Albuminuria Testing in a Primary Care Facility in the North of Portugal

Avaliação da Utilização de Determinação da Microalbuminúria nos CSP: Realidade de uma Unidade de Saúde do Norte de Portugal

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RESUMO

INTRODUÇÃO. A doença renal crónica (DRC) é uma causa significativa de morbilidade e mortalidade a nível mundial. O diagnóstico implica alteração da função ou estrutura renal, com duração superior a 3 meses. Este estudo teve como objetivo avaliar a utilização da determinação da albuminúria como ferramenta de rastreio da DRC numa unidade de cuidados de saúde primários (CSP) do Norte de Portugal.

MÉTODOS. Estudo observacional, transversal e analítico, numa amostra de 400 adultos inscritos na unidade em estudo. Foram recolhidos dados sociodemográficos e clínicos de janeiro a dezembro de 2023.

RESULTADOS. Critérios de inclusão foram cumpridos por 188 utentes, 63,8% do sexo feminino, com idade mediana de 62 anos e pressão arterial sistólica média de 126 ± 18 mmHg. Dos doentes, 38,8% apresentavam hipertensão arterial (HTA), 17,0% diabetes *mellitus* (DM) e 5,3% insuficiência cardíaca. A albuminúria foi doseada em 58 utentes (30,9%), 89,7% dos quais apresentavam normoalbuminúria. Foi avaliada em 81,2% de doentes diabéticos e 61,6% de doentes hipertensos. Foram encontradas associações entre a medição de albuminúria e a idade avançada, a presença de comorbilidades e valores mais elevados de glicemia e pressão arterial.

CONCLUSÃO. Apesar da sua acessibilidade e importância, existe uma lacuna significativa na testagem da albuminúria nos CSP. O rastreio da DRC em doentes de alto risco é essencial para atrasar a sua progressão e diminuir o seu impacto.

PALAVRAS-CHAVE: Albuminúria; Cuidados de Saúde Primários; Fatores de Risco de Doenças Cardíacas; Insuficiência Renal Crónica.

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ABSTRACT

INTRODUCTION. Chronic kidney disease (CKD) causes significant morbidity and mortality worldwide. Diagnosis involves a minimum of 3 months of impaired kidney function or kidney damage. This study aimed to evaluate the use of albuminuria testing as a CKD screening tool in a primary health care (PHC) facility in the North of Portugal.

METHODS. Observational retrospective study involving a sample of 400 adults registered in a PHC facility in Portugal. Sociodemographic and clinical data from January to December 2023 were collected.

RESULTS. Inclusion criteria were met by 188 patients, of whom 63.8% were female, the median age was 62 years and the mean systolic blood pressure was 126 ± 18 mmHg. In total, 38.8% of participants had hypertension and 17.0% had diabetes mellitus. Albuminuria was measured in 58 patients (30.9%), 89.7% of whom had normoalbuminuria. Albuminuria testing was conducted in 81.2% of diabetic patients and 61.6% of hypertensive patients. Associations between albuminuria measurement and advanced age, presence of comorbidities and higher blood glucose and blood pressure were found.

CONCLUSION. Despite its accessibility and importance, there is a significant gap in albuminuria testing in PHC. CKD screening in high-risk patients is essential to slow its progression and to decrease its burden.

KEYWORDS: Albuminuria; Heart Disease Risk Factors; Primary Health Care; Renal Insufficiency, Chronic

INTRODUCTION

Chronic kidney disease (CKD) is one of the leading causes of morbidity and mortality worldwide, both of which are predicted to become ever more significant in the coming decades. Globally, the prevalence of CKD in the general population is estimated to be around 11% to 13%,[1] and according to data published in the Global Disease Burden study, in 2019, CKD was the eleventh leading cause of death worldwide.[2] In Portugal, CKD was the ninth leading cause of death in 2019 and its estimated prevalence in the general population reaches as high as 20,9%.[2,3]

