serum creatinine > 1.3 mg/dl for women, > 1.5 mg/dl for men	x	0	√	B	0
CKD 3	√	0	√	A	0
CKD 3-4	+	0	√	A	0
CKD 3-4	√	0	√	A	0
CKD 3-5	x	0	√	A	0
ICD-9-CM	x	0	√	A	0
CKD 3b-5	+	0	√	B	0

Table S2.2: Definitions of all indicators with their scoring on face, content, operational and predictive validity (continued)

Indicators

Haemoglobin in CKD patients

- The percentage of patients with stage 3-4 CKD annually tested for haemoglobin¹
- The percentage of patients with CKD stage 3-5 that had their haemoglobin level tested⁵
- The percentage of patients with CKD using ESA that had their haemoglobin measured¹⁵
- The percentage of patients with two eGFR <45 ml/min/1.73m² that had haemoglobin measured annually¹⁰
- The percentage of patients with evidence of impaired renal function with haemoglobin measurement¹⁴
- The percentage of patients with CKD stage 3-4 with an annual serum haemoglobin/haematocrit test³
- The percentage of patients with CKD tested for serum haemoglobin¹⁶

Haemoglobin in CKD patients with comorbidities

- The percentage of patients with diabetes, ischaemic heart disease, hypertension and stage 3 CKD with a measurement of haemoglobin¹³

Iron

- The percentage of patients with CKD stage 3-5 that had their iron level tested⁵
- The percentage of patients with CRI with screening of iron studies⁸
- The percentage of patients with CKD with screening for iron levels⁴
- The percentage of patients with evidence of impaired renal function with iron parameters measurement¹⁴

Haematocrit

- The percentage of patients with two serum creatinine levels ≥1.7 mg/dl and CrCl <50 ml/min with measurements of serum haematocrit levels⁷
- The percentage of patients with CRI with screening of haematocrit⁸

Other

- The percentage of patients with CKD stage 3-5 that had their total iron binding capacity tested⁵
- The percentage of patients with CKD stage 3-5 that had their ferritin level tested⁵
- The percentage of patients with CKD using ESA that had their ferritin and TSAT measured¹⁵
- The percentage of patients with CKD with screening for anaemia⁴
- The percentage of patients with CKD stage 3b-5 (eGFR <45 ml/min/1.73m²) with a complete blood count measured annually²

Measuring lipid levels

Lipid levels in CKD patients

- The percentage of patients with stage 3-4 CKD annually tested for LDL-cholesterol¹
- The percentage of patients with CRI with screening of LDL-cholesterol⁸

Inclusion criteria for CKD	Content validity	Face validity	Operational validity	Data source	Predictive validity
CKD 3-4	√	0	√	A	0
CKD 3-5	x	0	√	A	0
CKD 1-5	+	0	√	A	0
CKD 3b-5	+	0	√	B	0
Serum creatinine>1.3 mg/dl for women, >1.5 mg/dl for men	x	0	√	B	0
CKD 3-4	+	0	√	A	0
CKD 3-5	-	0	√	A	0
CKD 3	+	+	√	A	0
CKD 3-5	x	0	√	A	0
Serum creatinine≥1.5 mg/dl for women, ≥2.0 mg/dl for men	x	0	√	B	0
ICD-9-CM	x	0	√	A	0
Serum creatinine>1.3 mg/dl for women, >1.5 mg/dl for men	x	0	√	B	0
Serum creatinine≥1.7 mg/dl and CrCl<50 ml/min	x	0	√	B	0
Serum creatinine≥1.5 mg/dl for women, ≥2.0 mg/dl for men	x	0	√	B	0
CKD 3-5	x	0	√	A	0
CKD 3-5	x	0	√	A	0
CKD 1-5	+	0	√	A	0
ICD-9-CM	x	0	√	B	0
CKD 3b-5	√	√	0		0
CKD 3-4	√	0	√	A	0
Serum creatinine≥1.5 mg/dl for women, ≥2.0 mg/dl for men	x	0	√	B	0

Table S2.2: Definitions of all indicators with their scoring on face, content, operational and predictive validity (continued)

Indicators

- The percentage of patients with CRI with screening of cholesterol⁸
- The percentage of patients with CRI with screening of triglycerides⁸
- The percentage of patients with CKD with screening for lipids⁴
- The percentage of patients with CKD with a lipid panel in the past year²
- The percentage of patients with two eGFR <60 ml/min/1.73m² that had LDL-cholesterol measured at least annually¹⁰
- The percentage of patients with evidence of impaired renal function with serum cholesterol level measurement¹⁴
- The percentage of patients with CKD with lipid assessment¹¹
- The percentage of patients with CKD stage 3-4 with an annual LDL test³

Lipid levels in CKD patients with comorbidities

- The percentage of patients with diabetes, ischaemic heart disease, hypertension and stage 3 CKD with a measurement of LDL-cholesterol¹³

Measuring HbA_{1c}

HbA_{1c} in CKD patients

- The percentage of patients with CKD stage 3-5 that had their A_{1c} tested⁵
- The percentage of patients with two serum creatinine levels ≥1.7 mg/dl with a measurement of HbA_{1c}⁷
- The percentage of patients with two eGFR <60 ml/min/1.73m² that had A_{1c} measured at least annually¹⁰

HbA_{1c} in CKD patients with diabetes

- The percentage of patients with CRI and diabetes with screening of HbA_{1c}⁸
- The percentage of patients with CKD and diabetes with screening for HbA_{1c}⁴
- The percentage of patients with eGFR <45 ml/min/1.73m² with glycated haemoglobin tested at least annually¹²

