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ARTICLE

Quality indicators for primary health care in chronic kidney disease in the public service of a city in the State of São Paulo, Brazil

Qualidade de atenção primária em doença renal crônica em um serviço público de um município do Estado de São Paulo, Brasil

Calidad de los cuidados de salud en la atención primaria relacionados con la enfermedad crónica de riñón en un servicio público en una ciudad del Estado de São Paulo, Brasil

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Abstract

Complications of chronic kidney disease (CKD) can be avoided when promptly diagnosed and treated. The objective was to describe quality indicators of CKD detection and health care in the primary care public service of a city in the State of São Paulo, Brazil. This retrospective study analyzed charts of patients who attended primary care in the public service between November 2019 and February 2020. We selected 10 health quality indicators based on their scientific relevance and availability from the medical records that could express how CKD was identified and managed in primary health care. We estimated the adequate percentage of health indicators with data from 1,066 individuals who had ≥ one risk factor for CKD: hypertension, diabetes, or > 60 years old. Among patients, 79.4% had information on serum creatinine, whereas 58.8% were investigated for proteinuria. Blood pressure data were found in 98.9% of the records. The percentage of patients with blood pressure < 140x90mmHg, glycosylated hemoglobin < 6.5% and LDL-cholesterol < 100mg/dL was 79.2%, 49.2%, and 33.3%, respectively. Renin-angiotensin system blockers were prescribed to 82.8% of the patients with hypertension and CKD. Serum potassium was measured in 35.7% for those who were using renin-angiotensin system blockers. Among those people with CKD, 16.7% had CKD assigned in the medical records as a diagnose. Among those participants at higher risk for CKD, the referral rate to a nephrologist was 31.6%. This study confirmed some missed quality indicators of CKD in primary healthcare. Our results may help administrators develop public policies that improve health care for individuals at high risk for CKD. Long-term follow-up of the health indicators we proposed here will be useful to assess the impact of policy intervention.

Chronic Renal Insufficiency; Health Status Indicators; Primary Health Care

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Introduction

Chronic kidney disease (CKD) affects approximately 10% of adults and concerns the public health system worldwide [1,2]. Obesity, hypertension, and diabetes account for the main reasons why CKD has become more prevalent recently [3]. A report from the World Health Organization (WHO) defined kidney disorders as the most neglected non-communicable diseases of the world [4].

Diagnosing CKD is simple and cheap, indeed, and screening for CKD is highly cost-effective as its risk factors and natural course are widely known [5]. Even though CKD remains asymptomatic for a long time, once CKD is diagnosed poor outcomes can be delayed or avoided [5]. However, only 10% of the patients who were in the initial stages of CKD know they have kidney disorders and only 16-30% of the health care professionals can recognize a pre-dialytic CKD [6].

In 2014, the Brazilian Ministry of Health published the *Clinical Guidelines for Chronic Kidney Disease Healthcare* [7]. This document describes the role of the primary care in identifying people at high risk for CKD and in managing the initial stages of the disease, which aims to delay or preventing CKD from evolving into end-stage renal disease and dialysis. Previous international studies showed that treating CKD in primary care is not suitable [8,9]. Moreover, relevant research in this field showed that some health indicators could be used to appraise health services in CKD [10].

The Brazilian Ministry of Health supports that states and cities decide which health indicators – among the ones the Brazilian Ministry of Health suggests – better fit their local problems [11]. Therefore, this study aimed to describe quality indicators of CKD detection and healthcare in the primary care public service of a city in the State of São Paulo, Brazil.

Material and methods

Healthcare indicators selection

We revised the healthcare quality indicators for CKD identification and pre-dialytic CKD managing on PubMed, Google Scholar, and EBSCO (Business Source Complete) from October to December 2019. The descriptors we used were "chronic kidney disease", "quality indicators", "performance measures", and "key performance indicators". We selected the indicators that met the following criteria: (1) identification or management of CKD in primary care; (2) stronger evidence of their association with renal and non-renal endpoints (CKD progression, renal replacement therapy incidence, cardiovascular outcomes, hospitalization, and death) [8,9,10,12]; (3) feasibility of recovering such information from the patients' medical records. We excluded the health indicators associated with anemia treatment, bone and mineral disorder, and metabolic acidosis because they are included in the secondary health care [7]. We also excluded missing indicators in the medical records, such as the percentage of patients with CKD and inappropriate prescription of nonsteroidal anti-inflammatory drugs, and the vaccination rate for influenza, pneumococcus, and hepatitis B virus in patients with CKD. The final list of health indicators is shown in Box 1.