The Kidney Disease Improving Global Outcomes (KDIGO) defines CKD as the presence of an abnormality of either kidney function or kidney structure, lasting for more than 3 months. Two of the most commonly applied diagnostic criteria in clinical practice are a reduction of estimated glomerular filtration rate (eGFR) to less than 60 mL/min/1.73 m,[2] indicating abnormal kidney function, and/or the presence of albuminuria measured by the albumin to creatinine ratio (ACR) in a spot urine sample equal or superior to 30 mg/g creatinine, indicating abnormal kidney structure.[4]

Early identification of CKD and timely treatment are essential for slowing down the progression of the disease.[5] CKD screening addressed to high-risk populations, using periodical measurement of serum creatinine and albuminuria in the first morning urine sample, is widely accepted and proven to be cost-effective.[6–8] International recommendations consistently recommend screening for CKD in patients with arterial hypertension (HTN), diabetes mellitus (DM) and cardiovascular disease (including heart failure) and suggest it may be considered if the patient is obese, is of advanced age or has a family history of kidney disease.[6,9–13]

Screening is pivotal in the identification of the so called "blind spot" of CKD, which refers to patients with a slight degree of albuminuria, without a reduction in the glomerular filtration rate, i.e., patients with eGFR greater than or equal to 60 mL/min/1.73 m^2 (G1 and G2) and albuminuria greater than or equal to 30 mg/g of creatinine (A2 and A3). In these cases, if albuminuria remains unmeasured, CKD will inevitably tend to progress, compromising the use of prognosis-modifying therapies, such as sodium-glucose cotransporter 2 (iSGLT2) inhibitors, glucagon-like peptide-1 receptor (GLP-1R) agonists and mineralocorticoid receptor antagonists (MRA).[14,15]

Besides, albuminuria is an important cardiovascular (CV) risk factor, which translates into endothelial dysfunction and whose development is associated with non-modifiable factors such as genetic load and advanced age, as well as modifiable factors such as obesity and smoking.[14,16]

Several studies have shown that any level of albuminuria, even normoalbuminuria, i.e., ACR below 30 mg/g, is associated not only with the development of CV disease (such as coronary artery disease, stroke, heart failure or arrhythmia), but also with an increase in CV and overall mortality.[17–19] This increase is seen both in people with known risk factors for the development of CKD and in apparently healthy individuals.[18–20]

Thus, periodic albuminuria measurement in primary health care (PHC) is crucial, not only in the context of CKD screening in high-risk patients, but also as an increasingly important CV disease biomarker.

The aim of this study is to quantify the prescription of albuminuria measurement in a sample of patients enrolled in a primary care facility in the North of Portugal.

METHODS

The study protocol approval was given by the Health Ethics Committee of the Northern Regional Health Administration, with the reference number CE/2023/78.

An observational, cross-sectional and analytical study was carried out, encompassing a population of adult patients registered at an urban Primary Care Unit (PCU) in the North of Portugal, in the year of 2023 (N = 11928). The list of patients included in the study population was obtained from the Functional Units Information and Monitoring Module (MIM@UF®) electronic program.

Regarding the inclusion and exclusion criteria: to be included in the study patients needed to be 18 years of age or older and be registered at the PCU where the study was conducted between January 1st and December 31st of 2023. Additionally, the patient would also need to have at least one in-person medical appointment during that year, as well as a documented blood pressure measurement registered in the electronic health records. Exclusion criteria included patients who were deceased or without an assigned family doctor at the time of the sample selection. Patients without any record of an in-person appointment during 2023 or a blood pressure measurement in their electronic records, or with incomplete clinical data based on the variables defined in the study were also excluded.

To determine sample size, a hypothetical frequency of 50%, a margin of error of 5% and a confidence interval of 95% were used, which determined a representative sample size of 373 patients, which was rounded up to 400 users in order to mitigate possible losses. The final sample was obtained through simple randomization, after the exclusion of dead patients and those who did not have an assigned family doctor.