HbA_{1c} in CKD patients with comorbidities

- The percentage of patients with diabetes, ischaemic heart disease, hypertension and stage 3 CKD with a measurement of HbA_{1c}¹³

Measuring blood pressure

Blood pressure in CKD patients

- The percentage of patients with CKD with blood pressure recorded in 6 months²
- The percentage of patients on the CKD register whose notes have a record of blood pressure in the previous 15 months¹⁷
- The percentage of patients in the British Forces Germany health services primary care on the CKD register whose notes have a record of blood pressure in the previous 15 months¹⁸

Blood pressure in CKD patients with comorbidities

Inclusion criteria for CKD	Content validity	Face validity	Operational validity	Data source	Predictive validity
Serum creatinine ≥ 1.5 mg/dl for women, ≥ 2.0 mg/dl for men	x	0	√	B	0
Serum creatinine ≥ 1.5 mg/dl for women, ≥ 2.0 mg/dl for men	x	0	√	B	0
ICD-9-CM	x	0	√	A	0
CKD	√	√	0		0
CKD 3-5	+	0	√	B	0
Serum creatinine > 1.3 mg/dl for women, > 1.5 mg/dl for men	x	0	√	B	0
CKD 3	√	0	√	A	0
CKD 3-4	+	0	√	A	0
CKD 3	√	0	√	A	0
CKD 3-5	x	0	√	A	0
Serum creatinine ≥ 1.7 mg/dl	x	0	√	B	0
CKD 3-5	+	0	√	B	0
Serum creatinine ≥ 1.5 mg/dl for women, ≥ 2.0 mg/dl for men	x	0	√	B	0
ICD-9-CM	x	0	√	A	0
CKD 3b-5	√	0	√	A	0
CKD 3	√	0	√	A	0
CKD	√	√	0		0
CKD 3-5	+	+	√	A	0
CKD 3-5	+	∅	0		0

Table S2.2: Definitions of all indicators with their scoring on face, content, operational and predictive validity (continued)

Indicators

- The percentage of patients with diabetes, ischaemic heart disease, hypertension and stage 3 CKD with a measurement of blood pressure¹³

Measuring body composition

- The percentage of patients with CKD stage 3-5 and routine determination of body weight/body mass index⁶
- The percentage of patients with CKD stage 3-5 and routine determination of subjective global assessment (nutritional assessment)⁶
- The percentage of patients with CKD stage 3-5 and routine determination of skinfold thickness⁶
- The percentage of patients with CKD stage 3-5 and routine determination of bioimpedance analysis⁶

Measuring diet

- The percentage of patients with CKD stage 3-5 and routine determination of nutrient levels⁶

Other measurements

- The percentage of patients with evidence of impaired renal function with plasma homocysteine/C-reactive protein level measurement¹⁴

Treatment

Treatment with ACE-i/ARB

Use of ACE-i/ARBs in CKD patients

- The percentage of patients with CKD stage 3-5 that were prescribed with RAAS inhibitors⁵
- The percentage of patients with CKD stage 3-5 that were prescribed an ACE-i/ARB¹⁹
- The percentage of patients with albuminuria (≥ 30 mg/24 h or ≥ 20 mg/l), or clinical proteinuria (≥ 300 mg/24 h or ≥ 20 mg/l), or a positive proteinuria dipstick receiving ACE-i/ARBs²⁰
- The percentage of patients with CKD stage 3-5 on ACE-i²¹
- The percentage of patients with CKD stage 3-5 on ARBs²¹
- The percentage of patients with two serum creatinine levels ≥ 1.7 mg/dl using ACE-i/ARB⁷
- The percentage of patients with CKD receiving ACE-i/ARBs, but no diuretics²²
- The percentage of patients with CKD receiving ACE-i/ARBs and diuretics²²
- The percentage of patients with CKD receiving ACE-i/ARBs (regardless of diuretic use)²²
- The percentage of patients with CRI receiving ACE-i⁸

- The percentage of patients with CKD prescribed ACE-i/ARB⁴
- The percentage of patients with CKD stage 3-5 prescribed ACE-i or ARB in last year²³
- The percentage of patients with two eGFR < 60 ml/min/1.73m² that had ACE-i/ARB initiated¹⁰
- The percentage of patients with evidence of impaired renal function without intolerance for ACE-i/ARB receiving ACE-i/ARB¹⁴
- The percentage of patients with diabetes and eGFR < 60 ml/min/1.73 m² with prescription of ACE-i or ARBs²⁴
- The percentage of patients with CKD using ACE-i/ARBs¹¹
- The percentage of patients with CKD stage 3-4 with an ACE-i/ARB prescription³

Inclusion criteria for CKD	Content validity	Face validity	Operational validity	Data source	Predictive validity
CKD 3	√	0	√	A	0
CKD 3-5	√	∅	√	C	0
CKD 3-5	√	∅	√	C	0
CKD 3-5	√	∅	√	C	0
CKD 3-5	√	∅	√	C	0
CKD 3-5	√	∅	√	C	0
Serum creatinine>1.3 mg/dl for women, >1.5 mg/dl for men	x	0	√	B	0
CKD 3-5	x	0	√	A	0
CKD 3-5	√	0	√	A	0
Albuminuria/ proteinuria	√	0	√	A	0
CKD 3-5	x	0	√	B	0
CKD 3-5	x	0	√	B	0
Serum creatinine≥1.7 mg/dl	x	0	√	B	0
CKD 1-5	x	0	√	A	0
CKD 1-5	x	0	√	A	0
CKD 1-5	x	0	√	A	0
Serum creatinine≥1.5 mg/dl for women, ≥2.0 mg/dl for men	x	0	√	B	0
ICD-9-CM	x	0	√	A	0
CKD 3-5	√	0	√	A	0
CKD 3-5	+	0	√	B	0
Serum creatinine>1.3 mg/dl for women, >1.5 mg/dl for men	x	0	√	B	0
CKD 3-5	x	0	√	B	0
CKD 3	√	0	√	A	0
CKD 3-4	+	0	√	A	0