Study design, setting and population

This is a retrospective study. All the data showed here were obtained from the patients' medical records. The appointments evaluated occurred between November 2019 and February 2020, and data were collected between July 8th, 2020, and October 21st, 2021.

We included patients who had ≥ 1 risk factor for CKD: hypertension, diabetes, or > 60 years old [13]. We excluded the individuals who were younger than 18 years old, adults with no information on hypertension or diabetes on their medical records, and follow-up < 12 months. We analyzed medical records from all 10 basic health units (UBS) from Santana do Parnaíba city, a metropolitan area of São Paulo with 138,132 inhabitants (12.02% ≥ 60 years old, per capita income of BRL 1,507.55, and human development index of 0.814 [14]). The mean number of public primary care appointments was 3.14/inhabitant, and private healthcare coverage was 40.5% in 2017 [15]. Santana do Parnaíba public

Box 1

Selected healthcare quality indicators [8,9,10,12].

DESCRIPTION
The percentage of patients with blood pressure recorded in the previous 12 months
The percentage of patients with serum creatinine recorded in the previous 12 months
The percentage of patients with a test for proteinuria recorded in the previous 12 months
The percentage of patients with arterial hypertension and blood pressure < 140x90mmHg
The percentage of patients with diabetes mellitus and HbA1c < 6.5%
The percentage of patients with dyslipidemia and LDL-cholesterol < 100mg/dL
The percentage of patients with CKD that were identified
The percentage of patients with CKD correctly referred to a nephrologist
The percentage of patients with CKD and arterial hypertension that were prescribed an ACE-I or ARB
The percentage of patients receiving ACE-I or ARB with serum potassium recorded in the previous 12 months

ACE-I: angiotensin-converting enzyme inhibitor; ARB: angiotensin-receptor blocker; CKD: chronic kidney disease; HbA1c: glycosylated hemoglobin; LDL: low-density lipoprotein.

health system also has a secondary healthcare clinic where a nephrologist is available 12 hours a week. In 2019, this nephrologist performed 1.295 medical appointments.

Extracted data and variables definitions

We collected information on age, gender, ethnicity, and chronic diseases (hypertension, diabetes, dyslipidemia, heart failure, coronary insufficiency, stroke, and CKD). Besides being explicitly described in the records, additional definitions were adopted for identification of the diseases, as follows: (1) anti-hypertensive drugs use for hypertension; (2) oral anti-diabetics or insulin use for diabetes; (3) statins or fibrates use for dyslipidemia according to U.S. National Cholesterol Education Program (NCEP) [16]; (4) angina pectoris, acute myocardial infarction, coronary stent surgery, or myocardial revascularization defined coronary insufficiency; and (5) estimated glomerular filtration ratio (eGFR) < 60mL/min/1.73m^2 or proteinuria defined CKD according to Kidney Disease Outcomes Quality Initiative (KDOQI) [17,18].

If the blood pressure was described, we used the last three measures to estimate the mean blood pressure we show in this study. We looked for information on the two anti-hypertensive drugs that are freely provided by the Brazilian Unified National Health System (SUS) and undoubtedly slow CKD progression: the renin-angiotensin system (RAS) blockers, the angiotensin-receptor blockers (ARBs), and the angiotensin-converting enzyme inhibitor (ACEs).

The laboratory results we collected were serum creatinine, LDL-cholesterol, potassium, glycosylated hemoglobin, and proteinuria. We defined blood pressure < 140x90mmHg, glycosylated hemoglobin (HbA1c) < 6.5% and LDL-cholesterol < 100mg/dL as targets for considering controlled hypertension, diabetes, and dyslipidemia, respectively [7,10,17,18]. We estimated the eGFR using CKD-EPI (Chronic Kidney Disease Epidemiology Collaboration) equation [18].