Since the MIM@UF® electronic program is unable to provide a list consisting of only patients with at least one face-to-face consultation in 2023, patients who did not meet this requirement were only excluded during the data collection phase.

Data was collected by the researchers in January 2024 using the SClínico®, RSE® and PEM® health record programs. The data obtained was coded and recorded in an electronic Microsoft Office Excel 2016® database, coded by password, making it impossible to identify patients and thus ensuring the anonymity and confidentiality of the information.

The variables collected included: gender; age; smoking status; last recorded systolic blood pressure, glycated hemoglobin, serum creatinine, estimated glomerular filtration rate using the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) 2021 equation and ACR in an occasional urine sample; active ICPC-2 coding consistent with heart failure (ICPC-2 coding K77), arterial hypertension (ICPC-2 coding K86 or K87) and diabetes mellitus (ICPC-2 coding K89 or K90); current pharmacological therapy (insulin, biguanide, sodium-glucose cotransporter 2 (SGLT2) inhibitor, glucagon-like peptide-1 receptor (GLP-1R) agonist, dipeptidyl peptidase-4 (DPP4) inhibitor, angiotensin-converting enzyme (ACE) inhibitor, angiotensin II receptor blocker (ARB), calcium channel blocker (CCB), beta-blocker (BB), mineralocorticoid receptor antagonist (MRA), statin, antiplatelet, oral anticoagulant and diuretic.

Statistical analysis was carried out using the Statistical Package for the Social Sciences® v.29 and a significance level of 5% was considered.

Descriptive analysis included determining absolute (n) and relative (%) frequencies for categorical variables. Continuous variables were described using measures of central tendency, mean (M) or median (Med), and dispersion, standard deviation (SD) or interquartile range (IQR), according to the normality or non-normality of variable distribution, which was assessed using the Shapiro-Wilk test.

For inferential analysis, the association between categorical variables was assessed using Pearson's Chi Square test. The association between continuous variables was assessed using *t-test* for independent samples in the case of normally distributed variables and Mann-Whitney test for independent samples in the case of non-normally distributed variables.

RESULTS

Of the 400 health records initially included in the sample, representing adult patients registered at the PCU where the study was conducted during the year of 2023, 188 patients met the inclusion criteria, meaning

they had at least one in-person medical appointment and a registered blood pressure measurement during that year, most of whom were female (63.8%) and non-smokers (87.8%), with a median age of 62 (IQR: 44 - 73) years and an average systolic blood pressure of 126 ± 18 mmHg.

Regarding the presence of active ICPC-2 coding, there was a higher proportion of patients with HTN (38.8%), followed by DM (17.0%) and heart failure (5.3%).

Throughout the year of 2023, serum creatinine was determined in 63.3% of the sample (n=119), with a median value of 0.82 (IQR: 0.69 - 1.00) mg/dL. The corresponding median eGFR, calculated using the CKD-EPI 2021 equation, was 90 (IQR: 74 - 101) mL/min/1.73 m^2, with a minimum value of 23 mL/min/1.73 m^2 and a maximum of 129 mL/min/1.73 m^2. Category G1 of eGFR was the most represented (51.3%), followed by categories G2 (38.7%) and G3a (6.7%).

Albuminuria measurement was prescribed in 58 patients (30.9%), 6 of whom had an ACR measurement between 30 and 300 mg/g creatinine, i.e., category A2 of albuminuria. None of the patients included in the sample had an ACR above 300 mg/g creatinine.

Variable descriptive analysis is shown in Table 1.

Albuminuria testing was prescribed in 81.3% of diabetic patients, 61.6% of hypertensive patients, 60% of patients with heart failure and 5.8% of patients without any of the aforementioned conditions.