A

Table S2.2: Definitions of all indicators with their scoring on face, content, operational and predictive validity (continued)

Indicators

- The percentage of patients with CKD using ACE-i or ARBs²⁵
- The percentage of patients with CrI using ACE-i²⁶
- The percentage of patients with CrI using ARBs²⁶
- The percentage of patients with CrCl <75 ml/min documented at least twice not prescribed with ACE-i/ARB²⁷

Undertreatment of ACE-i/ARBs in CKD patients

- The percentage of patients with CrCl <60 ml/min receiving too low a dose of ACE-i/ARB to benefit from its optimal nephroprotective effect²⁸

ACE-i/ARBs in CKD patients with hypertension

- The percentage of patients with CKD stage 3-5 and hypertension that received an ACE-i¹⁹
- The percentage of patients with CKD stage 3-5 and hypertension that received an ARB¹⁹
- The percentage of patients with CKD stage 3-5 and hypertension that received an ACE-i and/or ARB¹⁹
- The percentage of patients with both blood pressure $\geq 130/80$ mmHg and eGFR <60 ml/min/1.73m², regardless of albuminuria/proteinuria status receiving ACE-i/ARBs²⁰
- The percentage of patients on the CKD register with hypertension and proteinuria who are treated with an ACE-i or ARB (unless a contraindication of side effect are recorded)⁹
- The percentage of patients on the CKD register with hypertension taking with an ACE-i/ARB²⁹
- The percentage of patients on the CKD register with hypertension and proteinuria who are treated with an ACE-i/ARB³⁰
- The percentage of patients on the CKD register with hypertension who are treated with an ACE-i or ARB – unless a contraindication or side effects are recorded¹⁷
- The percentage of patients on the CKD register with hypertension who are treated with an ACE-i or ARB – unless a contraindication or side effects are recorded¹⁸

ACE-i/ARBs in CKD patients with diabetes

- The percentage of patients with CKD stage 3-5 and diabetes that were prescribed an ACE-i/ARB¹⁹
- The percentage of patients with CrCl <60 ml/min and diabetic neuropathy not receiving an ACE-i or ARB to slow progression of his chronic kidney disease²⁸
- The percentage of patients with eGFR <45 ml/min/1.73 m² with at least one prescription of an ACE-i or ARB among patients >66 year with diabetes or significant proteinuria¹²
- The percentage of patients with diabetes and proteinuria who are prescribed ACE-i/ARB³¹

ACE-i/ARBs in CKD patients with multiple comorbidities

- The percentage of patients with stage 3-4 CKD and hypertension, diabetes, urine protein/creatinine ratio >0.15 or a spot urine albumin/creatinine ratio >30 mcg/mg and no documented drug allergy prescribed ACE-i/ARBs during the previous 12 months¹
- The percentage of patients with CKD stage 3-5 and presence of 1 comorbidity (diabetes, hypertension or dyslipidaemia) that were prescribed an ACE-i/ARB¹⁹
- The percentage of patients with CKD stage 3-5 and presence of 2 comorbidities (diabetes, hypertension or dyslipidaemia) that were prescribed an ACE-i/ARB¹⁹

Inclusion criteria for CKD	Content validity	Face validity	Operational validity	Data source	Predictive validity
CKD 1-4	√	0	√	C	0
CrCl<75 ml/min	x	0	√	B	0
CrCl<75 ml/min	x	0	√	B	0
CrCl<75 ml/min	√	0	√	C	0
CrCl<60 ml/min	√	-	√	B	0
CKD 3-5	√	0	√	A	0
CKD 3-5	√	0	√	A	0
CKD 3-5	√	0	√	A	0
CKD 3-5	√	0	√	A	0
CKD 3-5	+	+	√	A	0
CKD 3-5	+	+	√	A	0
CKD 3-5	+	√	0		0
CKD 3-5	√	+	√	A	0
CKD 3-5	+	∅	0		0
CKD 3-5	√	0	√	A	0
CrCl<60 ml/min	√	-	√	B	0
CKD 3b-5	√	0	√	A	0
Albuminuria/ proteinuria	√	0	√	A	0
CKD 3-4	√	0	√	A	0
CKD 3-5	√	0	√	A	0
CKD 3-5	√	0	√	A	0

A

Table S2.2: Definitions of all indicators with their scoring on face, content, operational and predictive validity (continued)

Indicators

- The percentage of patients with CKD stage 3-5 and presence of 3 comorbidities (diabetes, hypertension and dyslipidaemia) that were prescribed an ACE-i/ARB¹⁹
- The percentage of patients with CrCl <60 ml/min and non-diabetic neuropathy whose albumin/creatinine ratio is >2 mg/g and not receiving an ACE-i/ARB to slow progression of his chronic kidney disease²⁸
- The percentage of patients with CKD, hypertension and proteinuria with a prescription of ACE-i or ARB recorded in the past year²
- The percentage of patients with diabetes, hypertension and proteinuria who are prescribed ACE-i/ARB³¹