Identification of CKD was defined if one of the following terms were observed in the medical records: "CKD", "chronic kidney disease", "renal failure", and "renal insufficiency". We considered that the patients were correctly referred to a nephrologist if some of these criteria were met: severe proteinuria regardless of CKD stage, CKD stages 4 or 5 regardless of proteinuria, or CKD stage 3b with mild proteinuria, according to the Brazilian Ministry of Health's or the KDIGO's recommendations [7,13]. We classified CKD into five stages according to the current guidelines: stage 1 (eGFR ≥ 90mL/min/1.73m^2 and any level of proteinuria), stage 2 (eGFR between 60-89mL/min/1.73m^2 and any level of proteinuria), stage 3a (eGFR between 45-59mL/min/1.73m^2), stage 3b (eGFR between 30-44mL/

min/1.73m2), stage 4 (eGFR between 15-29mL/min/1.73m2), and stage 5 (eGFR < 15mL/min/1.73m2) [13,17]. The methods for measuring proteinuria were urinalysis, albumin-to-creatinine ratio (ACR), 24h-albuminuria, and 24h-proteinuria. We categorized proteinuria into: (1) absent of mild (urinalysis < 1+, ACR < 30mg/g, 24h-albuminuria < 30mg, or 24h-proteinuria < 150mg); (2) moderate (urinalysis = 1+, ACR between 30-300mg/g, 24h-albuminuria between 30-300mg, or 24h-proteinuria between 150-1,000mg); and (3) severe (urinalysis = 2+ or 3+, ACR > 300mg/g, 24h-albuminuria > 300mg, or 24h-proteinuria > 1,000mg) [13].

Sample size and statistical analysis

We estimated our sample size based on previous data that described the investigation rate of serum creatinine and proteinuria (70% and 20%, respectively) [8,9,12,19,20], blood pressure (50%) [21,22], and diagnosing CKD (10-27%) [23,24,25,26,27,28,29]. We set a 95% confidence interval, with an error of 20%, which led us to a minimal sample of 857 patients. The number of medical records evaluated for inclusion was 2,450. After applying the inclusion criteria, we selected 1,066 patients, being 107 to 152 from the bigger UBS (Álvaro Ribeiro, Fazendinha, São Pedro, Parque Santana, and Colinas) and 45 to 95 from the smaller ones (Limério, Jaguari, Ingaí, Cururuquara, and Alphaville). Figure 1 shows our enrollment flow chart.

We used the SPSS software, version 18 (https://www.ibm.com/), to analyze our data. The categorical variables were described in frequencies and compared by chi-square test. The numerical variables were shown in median and interquartile, given their non-normal distribution. The indicators' performances are shown in percentages.

Our protocol was approved by the Research Ethical Committee of Federal University of São Paulo (document n. 4.055.532), and it was performed according to the *Declaration of Helsinki* and *Resolution n. 466/2012* of the Brazilian National Healtth Council.

Results

Altogether (n = 1,066), our sample was mostly of women (61.5%) whose mean age was 61.2 years old. Hypertension was found in 77.3% of our sample, while diabetes was found in 43.3%. The main comorbidities were dyslipidemia (45.9%), CKD (12.9%), and heart failure (2.4%) (Table 1). The CKD prevalence among the hypertensive, diabetic, and > 60 years old reached 14.1%, 15.7%, and 18%, respectively. Compared to individuals without CKD, the ones with CKD were mostly male (73.9%

Figure 1

Enrollment flow diagram.

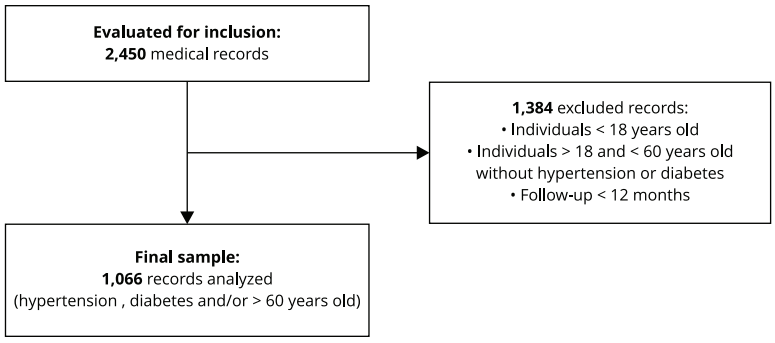

Table 1

Sample characteristics (N = 1,066).