Concerning the eGFR category, albuminuria testing was higher in patients with eGFR below 60 mL/min/1.73 m^2 and its use was the highest in more advanced categories of eGFR, being carried out in 75% of those in category G3a and in 100% of those in categories G3b and G4.

The distribution of albuminuria testing according to the presence of ICPC-2 active coding and eGFR category is shown in Tables 2 and 3, respectively.

Table 4 shows the inferential analysis that correlates the presence or absence of albuminuria testing with other variables. A prescription of albuminuria testing was associated with older age (Mann-Whitney, $p < 0.001$), higher systolic blood pressure (t-test, $p < 0.001$), higher glycated hemoglobin (Mann-Whitney, $p = 0.43$) and lower glomerular filtration rate (Mann-Whitney, $p = 0.002$). Regarding ICPC-2 coding, a prescription for albuminuria testing was found to be associated with a diagnosis of HTN (Pearson's Chi Square, $p < 0.001$), DM (Pearson's Chi Square, $p < 0.001$) and heart failure (Pearson's Chi Square, $p = 0.04$).

TABLE 1. Descriptive analysis of the variables studied

Gender (n = 188), n (%)	
Female	120 (63.8%)
Male	68 (36.2%)
Age (n = 188), Med (IQR) years	62 (44-73) years
Smoking status (n = 188), n (%)	
Smoker	23 (12.2%)
Non smoker	165 (87.8%)
Comorbidities according to ICPC-2 coding (n = 188), n (%)	
No hypertension, diabetes mellitus or heart failure	104 (55.3%)
Hypertension (K86 and K87)	73 (38.8%)
Diabetes mellitus (T89 and T90)	32 (17.0%)
Heart failure (K77)	10 (5.3%)
Pharmacological therapy (n = 188), n (%)	
Statin	76 (40.4%)
ACEi	41 (21.8%)
ARB	21 (11.2%)
CCB	26 (13.8%)
BB	26 (13.8%)
Biguanide	30 (16%)
SGLT2 inhibitor	18 (9.6%)
DPP4 inhibitors	9 (4.8%)
Insulin	5 (2.7%)
GLP-1R agonist	5 (2.7%)
MRA	3 (1.6%)
Antiplatelet therapy	15 (8%)
Anticoagulant therapy	7 (3.7%)
Systolic blood pressure (n = 188), M ± SD mmHg	126 ± 18
Glycated hemoglobin (n = 45), Med (IQR) %	6.4 (6.0 - 7.1)
Serum creatinine (n = 119), Med (IQR) mg/dL	0.82 (0.69 - 1.00)
eGFR (n = 119), Med (IQR) mL/min/1.73 m^2	90 (74 - 101)
eGFR category (n = 119), n (%)	
G1 (GFR ≥ 90 mL/min/1.73 m^2)	61 (51.3%)
G2 (GFR 60-89 mL/min/1.73 m^2)	46 (38.7%)
G3a (GFR 45-59 mL/min/1.73 m^2)	8 (6.7%)
G3b (GFR 30-44 mL/min/1.73 m^2)	2 (1.7%)
G4 (GFR 15-29 mL/min/1.73 m^2)	2 (1.7%)
G5 (GFR < 15 mL/min/1.73 m^2)	0 (0%)
Albuminuria category (n = 58), n (%)	
A1 (ACR < 30 mg/g)	52 (89.7%)
A2 (ACR ≥ 30 e < 300 mg/g)	6 (10.3%)
A3 (ACR ≥ 300 mg/g)	0 (0%)

Table caption: M = mean, Med = median, SD = standard deviation, IQR = interquartile range; ARB = angiotensin II receptor blocker, GLP-1R agonist = GLP-1 receptor agonist, MRA = Mineralocorticoid receptor antagonists, BB = Beta blockers; CCB = calcium channel blockers, ACEi - Angiotensin-Converting Enzyme Inhibitors, iDPP4 - dipeptidil peptidase-4 inhibitors, SGLT2 inhibitor - Sodium-glucose co-transporter-2 inhibitors, ACR = albumin-creatinine ratio, eGFR = estimated glomerular filtration rate