Treatment with other antihypertensives

Beta blocking agents in CKD patients

- The percentage of patients with CKD stage 3-5 on beta-blocker²¹
- The percentage of patients with CRI using β -adrenergic blockers²⁶

Beta blocking agents in CKD patients with diabetes

- The percentage of patients with diabetes and eGFR <60 ml/min/1.73 m² with prescription of β -blockers²⁴

Calcium channel blocker in CKD patients

- The percentage of patients with CKD stage 3-5 on calcium channel blocker²¹

Calcium channel blocker in CKD patients with diabetes

- The percentage of patients with diabetes and eGFR <60 ml/min/1.73 m² with prescription of calcium channel blockers²⁴

Diuretics in CKD patients

- The percentage of patients with CKD stage 3-5 that were prescribed aldosterone antagonists⁵
- The percentage of patients with CKD stage 3-5 that were prescribed a loop diuretic⁵
- The percentage of patients with CKD receiving diuretics, but no ACE-i/ARBs²²

Antihypertensive treatment in CKD patients

- The percentage of patients with CKD receiving antihypertensives²²
- The percentage of patients with stage 3-5 CKD and hypertension taking two or more antihypertensive medication²⁹
- The percentage of patients with CRI receiving non-ACE-i antihypertensive medications⁸
- The percentage of patients with CKD prescribed antihypertensive drugs⁴

Not receiving antihypertensive treatment in CKD patients

- The percentage of patients with CrCl <60 ml/min and a blood pressure >130/80 with no prescription of antihypertensives²⁸
- The percentage of patients with two serum creatinine levels ≥ 1.7 mg/dl not using antihypertensive agents⁷
- The percentage of patients with CKD receiving no ACE-i/ARBs and no diuretics²²
- The percentage of patients with stage 3-5 CKD and hypertension receiving no treatment for blood pressure²⁹

Inclusion criteria for CKD	Content validity	Face validity	Operational validity	Data source	Predictive validity
CKD 3-5	√	0	√	A	0
CrCl<60 ml/min	√	-	√	B	0
CKD	√	√	0		0
Albuminuria/ proteinuria	√	0	√	A	0
CKD 3-5	x	0	√	B	0
CrCl<75 ml/min	x	0	√	B	0
CKD 3-5	x	0	√	B	0
CKD 3-5	x	0	√	B	0
CKD 3-5	x	0	√	B	0
CKD 3-5	x	0	√	A	0
CKD 3-5	x	0	√	A	0
CKD 1-5	x	0	√	A	0
CKD 1-5	x	0	√	A	0
CKD 3-5	x	0	√	A	0
Serum creatinine≥1.5 mg/dl for women, ≥2.0 mg/dl for men	x	0	√	B	0
ICD-9-CM	x	0	√	A	0
CrCl<60 ml/min	√	√	√	B	0
Serum creatinine≥1.7 mg/dl	x	0	√	B	0
CKD 1-5	x	0	√	A	0
CKD 3-5	x	0	√	A	0

A

Table S2.2: Definitions of all indicators with their scoring on face, content, operational and predictive validity (continued)

Indicators

Wrong dose/not intensifying antihypertensive treatment in CKD patients

- The percentage of patients with CrCl <60 ml/min and a blood pressure >130/80 receiving too low a dose of antihypertensives²⁸
- The percentage of patients with a CrCl <75 ml/min documented at least twice and a blood pressure ≥140/90 mmHg whose antihypertensive treatment was not intensified²⁷

Treatment with lipid lowering drugs

Statins in CKD patients

- The percentage of patients with CKD stage 3-5 that were prescribed a statin⁵
- The percentage of patients with CKD stage 3-5 on HMG-CoA reductase inhibitor/statin²¹
- The percentage of patients with CKD receiving statins, but no ezetimibe²²
- The percentage of patients with CKD receiving statins and ezetimibe²²
- The percentage of patients with CRI using statins when there is hyperlipidemia²⁶

Statins in CKD patients with elevated LDL-cholesterol

- The percentage of patients with stage 3-4 CKD, a LDL-cholesterol >100 mg/dl and no documented drug allergy prescribed statins during the last 12 months¹
- The percentage of patients with CrCl <60 ml/min, LDL-cholesterol >2.0 mmol/L and not receiving statin for appropriate cardiovascular prevention²⁸
- The percentage of patients with CrCl <60 ml/min and a LDL-cholesterol >2.0 mmol/L receiving too low a dose of statin²⁸
- The percentage of patients with eGFR <45 ml/min/1.73m² with at least one prescription for a statin among patients aged >66 with at least one LDL value >2.5 mmol/l within 6 months of index eGFR <45 ml/min/1.73m²¹²

Lipid lowering drugs in CKD patients

- The percentage of patients with CKD receiving lipid-modifying therapies²²
- The percentage of patients with CKD receiving ezetimibe but no statins²²
- The percentage of patients with CKD receiving multiple lipid-modifying therapies²²
- The percentage of patients with CKD prescribed lipid lowering agents⁴
- The percentage of patients with CKD stage 3-5 prescribed lipid lowering medication last year²³
- The percentage of patients with CKD patients using lipid lowering agents²⁵

Lipid lowering drugs in CKD patients with elevated LDL-cholesterol

- The percentage of patients with evidence of impaired renal function and cholesterol >200 mg/dl on lipid lowering agents¹⁴

Lipid lowering drugs in CKD patients with diabetes

- The percentage of patients with diabetes and eGFR <60 ml/min/1.73 m² with prescription of lipid lowering agents²⁴