Demographic characteristic	n (%)
Age (years) [mean (SD)]	61.2 (51.8-67.8)
Male sex	421 (39.5)
White	434 (40.7)
Risk factors for CKD	
Hypertension	824 (77.3)
Diabetes	464 (43.5)
Hypertension, non-diabetic	483 (45.3)
Diabetes, non-hypertensive	123 (11.5)
Older adults, non-hypertensive, non-diabetic	115 (10.8)
Comorbidities	
Dyslipidemia	489 (45.9)
CKD	137 (12.9)
Heart failure	26 (2.4)
Coronary insufficiency	24 (2.3)
Stroke	17 (1.6)
Clinical data	
Systolic blood pressure (mmHg) [mean (SD)]	127 (117-137)
Diastolic blood pressure (mmHg) [mean (SD)]	73 (80-85)
Serum creatinine (mg/dL) [mean (SD)]	0.76 (0.84-1.00)
eGFR (mL/min/1.73m^2) [mean (SD)]	69.9 (82.2-3.5)
Glycosylated hemoglobin (%) [mean (SD)]	5.6 (6.0-6.7)
LDL-cholesterol (mg/dL) [mean (SD)]	93 (116-141)
Follow-up (years) [mean (SD)]	3 (2.6-3.6)

CKD: chronic kidney disease; eGFR: estimated glomerular filtration ratio; LDL: low-density lipoprotein; SD: standard deviation.

vs. 38.7%, p = 0.001), with hypertension (95.7% vs. 76.9%, p = 0.04), dyslipidemia (69.6% vs. 45.3%, p = 0.03), coronary disease (13% vs. 2%, p = 0.01) and gout (13% vs. 3.1%, p = 0.04). No significant difference between the groups regarding ethnicity, smoking status, obesity, diabetes, heart failure, stroke history, and nephrolithiasis was found.

We found information on blood pressure measurement in 98.7% of the records. Among diabetic patients, 81.5% of them had their glycosylated hemoglobin registered in the medical records. LDL-cholesterol was described in 87.7% of the patients with dyslipidemia. Serum creatinine and proteinuria were found, respectively, in 79.4% and 58.8% of the records. Regarding serum creatinine measurements, the diabetic patients overcame the hypertensive ones (84.6% vs. 76%, p = 0.04). Proteinuria investigation was similar among those with diabetes and hypertension (62.6% vs. 57.4%, p = 0.34). ACR, 24h-albuminuria or 24h-proteinuria was found in 16.2% and 9.1% of the patients with diabetes and hypertension, respectively (p = 0.01). Blood pressure was adequately managed in 79.2% of the patients, as well as diabetes (49.2%) and dyslipidemia (33.3%). RAS blockers were prescribed to 82.8% of the patients who had both diabetes and hypertension, and 35.7% were investigated for serum potassium. Among those with CKD (n = 137), 16.8% had their diagnosis written down on the record. Among the 19 patients (13.9%) who met the criteria for a nephrologist referral, 6 (31.6%) reached this specialist, eventually. The healthcare performance indicators are summed up in Table 2.

We classified the patients who were investigated for their serum creatinine and proteinuria (n = 611) into the risk map for CKD. We found 83.9% (n = 513) of them at low risk, 10.6% (n = 65) at moderate risk, 3.6% (n = 22) at high risk, and 1.8% (n = 11) at very high risk (Table 3).

Table 2

Healthcare performance indicators.

Indicator	Numerator	Denominator	%
Patients with blood pressure recorded in the previous 12 months	1,054	1,066	98.9
Patients with serum creatinine recorded in the previous 12 months			
Total	846	1,066	79.4
Hypertensive, non-diabetic	367	483	76.0
Diabetic, non-hypertensive	104	123	84.6
Older adults, non-hypertensive, non-diabetic	93	115	80.9
Patients with a test for proteinuria recorded in the previous 12 months			
Total	627	1,066	58.8
Hypertensive, non-diabetic	277	483	57.4
Diabetic, non-hypertensive	77	123	62.6
Older adults, non-hypertensive, non-diabetic	72	115	62.6
Hypertensive patients with blood pressure < 140x90mmHg	647	817	79.2
Diabetic patients with HbA1c < 6.5%	186	378	49.2
Dyslipidemia patients with LDL-cholesterol < 100mg/dL	138	415	33.3
Patients with CKD that were identified	23	137	16.8
Patients who were referred to a nephrologist	6	19	31.6
Patients with CKD and hypertension who were taking renin-angiotensin system blockers, unless contraindicated	96	116	82.8
Patients who were taking renin-angiotensin system blockers who had their serum potassium measured within the last 12 months	248	694	35.7

CKD: chronic kidney disease; HbA1c: glycosylated hemoglobin; LDL: low-density lipoprotein.

Table 3

Patients distribution according to risk categories for chronic kidney disease (CKD) outcomes (n = 611 *).