TABLE 2. Distribution of albuminuria category according to the presence of ICPC-2 active coding

	Albuminuria category			
Active ICPC-2 coding	A1, n (%)	A2, n (%)	A3, n (%)	Total, n (%)
Arterial hypertension	41 (91.1%)	4 (8.9%)	0 (0%)	45 (61.6%)
Diabetes mellitus	22 (84.6%)	4 (15.4%)	0 (0%)	26 (81.2%)
Heart failure	4 (66.7%)	2 (33.3%)	0 (0%)	6 (60.0%)
No arterial hypertension, diabetes mellitus or heart failure	5 (83.3%)	1 (16.7%)	0 (0%)	6 (5.8%)

TABLE 3. Distribution of albuminuria category according to eGFR category

	Albuminuria category			
eGFR category	A1, n (%)	A2, n (%)	A3, n (%)	Total, n (%)
G1	21 (95.5%)	1 (4.5%)	0 (0%)	22 (36.1%)
G2	22 (91.7%)	2 (8.3%)	0 (0%)	24 (52.2%)
G3a	5 (83.3%)	1 (16.7%)	0 (0%)	6 (75.0%)
G3b	2 (100 %)	0 (0%)	0 (0%)	2 (100%)
G4	0 (0%)	2 (100 %)	0 (0%)	2 (100%)
G5	0 (0%)	0 (0%)	0 (0%)	0 (0%)

TABLE 4. Inferential analysis: link between albuminuria testing and the variables studied

	No albuminuria testing	Albuminuria testing	*p*
Sex, n (%)			
Female	86 (71.7%)	34 (38.3%)	0.321#
Male	44 (64.7%)	24 (35.3%)	
Smoker, n (%)	22 (95.7%)	1 (4.3%)	**0.003#**
Arterial hypertension, n (%)	28 (38.4%)	45 (61.6%)	**< 0.001#**
Diabetes mellitus, n (%)	6 (18.8%)	26 (81.3%)	**< 0.001#**
Heart failure, n (%)	4 (40%)	6 (60%)	**0.04#**
Age, Med (IQR) years	52 (38 - 70)	71 (64 - 79)	**<0.001a**
HbA1c, Med (IQR) %	6.0 (5.5 - 6.8)	6.5 (6.1 - 7.2)	**0.043a**
Cr, Med (IQR) mg/dL	0.80 (0.67 - 0.96)	0.86 (0.69 - 1.04)	0.123a
eGFR, Med (IQR)	93 (83 - 107)	82 (67 – 96)	**0.002a**
Systolic BP, M ± SD mmHg	123 ± 16	132 ± 16	**<0.001b**

Pearson's Chi-square test; a Mann-Whitney test; b t-Student test
Table caption: M = mean, Med = Median, SD = standard deviation, IQR = interquartile range, Hb = Hemoglobin, HbA1c = glycated hemoglobin, Cr = serum creatinine, eGFR = Estimated glomerular filtration rate, BP = blood pressure

Table 5 shows the inferential analysis which correlates albuminuria categories, described as normal to slightly increased (ACR < 30 mg/dL) and moderately increased albuminuria (ACR 30 - 300 mg/dL), with other variables collected. There was an association between the presence of moderately increased albuminuria and higher values of serum creatinine (Mann-Whitney, p = 0.024), as well as lower values of eGFR (Mann-Whitney, p = 0.043).