Not receiving lipid lowering treatment in CKD patients

- The percentage of patients with CKD receiving no statins and no ezetimibe²²

Treatment related to anaemia

EPO in CKD patients

Inclusion criteria for CKD	Content validity	Face validity	Operational validity	Data source	Predictive validity
CrCl<60 ml/min	√	√	√	B	0
CrCl<75 ml/min	√	0	√	C	0
CKD 3-5	x	0	√	A	0
CKD 3-5	x	0	√	B	0
CKD 1-5	x	0	√	A	0
CKD 1-5	x	0	√	A	0
CrCl<75 ml/min	x	0	√	B	0
CKD 3-4	√	0	√	A	0
CrCl<60 ml/min	√	-	0		0
CrCl<60 ml/min	√	-	0		0
CKD 3b-5	√	0	√	A	0
CKD 1-5	x	0	√	A	0
CKD 1-5	x	0	√	A	0
CKD 1-5	x	0	√	A	0
ICD-9-CM	x	0	√	A	0
CKD 3-5	√	0	√	A	0
CKD 1-4	√	0	√	C	0
Serum creatinine>1.3 mg/dl for women, >1.5 mg/dl for men	x	0	√	B	0
CKD 3-5	√	0	√	B	0
CKD 1-5	x	0	√	A	0

Table S2.2: Definitions of all indicators with their scoring on face, content, operational and predictive validity (continued)

Indicators

- The percentage of patients with CKD stage 3-5 that were prescribed ESA⁵
- The percentage of patients with CKD stage 3-5 on EPO²¹
- The percentage of patients with CKD receiving ESA²²
- The percentage of patients with CRI receiving rHuEPO therapy⁸

- The percentage of patients with diabetes and eGFR <60 ml/min/1.73 m² with prescription of EPO agents²⁴

EPO in CKD patients with evidence for anaemia

- The percentage of patients with CrCl <60 ml/min, haemoglobin <1 g/L, all other causes of anaemia have been eliminated and not receiving a hematopoietic agent²⁸
- The percentage of patients with two serum creatinine levels ≥1.7 mg/dl, CrCl <50 ml/min and haematocrit <33% using erythropoietin⁷
- The percentage of patients with evidence of impaired renal function and haemoglobin <11 g/dL on erythropoietin therapy¹⁴

Iron supplement in CKD patients

- The percentage of patients with CKD stage 3-5 on iron²¹
- The percentage of patients with CrCl <60 ml/min, taking an erythropoiesis regulating agent and not receiving iron supplement by IV or P.O.²⁸
- The percentage of patients with CRI receiving iron⁸

Iron supplement in CKD patients with evidence for anaemia

- The percentage of patients with CKD using ESA that initiated iron therapy within 2 weeks after ferritin level less than 100 ng/ml or TSAT < 20%¹⁵
- The percentage of patients with CrCl <60 ml/min, receiving iron supplement by IV and his ferritin is >500 µg/L and the coefficient of transferrin saturation is >20% when measured at least 2 weeks after IV administration of iron²⁸
- The percentage of patients with CrCl <60 ml/min, not being treated with a haematopoietic agent, a ferritin <100 µg/L or a transferrin saturation rate <2% and not receiving an iron supplement by IV or P.O.²⁸
- The percentage of patients with evidence of impaired renal function and TSAT <20% on iron therapy¹⁴

Treatment related to MBD

Phosphate binders in CKD patients

- The percentage of patients with CKD stage 3-5 that were prescribed a phosphate binder⁵
- The percentage of patients with CrCl <60 ml/min receiving too low a dose of phosphate binder²⁸
- The percentage of patients with CRI receiving phosphate binders⁸

Phosphate binders in CKD patients with high levels of phosphate

Inclusion criteria for CKD	Content validity	Face validity	Operational validity	Data source	Predictive validity
CKD 3-5	x	0	√	A	0
CKD 3-5	x	0	√	B	0
CKD 1-5	x	0	√	A	0
Serum creatinine ≥ 1.5 mg/dl for women, ≥ 2.0 mg/dl for men	x	0	√	B	0
CKD 3-5	x	0	√	B	0
CrCl < 60 ml/min	√	-	0		0
Serum creatinine ≥ 1.7 mg/dl and CrCl < 50 ml/min	x	0	√	B	0
Serum creatinine > 1.3 mg/dl for women, > 1.5 mg/dl for men	√	0	√	B	0
CKD 3-5	x	0	√	B	0
CrCl < 60 ml/min	√	-	0		0
Serum creatinine ≥ 1.5 mg/dl for women, ≥ 2.0 mg/dl for men	x	0	√	B	0
CKD 1-5	+	0	√	A	0
CrCl < 60 ml/min	√	-	0		0
CrCl < 60 ml/min	√	-	0		0
Serum creatinine > 1.3 mg/dl for women, > 1.5 mg/dl for men	√	0	√	B	0
CKD 3-5	x	0	√	A	0
CrCl < 60 ml/min	√	-	0		0
Serum creatinine ≥ 1.5 mg/dl for women, ≥ 2.0 mg/dl for men	x	0	√	B	0

Table S2.2: Definitions of all indicators with their scoring on face, content, operational and predictive validity (continued)

Indicators

- The percentage of patients with CrCl <60 ml/min and serum phosphate higher than normal values for a patients with chronic kidney disease despite an appropriate diet receiving a phosphate binder (calcium, sevelamer or lanthanum carbonate)²⁸
- The percentage of patients with evidence of impaired renal function and serum phosphorous >4.5 mg/dl on phosphate binding therapy¹⁴