CKD stages	eGFR (mL/min)	Proteinuria		
		Absent/Mild	Moderate	Severe
1	≥ 90	194 (31.8) **	9 (1.5) ***	3 (0.5) #
2	60-89	319 (52.2) **	11 (1.8) ***	3 (0.5) #
3a	45-59	45 (7.4) ***	5 (0.8) #	3 (0.5) ##
3b	30-44	11 (1.8) #	2 (0.3) ##	1 (0.2) ##
4	15-29	3 (0.5) ##	2 (0.3) ##	0 (0) ##
5	< 15	0 (0) ##	0 (0) ##	0 (0) ##

eGFR: estimated glomerular filtration ratio.

* 611 patients were investigated for serum creatinine and proteinuria;

** Low risk: n = 513; 83.9%;

*** Moderate risk: n = 65; 10.5%;

High risk: n = 22; 3.6%;

Very high risk: n = 11; 1.8%.

Discussion

This study showed that healthcare performance indicators could demonstrate how CKD has been managed in the public health system of a city in the State of São Paulo. Up to 20-50% of the individuals – who were at high risk – were not screened for CKD with serum creatinine and proteinuria. Except hypertension, no other comorbidity reached the targets to be considered under control.

For those at risk for CKD, screening for kidney disorders by serum creatinine varied from 32% to 73.5% in previous reports. Proteinuria investigation (no method mentioned) was described in 2.5% to 40% of the hypertensive, diabetic and/or older patients [8,9,10,12,19,20]. Similarly, our results show that healthcare professionals still poorly understand the role of proteinuria over the serum creatinine investigation among those at high risk for CKD. KDIGO recommends screening non-diabetic patients for CKD executing urinalysis or P/C in a random urine sample. Those with diabetes need to be screened for CKD by a random urine sample albuminuria [13]. In 2016, Medicare disclosed that the albuminuria investigation rate reached 40% (diabetic patients) and 18% (hypertensive patients) [20]. Our results show that, even among diabetic patients, the albuminuria investigation was extremely infrequent, which reinforces that further medical training programs should approach methods of screening for CKD.

The rate at which CKD is acknowledged varies between 12-38% in international reports, and it increases as the disease becomes more severe (stage 3 = 6-8%, stage 4 = 12-31%, and stage 5 = 50-87%) [23,24,25,26,27,28]. Our study also shows that only 16.8% of patients with CKD were identified (stage 3 = 13.5% and stage 4 = 42.9%), which confirms that general practitioners and non-nephrologists physicians are unaware of the definition and classification of CKD [29,30,31]. We could not explore if the participants knew about their CKD condition, but we investigated if those with eGFR < 60mL/min/1.73m^2 had this diagnosis registered in medical records. At Santana de Parnaíba, the laboratories that perform serum creatinine measurement do not describe the corresponding eGFR, an important analysis which could help physicians deal with the initial stages of CKD. The description of the eGFR and medical trainings may improve the concern of both health professionals and patients regarding the CKD [32,33]. It was reported that the referrals to a nephrologist reached 36% (CKD stage 4-5) and 35% (severe proteinuria) in Stockholm [27]. Similarly, one-third of our patients met a nephrologist.

Some of the limitations of this study should be mentioned. First, the patients' medical records missing information may not have been associated with the healthcare professional unawareness of the CKD diagnosis or laboratory results, as we presumed. Some studies have suggested that diagnosis annotations overcome looking for the International Classification of Diseases (ICD) [22,23,27]. Second, some variables we did not include in this study may have interfered with the health indicators we studied – weight, height, and body surface can affect eGFR; age, tobacco use, cardiovascular diseases determine LDL-cholesterol target. Additionally, the cross-sectional design prevented us from establishing causal relationships between failures in quality indicators and clinical outcomes. Third, we could not recover other causes of CKD, such as glomerulonephritis, polycystic kidney disease, and urinary obstruction. Still, diabetes and hypertension remain the pivotal causes of CKD in Brazil and worldwide [34,35]. Finally, the results of only one city, even if they covered 100% of its UBS, lack external validity. However, they may work as a comparator to other similar places and may contribute to evaluating further health interventions – such as medical training – in the city where this investigation occurred. This study is probably one of the largest and the most detailed that investigated quality indicators of CKD assistance in primary healthcare of the SUS, which may contribute to planning health interventions in São Paulo and Brazil.