DISCUSSION

In this study, albuminuria testing was conducted in 30.9% of patients, while serum creatinine values were assessed in 63.8%. This is possibly because many patients in the sample did not have the illnesses that require regular albuminuria testing for kidney disease screening in Portugal, such as diabetes and high blood pressure.[4] Additionally, in Portugal, primary care physicians monitor DM and HTN patients every six months, which includes clinical examination and blood analysis prescription.[21,22]

In the sample analyzed, albuminuria testing was predominantly conducted in patients with diabetes (81.2%),

TABELA 5. Inferential analysis: link between albuminuria category and variables

	Normal or slightly increased albuminuria	Moderately elevated albuminuria	*p*
Sex, n (%)			
Female	31 (91,2%)	3 (8.8%)	0.651#
Male	21 (87.5%)	3 (12.5%)	
Smoker, n (%)	0.732	0 (0%)	0.732#
Arterial hypertension, n (%)	0.498	4 (8.9%)	0.498#
Diabetes mellitus, n (%)	0.256	4 (15,4%)	0.256#
Heart failure, n (%)	0.051	2 (33.3%)	0.051#
Age, Med (IQR) years	70 (64 - 77)	80 (66 - 90)	0.194a
HbA1c, Med (IQR) %	6.5 (6.1 - 7.1)	7,1 (6.0 – 8.5)	0.439a
Cr, Med (IQR) mg/dL	0.83 (0.6 - 1.02)	1,32 (0.80 - 1.91)	**0.024a**
eGFR, Med (IQR)	83 (70 – 96)	57 (26 – 84)	**0.043a**
Systolic BP, M ± SD mmHg	133 ± 14	127.5 ± 29	0.661b

Pearson's Chi-square test; a Mann-Whitney test; b t-Student test
Table caption: M = mean, Med = median, SD = standard deviation, IQR = interquartile range, Hb = Hemoglobin, HbA1c = glycated hemoglobin, Cr = serum creatinine, eGFR = Estimated glomerular filtration rate, BP = blood pressure

followed by patients with hypertension (61.6%). These percentages exceed global rates: 35.1% - 52.3% in diabetic groups and 4.1% - 35% in hypertensive groups, although the prevalence of microalbuminuria is similar between the two (32.1% in diabetic patients and 21.9% in hypertensive patients).[23–26] The subpar rates of albuminuria screening in at-risk populations in primary care can be attributed to various factors, including insufficient awareness of guidelines and the significance of microalbuminuria as a cardiovascular risk factor, excessive workload and time constraints, absence of financial incentives, and ineffective communication among healthcare levels.[27,28] Additionally, an abundance of conflicting clinical guidelines may also play a role in the limited albuminuria testing rates. Although recommendations for diabetic patients are consistent on the benefit of annual testing of serum creatinine and albuminuria, obtaining the albumin/creatinine ratio in a urine sample,[4,9,11,12] for hypertensive patients and those with cardiovascular disease, there is no clearly defined frequency, although some clinical guidelines do suggest annual testing.[10–12]

This study found statistically significant associations between albuminuria levels and cardiovascular risk factors, including smoking, hypertension, diabetes, heart failure, advanced age, decreased kidney function, inadequate glycemic control and elevated blood pressure.

The prevalence of moderately increased albuminuria (ACR 30 - 300 mg/dL) observed in this study was 10.3%. Albuminuria testing made it possible to detect 3 users with moderately increased albuminuria in the A2 category among patients with eGFR values in the G1 and G2 categories, emphasizing the importance of early CKD detection.[14] In other eGFR categories where CKD diagnosis was already established, albuminuria testing was more common, aligning with KDIGO recommendations.[4] Research also links albuminuria to kidney disease progression, increased serum creatinine levels and decreased GFR,[29] consistent with the study's findings of higher serum creatinine and lower eGFR values in individuals with albuminuria levels exceeding 30 mg/g.

PHCs are in charge of creating preventive health initiatives for early detection and treatment of CKD and CV risk management.[30] The authors argue that this study enhances the understanding of albuminuria's role in a Portuguese PCU, emphasizing the significance of screening for CKD in high-risk groups, primarily done at the PHC level.