Phosphate binders in CKD patients with diabetes

- The percentage of patients with diabetes and eGFR <60 ml/min/1.73 m² with prescription of phosphate binders²⁴

Vitamin D in CKD patients

- The percentage of patients with CKD stage 3-5 that were prescribed vitamin D⁵
- The percentage of patients with stage 3 or 4 CKD and serum 25(OH)D <75 nmol/l receiving vitamin D (cholecalciferol, calciferol)²⁸
- The percentage of patients with CRI receiving calcitriol⁸

Vitamin D in CKD patients with hyperparathyroidism

- The percentage of patients with CrCl <60 ml/min and hyperparathyroidism receiving vitamin D (calcitriol or alfacalcidol)²⁸
- The percentage of patients with CrCl <60 ml/min and hyperparathyroidism despite correcting modifiable risk factors receiving too low a dose of vitamin D (calcitriol or alfacalcidol)²⁸
- The percentage of patients with evidence of impaired renal function and PTH >100 on vitamin D analog therapy¹⁴

Treatment with glucose lowering drugs in CKD patients with diabetes

- The percentage of patients with CrCl <60 ml/min and HbA_{1c} >7% despite an appropriate diet receiving hypoglycaemic drug therapy²⁸
- The percentage of patients with diabetes and eGFR <60 ml/min/1.73 m² with prescription of oral hypoglycaemic²⁴
- The percentage of patients with diabetes and eGFR <60 ml/min/1.73 m² with prescription of insulin²⁴
- The percentage of patients with CKD and diabetes using hypoglycaemic medication²⁵

Treatment with acetylsalicylic acid in CKD patients

- The percentage of patients with CKD stage 3-5 on aspirin²¹
- The percentage of patients with CRI using acetylsalicylic acid²⁶

Treatment with diet

- The percentage of patients with CKD stage 3-4 prescribed a low protein diet (0.6-0.75 g protein per kg body weight per day)⁶
- The percentage of patients with CKD stage 5 prescribed a very low protein diet (0.3-0.35 g protein per kg body weight per day)⁶

Safety

Use of NSAIDs

- The percentage of patients with CKD stage 3-4 prescribed NSAIDs during the prior 12 months¹

Inclusion criteria for CKD	Content validity	Face validity	Operational validity	Data source	Predictive validity
CrCl<60 ml/min	√	-	0		0
Serum creatinine>1.3 mg/dl for women, >1.5 mg/dl for men	√	0	√	B	0
CKD 3-5	x	0	√	B	0
CKD 3-5	x	0	√	A	0
CKD 3-4	√	-	0		0
Serum creatinine≥1.5 mg/dl for women, ≥2.0 mg/dl for men	x	0	√	B	0
CrCl<60 ml/min	√	-	0		0
CrCl<60 ml/min	√	-	0		0
Serum creatinine>1.3 mg/dl for women, >1.5 mg/dl for men	√	0	√	B	0
CrCl<60 ml/min	√	-	0		0
CKD 3-5	x	0	√	B	0
CKD 3-5	x	0	√	B	0
CKD 1-4	√	0	√	C	0
CKD 3-5	x	0	√	B	0
CrCl<75 ml/min	x	0	√	B	0
CKD 3-4	x	∅	√	C	0
CKD 5	x	∅	√	C	0
CKD 3-4	√	0	√	A	0

Table S2.2: Definitions of all indicators with their scoring on face, content, operational and predictive validity (continued)

Indicators

- The percentage of patients with CKD stage 3-5 that were prescribed a NSAID⁵
- The percentage of patients with CrCl <60 ml/min receiving a medication that is not indicated, a non-steroidal anti-inflammatory drug²⁸
- The percentage of patients with CKD stage 3-5 NSAIDs recorded in chart last year²³
- The percentage of patients with CKD stage 3-5 with avoidance of NSAIDs or cyclooxygenase-2 (COX-2) inhibitors²
- The percentage of patients with two eGFR <60 ml/min/1.73m² that had NSAID use discontinued¹⁰

Use of inappropriate drugs

Inappropriate glucose lowering drugs in CKD patients

- The percentage of patients with CKD stage 3-4 prescribed glyburide during the prior 12 months¹
- The percentage of patients with CKD stage 3-4 prescribed metformin during the prior 12 months¹
- The percentage of patients with CrCl <25 ml/min receiving acarbose²⁸
- The percentage of patients with CrCl <30 ml/min receiving metformin²⁸

Inappropriate antibiotics in CKD patients

- The percentage of patients with CKD stage 3-4 prescribed nitrofurantoin during the prior 12 months¹
- The percentage of patients with CrCl <60 ml/min receiving nitrofurantoin²⁸

Inappropriate osteoporosis drugs in CKD patients

- The percentage of patients with CKD stage 3-4 and eGFR <35 ml/min/1.73m² prescribed alendronate during the prior 12 months¹
- The percentage of patients with CKD stage 3-4 and eGFR <30 ml/min/1.73m² prescribed ibandronate during the prior 12 months¹
- The percentage of patients with CKD stage 3-4 and eGFR <35 ml/min/1.73m² prescribed risedronate during the prior 12 months¹
- The percentage of patients with CrCl <30 ml/min receiving bisphosphonate (alendronate, etidronate, risedronate)²⁸
- The percentage of patients with eGFR <30 ml/min/1.73m² and avoidance of bisphosphonates²

