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Nephropathies and kidney transplantation: a study on patients from the cardiovascular care lines of a university outpatient clinic in Minas Gerais

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HIGHLIGHTS

What is already known?

- Nephropathies are directly influenced by cardiovascular diseases;
- Most cardiovascular diseases have preventable risk factors, which would prevent nephropathies;
- Care guidelines help patients understand the disease they have and receive targeted treat**ment.**

What was shown?

- Individuals' life history, such as smoking, alcoholism and obesity, can contribute to the development of nephropathies from cardiovascular damage;
- Patients' previous pathological history, such as acute myocardial infarction and stroke, increase the chances of nephropathies.

How can the study be added to the literature?

- Nephrological diseases are often portrayed as secondary to primary causes, such as cardiovascular diseases, but they can cause as much or more harm to patients;
- Encouraging the creation of a nephrological care line is the main point in order to contribute to the prognosis of nephropathy patients.

ABSTRACT

Introduction: The cardiovascular care line represents continuous care that aims to meet the demands of patients with cardiovascular system diseases in a comprehensive and multidisciplinary way. It focuses on several comorbidities, for example, hypertension, diabetes mellitus, and nephropathies. **Objective:** To analyze cardiological and nephrological data, relating them to patients aged between 18 and 91 years old. **Methods:** Cross-sectional epidemiological study carried out through the analysis of medical records obtained at a university outpatient clinic in Minas Gerais, of patients treated from January 2021 to June 2023. The research analyzed epidemiological, clinical, cardiological, and nephrological data. Patients from other lines of care were excluded, restricting the sample to cardiovascular patients. The data were analyzed using the R program, and a descriptive analysis of continuous, categorical, and numerical variables was conducted. The study was approved by the CEP after evaluating the cardiovascular care line of the outpatient clinic in question. **Results:** Data from 166 patients were analyzed. Samples were composed of 75 male and 95 female individuals, with an average age of 66 years. It was also observed that 50 patients were smokers and 42 were alcoholics, demonstrating a serious cardiovascular and, consequently, nephrological risk factor. Additionally, 46 diagnoses of kidney disease are presented, and another variable evaluated was kidney transplantation, with 2 patients undergoing this surgery. **Conclusion:** Risk factors and cardiovascular diseases directly affect kidney health. Including specialized care in nephrology is essential to monitor patients with nephropathies and ensure effective intervention.

Keywords: Kidney Diseases; Kidney Transplantation; Cardiovascular Diseases; Kidney Failure Chronic; Risk Factors.

INTRODUCTION

The lines of care are characterized by standardized care pathways focused on promotion, prevention, treatment, and rehabilitation actions. The objectives of the lines of care include guiding the health service to focus attention on the patient and their needs, highlighting care flows with safe therapeutic plans at all levels of care, and establishing an ideal care pathway within the different levels of care according to the patient's needs.

The cardiovascular care line represents continuous patient care and focuses on various morbidities that affect the health of the heart and blood vessels. It is known that among chronic non-communicable diseases, cardiovascular disease has a significant epidemiological impact, having an important relationship with chronic kidney disease (CKD), since they have similar risk factors - diabetes mellitus, dyslipidemia, average age over 60 years, smoking, obesity and family history - in addition to the fact that the heart and kidneys are closely related organs[1].

It is known that there is no condition associated with a cardiovascular risk as high as that conferred by CKD[1]. Therefore, having CKD is the highest risk factor for cardiovascular mortality. On the other hand, the main etiology of CKD in Brazil is uncontrolled chronic arterial hypertension[2], which shows that cardiovascular diseases can also significantly affect kidney health.

The Brazilian Society of Nephrology (BSN) estimates that more than ten million people have CKD and that it causes approximately 2.4 million deaths per year, making it a major public health issue. In addition, more than 100,000 patients need to undergo dialysis treatment per year, and the mortality rate reaches 17%[3].

Any patient with a glomerular filtration rate (GFR) <60 mL/min/1.73 m², or with changes in a marker of kidney damage (e.g. albuminuria) or with structural/anatomical changes, even with a GFR equal to or greater than 60 mL/min/1.73 m², for a period longer than three months, is considered to have CKD[4]. Thus, the use of previously validated formulas to estimate GFR allows the assessment of the presence of CKD and its current stage, enabling the establishment of a treatment plan to prevent the progression of the disease to more advanced stages.