The authors believe there is a need to establish an unequivocal codification for CKD, which the ICPC-2 coding system lacks and leads to using the U99 code for general kidney disease. This initiative would also provide a more precise evaluation of the extent of underdiagnosis of earlier stages of CKD in Portugal, a commonly discussed issue in global studies, as shown by two extensive studies on CKD patients, revealing that just 23% had their condition properly documented in their electronic health records [31,32] This late diagnosis contributes to disease progression towards more advanced stages, which in Portugal is particularly visible by the incidence and prevalence rates of stage 5 CKD (CKD G5), the highest in the world.[33]

In any case, the authors acknowledge limitations that should be considered when interpreting the results. Firstly, compared to the total eligible population (N = 11 928), the sample size was relatively small (N = 188). Although a random sampling method was used, and the initially calculated sample size was respected, the final number of valid participants after applying inclusion and exclusion criteria, may limit the generalizability of the findings to the broader population. Secondly, the study relied exclusively on secondary data obtained from electronic medical records (SClínico®, RSE®, and PEM®), which introduces potential risks related to information bias, particularly due to possible coding errors, missing data or variations in the completeness and accuracy of record-keeping among healthcare providers. Thirdly, the study was conducted in a single urban PCU located in the North of Portugal, lacking the representation of other regions of the country, particularly rural areas.

Additionally, the study did not take into account alternative methods for albuminuria assessment, such as 24-hour urine collection or urinary test strips, which may be used in other clinical settings. The exclusive use of albumin-to-creatinine ratio (ACR) from spot urine samples may not capture all clinically relevant cases, and this limitation should be considered in the interpretation of albuminuria-related outcomes.

Future research involving larger and more geographically diverse samples, as well as mixed-method approaches that combine primary and secondary data collection, would be valuable to enhance the generalizability and validity of findings. Furthermore, studies focusing on the determination of albuminuria as a working tool in PHC are essential for the development of strategies to improve adherence to this screening, thus optimizing the provision of care to patients at risk and, ultimately, to the general population.

CONCLUSION

The prescription of albuminuria testing in the health unit studied falls short of what is currently recommended for high-risk patients, especially those with DM and HTN, though it still shows some improvement compared to screening of CKD in diabetic and hypertensive patients in other countries.

Reducing the mortality and morbidity associated with CKD heavily depends on its early identification.

Primary healthcare workers play a fundamental role in identifying individuals at risk for CKD, conducting opportunistic screening, managing CV risk and implementing prognosis modifying treatment, all of which are essential to lessen the burden of CKD in terms of morbidity and mortality worldwide.

The availability of emerging prognosis-modifying agents (such as sodium-glucose cotransporter 2 (SGLT2) inhibitors and mineralocorticoid receptor antagonists) supports the need for a broader screening strategy beyond traditional high-risk groups, making it possible to detect CKD at earlier stages and optimize therapeutic interventions.

PRESENTATIONS

Exhibition, in the form of an E-Poster, in "VI Jornadas Multidisciplinares de Medicina Geral e Familiar", in March 2024.

Presentation, in the form of a Poster, in "International Meeting on Hypertension and Global Cardiovascular Risk", in January 2025.

DECLARAÇÃO DE CONTRIBUIÇÃO /CONTRIBUTORSHIP STATEMENT

ACF - Conceitualização, metodologia, software, validação, redação e revisão do texto final.

BG - Conceitualização, metodologia, validação, pesquisa, redação e revisão do texto final.

CA, IMF - Conceitualização, metodologia, validação, redação e revisão do texto final.

MM - Conceitualização, metodologia, software, validação, análise formal, pesquisa, gestão, redação e revisão do texto final.

Todos os autores aprovaram a versão final a ser publicada

ACF - Conceptualization, methodology, software, validation, writing and reviewing the final text

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All authors approved the final version to be published.

RESPONSABILIDADES ÉTICAS

CONFLITOS DE INTERESSE: Os autores declaram a inexistência de conflitos de interesse na realização do presente trabalho.

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