Inappropriate nutritional supplements in CKD patients

- The percentage of patients with CrCl <60 ml/min receiving a vitamin A enriched multivitamin²⁸
- The percentage of patients with CrCl <60 ml/min receiving garlic supplement²⁸

Other inappropriate drugs in CKD patients

- The percentage of patients with CKD stage 3-4 and eGFR <50 ml/min/1.73m² prescribed terbinafine during the prior 12 months¹
- The percentage of patients with CKD stage 3-4 prescribed one or more inappropriate drugs¹
- The percentage of patients with CrCl <60 ml/min receiving meperidine²⁸
- The percentage of patients with CrCl <60 receiving an antacid containing calcium, magnesium aluminium and/or sodium²⁸
- The percentage of patients with CrCl <60 ml/min receiving a purgative not indicated for kidney²⁸
- The percentage of patients with CrCl <60 ml/min receiving ginkgo biloba²⁸

Inclusion criteria for CKD	Content validity	Face validity	Operational validity	Data source	Predictive validity
CKD 3-5	x	0	√	A	0
CrCl<60 ml/min	√	√	√	B	0
CKD 3-5	√	0	√	A	0
CKD 3-5	√	√	0		0
CKD 3-5	+	0	√	B	0
CKD 3-4	√	0	√	A	0
CKD 3-4	√	0	√	A	0
CrCl<25 ml/min	√	√	√	B	0
CrCl<30 ml/min	√	√	√	B	0
CKD 3-4	√	0	√	A	0
CrCl<60 ml/min	√	√	√	B	0
CKD 3-4	√	0	√	A	0
CKD 3-4	√	0	√	A	0
CKD 3-4	√	0	√	A	0
CrCl<30 ml/min	√	√	√	B	0
CKD 4-5	√	√	0		0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CKD 3-4	√	0	√	A	0
CKD 3-4	√	0	√	A	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0

Table S2.2: Definitions of all indicators with their scoring on face, content, operational and predictive validity (continued)

Indicators

- The percentage of patients with CrCl <60 ml/min receiving St. John's wort²⁸
- The percentage of patients with CrCl <60 ml/min receiving liquorice root²⁸
- The percentage of patients with CrCl <60 ml/min and metabolic acidosis (HCO₃ <20 mmol/l) and not receiving bicarbonate of soda²⁸
- The percentage of patients with CrCl <60 ml/min and hyperkalemia (K⁺ >5.5 mmol/l) receiving sodium polystyrene sulfonate²⁸

Inappropriate dosages of drugs

Inappropriate dosages of anti-epileptic drugs in CKD patients

- The percentage of patients with CrCl <60 ml/min receiving too high a dose of gabapentin²⁸
- The percentage of patients with CrCl <60 ml/min receiving too high a dose of pregabalin²⁸

Inappropriate dosages of antivirals in CKD patients

- The percentage of patients with CrCl <60 ml/min receiving too high a dose of an antiviral (acyclovir, valacyclovir, famciclovir) according to the dosage-adjustment tables for kidney disease²⁸
- The percentage of patients with CrCl <60 ml/min receiving too high a dose of neuraminidase inhibitor (e.g. oseltamivir) according to the dosage-adjustment tables for kidney disease²⁸

Inappropriate dosages antifungals in CKD patients

- The percentage of patients with CrCl <60 ml/min receiving too high a dose of cephalosporin according to the dosage- adjustment tables for kidney disease²⁸
- The percentage of patients with CrCl <60 ml/min receiving too high a dose of a triazole (e.g. fluconazole) according to the dosage-adjustment tables for kidney disease²⁸

Inappropriate dosages of antibiotics in CKD patients

- The percentage of patients with CrCl <60 ml/min receiving too high a dose of penicillin according to the dosage-adjustment tables for kidney disease²⁸
- The percentage of patients with CrCl <60 ml/min receiving too high a dose of quinolone according to the dosage-adjustment tables for kidney disease²⁸
- The percentage of patients with CrCl <60 ml/min receiving too high a dose of a sulfamide according to the dosage-adjustment tables for kidney disease²⁸
- The percentage of patients with CrCl <60 ml/min receiving too high a dose of a tetracycline according to the dosage-adjustment tables for kidney disease²⁸

Inappropriate dosages of antigout preparations in CKD patients

- The percentage of patients with CrCl <60 ml/min receiving too high a dose of allopurinol²⁸
- The percentage of patients with CrCl <50 ml/min receiving too high a dose of colchicine as prophylactic treatment for gout²⁸

Inappropriate dosages of MBD drugs in CKD patients

- The percentage of patients with CrCl <60 ml/min receiving too high a dose of phosphate binder (calcium, sevelamer or lanthanum carbonate) since he has hyperphosphataemia (<0.87 mmol/l in stage 3/4, and <1.13 mmol/l in stage 5)²⁸
- The percentage of patients with CrCl <60 ml/min receiving too high a dose of calcium carbonate since he had hypercalcaemia²⁸

Inclusion criteria for CKD	Content validity	Face validity	Operational validity	Data source	Predictive validity
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	-	0		0
CrCl<60 ml/min	√	-	0		0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	-	0		0
CrCl<60 ml/min	√	-	0		0

A

Table S2.2: Definitions of all indicators with their scoring on face, content, operational and predictive validity (continued)

Indicators

- The percentage of patients with CrCl <60 ml/min and hypoparathyroidism, hypercalcaemia or hyperphosphataemia receiving too high a dose of vitamin D (calcitriol, alfacalcidol, cholecalciferol or calciferol)²⁸