Creatinine is a product of the metabolism and degradation of phosphocreatine in skeletal muscle, being generally produced at a virtually constant rate by the body and, consequently, released continuously into the bloodstream. Due to its low molecular weight, this molecule diffuses easily through cell membranes, being present in blood plasma, other biological fluids, and inside erythrocytes.

It is known that creatinine is predominantly eliminated by glomerular filtration, with only a small amount secreted by tubular cells. Thus, serum creatinine concentration is inversely associated with renal function. Therefore, serum creatinine measurement is an important laboratory test used to assess renal health. However, it is not recommended to consider only the reference value limits of this test as an index for evaluating renal function, with estimated GFR being considered more sensitive and specific as a marker of renal function[4].

CKD has assumed increasing importance in Brazil, as it is an increasingly common disease, associated with high mortality, morbidity, and costs, in addition to negatively impacting the quality of life of individuals[5]. Therefore, studies that determine the clinical and epidemiological profile of patients with CKD are increasingly relevant, since they allow assessing the impact of risk factors on the disease and the prognosis of patients, so that policies can be created seeking to prevent CKD and its progression to critical stages.

In view of the current scenario, the objective of this study is to analyze cardiological and nephrological data, relating them to patients aged between 18 and 91 years.

METHOD

Study design

This is a retrospective cross-sectional epidemiological study that investigated data from the medical records of patients included in the cardiovascular care line of an outpatient clinic in Belo Horizonte. This study is an integral part of the research "Evaluation of the comprehensive cardiovascular care line of 'Ambulatório Ciências Médicas de Minas Gerais' developed in the 'Programa de Pós-Graduação em Saúde da Faculdade Ciências Médicas de Minas Gerais' in partnership with the Extension and Teaching sector linked to the Medicine degree at the same faculty. This research was previously approved by the 'Comitê de Ética e Pesquisa da Faculdade Ciências Médicas de Minas Gerais' (CEPCM-MG) with 'Certificado de Apresentação para Apreciação Ética' (CAAE: 67119822.9.0000.5134) and was governed by Resolution 466/12 of the National Health Council.

Participants

In the study, electronic medical records of patients with nephropathies within the cardiovascular care line were selected from January 2021 to June 2023 in 'Ambulatório Ciências Médicas' in Belo Horizonte, Minas Gerais. As inclusion criteria, the electronic medical records of patients aged between 18 and 91 years old were selected, who had the following words contained in the ICDs in their records - "nephro", abbreviation for nephrology; "renal", related to the kidneys; "CKD", a progressive condition that leads to progressive loss of renal function, which means Chronic Kidney

Disease; "kidney", the organ of focus of the research; "rins", the plural of the word kidney; "TX", abbreviation for transplant; "IRC", abbreviation for Chronic Renal Failure and "ARF", abbreviation for Acute Renal Failure - to distinguish those heart disease patients who also had kidney disease. The exclusion criteria were patients who were not part of the cardiovascular care line, who did not have the words in the ICDs mentioned above described in their medical records, who were under 18 years of age, and who were treated before January 1, 2021, or after June 30, 2023.

Instruments

The "MV pep" platform was used for data collection, allowing access and application of filters to extract the necessary information directly from the electronic medical records. In addition, the electronic medical records themselves were essential instruments since this is a study based on the analysis of retrospective data from patients included in the cardiovascular care line, covering relevant information on the characterization of the epidemiological, clinical, and cardiovascular profile, as well as specific nephrology data. The extracted data were organized and tabulated in a Google Excel spreadsheet, where they were categorized into the subdivisions of "epidemiological profile", "clinical profile", "cardiology data", and "nephrology data".

Procedures

The data were collected through the "MV pep" platform provided by the institution and were tabulated in a Google Excel spreadsheet by the authors to ensure data validation. The spreadsheet had the following subdivisions: "epidemiological profile", with filter on ICD, service number, medical record number, patient name, date of service, age, sex, place of birth, smoking or ex-smoking, alcoholism or ex-smoking; "clinical profile", which included previous comorbidities (ICDs), use of daily medications, prior surgeries/hospitalizations, kidney transplant; "cardiology data", specified in mean systolic and diastolic arterial pressure, heart rate, saturation; and "nephrology data" with information on creatinine, glomerular filtration rate/rhythm (GFR), urea, proteinuria, and protein in the urine.