Conclusion

This study revealed some missed quality indicators of identifying CKD and treatment of its main risk factors. Our results show data that may help managers develop public policies that improve health care for those at high risk for CKD. Long-term follow-up of the quality health indicators we proposed here will be helpful to assess the impact of policy intervention.

Contributors

All authors contributed to the study design, data collection and writing of the manuscript.

Additional informations

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Resumo

As complicações da doença renal crônica (DRC) podem ser evitadas quando a doença é diagnosticada e tratada oportunamente. O estudo teve como objetivo descrever a qualidade dos indicadores da detecção e assistência para a DRC no sistema púbico de saúde em um município do Estado de São Paulo, Brasil. O estudo retrospectivo analisou prontuários de pacientes que utilizaram serviços de atenção primária no sistema público entre novembro de 2019 e fevereiro de 2020. Selecionamos dez indicadores de qualidade com base na relevância científica e disponibilidade, a partir dos prontuários médicos. Calculamos o percentual de adequação com dados de 1.066 indivíduos que apresentavam ≥ 1 fatores de risco para DRC: hipertensão, diabetes ou idade > 60 anos. No total, 79,4% dos pacientes apresentavam informação sobre creatinina sérica, e 58,8% foram investigados para proteinúria. Dados de pressão arterial foram encontrados em 98,9% dos prontuários. As proporções de pacientes com pressão arterial < 140x90mmHg, hemoglobina glicada < 6,5% e LDL < 100mg/dL foram 79,2%, 49,2% e 33,3%, respectivamente. Os antagonistas do sistema renina-angiotensina foram prescritos em 82,8% dos pacientes com hipertensão e DRC. O potássio sérico foi medido em 35,7% dos pacientes em uso de antagonistas do sistema renina-angiotensina. Entre os indivíduos com DRC, 16,7% tinham esse diagnóstico registrado no prontuário médico. Entre os participantes com risco mais elevado de DRC, 31,6% foram encaminhados para um nefrologista. O estudo confirmou a falta de alguns indicadores de qualidade para DRC na assistência primária. Os resultados podem ajudar gestores a desenvolverem políticas públicas que melhorem a assistência para indivíduos com risco maior de DRC. O seguimento a longo prazo dos indicadores de saúde propostos aqui será útil para avaliar o impacto dessa política de intervenção.

Insuficiência Renal Crônica; Indicadores Básicos de Sáude; Atenção Primária à Saúde

Resumen

Las complicaciones de la enfermedad crónica de riñón (ECR) se pueden evitar cuando esta enfermedad se diagnostica con prontitud y se trata. El objetivo fue describir indicadores de calidad en la detección de ECR, así como la asistencia en el servicio público de una ciudad, en el Estado de São Paulo, Brasil. Este estudio retrospectivo analizó fichas de pacientes que acudían a atención primaria en el servicio público, entre noviembre 2019 y febrero 2020. Seleccionamos 10 indicadores de calidad en salud, basados en relevancia científica y disponibilidad de registros médicos. Calculamos el porcentaje de adecuación de ellos con datos de 1.066 personas que tenían ≥ 1 factor de riesgo ECR: hipertensión, diabetes, o > 60 años. Un 79,4% de los pacientes tenían información sobre la creatinina sérica, y se investigó a un 58,8% en el caso de la proteinuria. Los datos de presión sanguínea se encontraron en un 98,9% de los registros. El porcentaje de pacientes con presión sanguínea < 140x90mmHg, hemoglobina glicada < 6,5% y LDL < 100mg/dL fue 79,2%, 49,2%, y 33,3%, respectivamente. Se prescribieron bloqueadores del sistema renina-angiotensina a un 82,8% de los pacientes con hipertensión y ECR. Se midió el potasio sérico en un 35,7% de aquellos quienes estaban usando bloqueadores del sistema renina-angiotensina. Entre aquellas personas con ECR, 16,7% había ECR asignado en los registros médicos como diagnosis. Entre aquellos participantes en riesgo mayor por ECR, la tasa de derivación a un nefrólogo fue 31,6%. Este estudio confirmó algunos indicadores de calidad olvidados de ECR en los cuidados de salud en la atención primaria. Nuestros resultados quizás podrían ayudar a los gestores a desarrollar políticas públicas que mejoraran el cuidado de salud para las personas con alto riesgo de ECR. El seguimiento a largo plazo de los indicadores de salud que propusimos aquí será útil para evaluar el impacto de la política de intervención.

Insuficiencia Renal Crónica; Indicadores de Salud; Atención Primaria de Salud

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