Other inappropriate dosages in CKD patients

- The percentage of patients with CrCl <60 ml/min receiving too high a dose of a beta-blocker according to the dosage-adjustment tables for kidney disease²⁸
- The percentage of patients with CrCl <60 ml/min receiving too high a dose of fenofibrate nanocrystals²⁸
- The percentage of patients with CrCl <50 ml/min receiving too high a dose of ranitidine²⁸
- The percentage of patients with CrCl <30 ml/min receiving too high a dose of varenicline²⁸
- The percentage of patients with CrCl <60 ml/min receiving too high a dose of an ascorbic acid supplement (vitamin C), a dose >25 mg/day²⁸
- The percentage of patients with CrCl <60 ml/min and haemoglobin >130 g/L receiving too high a dose of an hematopoietic agent (darbepoetine alfa, epoetin alfa)²⁸

Inappropriate combinations of drugs

- The percentage of patients with CrCl <60 ml/min experiencing a drug interaction between calcium carbonate and an antibiotic (tetracycline or fluorquinolone except moxifloxacin)²⁸
- The percentage of patients with CrCl <60 ml/min experiencing a drug interaction between calcium and iron P.O. taken concomitantly²⁸
- The percentage of patients with CrCl <60 ml/min experiencing a drug interaction between his phosphate binder (calcium carbonate, sevelamer or lanthanum) and levothyroxine²⁸
- The percentage of patients with CrCl <60 ml/min experiencing a drug interaction between levelamer or lanthanum and ciprofloxacin²⁸

Adherence and taking behaviour

- The percentage of patients with CrCl <60 ml/min that is non-adherent to the anaemia treatment since the patient received more than 120% or less than 80% of the required quantity of the drug over 90 days²⁸
- The percentage of patients with CrCl <60 ml/min that is non-adherent to the antihypertensive treatment since the patient received more than 120% or less than 80% of the required quantity of the drug over 90 days²⁸
- The percentage of patients with CrCl <60 ml/min that is non-adherent to the hypolipidaemic treatment since the patient received more than 120% or less than 80% of the required quantity of the drug over 90 days²⁸
- The percentage of patients with CrCl <60 ml/min that is non-adherent to the treatment regulating the phosphocalcic metabolism since the patient received more than 120% or less than 80% of the required quantity of the drug over 90 days²⁸
- The percentage of patients with CrCl <60 ml/min that is non-adherent to the diabetes treatment since the patient received more than 120% or less than 80% of the required quantity of the drug over 90 days²⁸
- The percentage of patients with CrCl <60 ml/min not taking his phosphate binder (calcium carbonate, sevelamer or lanthanum) appropriately²⁸

Inclusion criteria for CKD	Content validity	Face validity	Operational validity	Data source	Predictive validity
CrCl<60 ml/min	√	-	0		0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<50 ml/min	√	√	√	B	0
CrCl<30 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	-	0		0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0

A

Table S2.2: Definitions of all indicators with their scoring on face, content, operational and predictive validity (continued)

Indicators

- The percentage of patients with CrCl <60 ml/min not taking his vitamin D (calcitriol or alfacalcidol) appropriately²⁸
- The percentage of patients with CrCl <60 ml/min not taking his sodium polystyrene sulfonate appropriately²⁸

Referral

- The percentage of patients with CrCl <60 ml/min not receiving a referral for smoking cessation or follow-up²⁸
- The percentage of patients with two serum creatinine levels ≥ 1.7 mg/dl for who a renal consultation was requested⁷
- The percentage of patients with eGFR <30 ml/min/1.73m² with a referral to a nephrologist²
- The percentage of patients with two eGFR <30 ml/min/1.73m² that is referred to a nephrologist¹⁰
- The percentage of patients with eGFR <45 ml/min/1.73m² with a visit to a specialist within 18 months of an index eGFR measurement of <45 ml/min/1.73m²¹²

CKD: chronic kidney disease; (e)GFR: (estimated) glomerular filtration rate; ICD-9-CM: International Classification of Disease, Ninth Revision, Clinical Modification; CrCl: creatinine clearance; ACR: albumin/creatinine-ratio; MBD: mineral and bone disorder; CRI: chronic renal impairment; (i)PTH: (intact) parathyroid hormone; ESA: erythropoiesis-stimulating agent; TSAT: transferrin saturation; LDL-cholesterol; low-density lipoprotein-cholesterol; HbA_{1c}: glycated haemoglobin; ACE-i: angiotensin-converting-enzyme inhibitor; ARB: angiotensin-II-receptor blocker; RAAS: renin-angiotensin-aldosterone system; EPO: erythropoietin; IV: intravenous (injection); P.O.: oral administration; NSAID: non-steroidal anti-inflammatory drug.

Content validity: x = source of indicators not known, + = previously developed based on guidelines, $\sqrt{}$ = developed based on guidelines, - = tested but assessed as insufficient by authors. Face validity/Operational validity: 0 = not tested, \emptyset = not adequately tested, - = tested but not valid, + = previously tested and validated, $\sqrt{}$ = tested and valid. Operational validity, way of retrieving data: A = computerized review of medical records or administrative data, B = chart review by researchers, C = self-reported.

Inclusion criteria for CKD	Content validity	Face validity	Operational validity	Data source	Predictive validity
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
CrCl<60 ml/min	√	√	√	B	0
Serum creatinine ≥1.7 mg/dl	x	0	√	B	0
CKD 4-5	√	√	0		0
CKD 4-5	+	0	√	B	0
CKD 3b-5	√	0	√	A	0

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