Statistical analysis

After data collection, they were analyzed using the R program. The study was conducted using descriptive analysis of continuous, categorical, and numerical variables. Categorical variables were presented as absolute and relative frequencies, while numerical variables were presented as mean ± standard deviation and/or median and interquartile range. Possible associations between variables were calculated using Pearson's Chi-square test, with a significance level of 5%.

RESULTS

Characterization of patient profiles

According to the data shown in Table 1, of the 166 participants included in the study, the average age was 66 years with a standard deviation of 13.94 years. A total of 92 (55%) female patients and 74 (45%) male patients were observed.

Most patients (120; 72%) were not allocated in Belo Horizonte; 50 (30%) were smokers; 43 (26%) were alcoholics; 21 (13%) were obese; 76 (45%) had a history of previous heart disease; 46 (28%) had CKD or chronic renal failure (CRF); 71 (43%) had dyslipidemia; 69 (41%) were diabetic; 143 (86%) were hypertensive; 19 (11%) had a history of acute myocardial infarction (AMI); 11 (6%) had a history of stroke and only 2 (1%) patients had kidney transplants. Furthermore, due to incomplete records in the medical records for the variables "Smoking or ex", "Alcoholism or ex", "CAD/HF/Heart Disease", "Dyslipidemia", "AMI", and "Stroke", some patients could not be considered.

Features	N = 166[1]
Middle Ages	**66**
Sex	
Female	92 (55%)
Male	74 (45%)
Location	
Belo Horizonte	46 (28%)
Others	120 (72%)
Smoking or ex	
NO	63 (37%)
YES	50 (30%)
NO INFORMATION	53 (33%)
Alcoholism or ex	
NO	64 (38%)
YES	43 (26%)
NO INFORMATION	59 (36%)
Obesity	
NO	145 (87%)
YES	21 (13%)
CAD/HF/Heart Disease	
NO	89 (54%)
YES	76 (45%)
NO INFORMATION	1 (1%)
CRD/CKF	
NO	117 (70%)
YES	46 (28%)
NO INFORMATION	3 (2%)
Dyslipidemia	
NO	94 (56%)
YES	71 (43%)
NO INFORMATION	1 (1%)
DM	
NO	98 (59%)
YES	68 (41%)
SAH	
NO	23 (14%)
YES	143 (86%)
AMI	
NO	58 (35%)
YES	19 (11%)
NO INFORMATION	89 (54%)
STROKE	
NO	66 (40%)
YES	11 (6%)
NO INFORMATION	89 (54%)
Transplanted	
NO	164 (99%)
YES	2 (1%)

Table 1 - Epidemiological and clinical data of patients in the cardiovascular care line of a university outpatient clinic in Minas Gerais

DISCUSSION

However, considering only patients with CRD/CKF, who are the focus of this study, the analysis changes, as shown in Table 2. It is important to highlight that of the 166 participants, 3 had incomplete records for the characterization of renal health, resulting in a final sample of 163 participants for this specific analysis. 46 participants were included in the group of people with nephropathies, and the average age found was 68 years, with a standard deviation of 13 years. It was observed that 26 (57%) patients were female, while 20 (43%) patients were male.

Most patients 38 (83%) are not allocated in Belo Horizonte; 18 (39%) are smokers; 12 (26%) are alcoholics; 4 (8%) are obese; 22 (48%) have a history of previous heart disease; 22 (48%) have dyslipidemia; 21 (46%) are diabetic; 41 (89%) are hypertensive; 5 (11%) have a history of acute myocardial infarction; 4 (9%) have a history of stroke and 2 (4%) patients are kidney transplant recipients. Some records were excluded due to incomplete and inconsistent data in the medical records for the variables “Smoking or ex”, “Alcoholism or ex”, “Obesity”, “AMI”, and “Stroke”.

Features	CRD/CKF NO N = 1171	YES N = 461
Ages	**62 (14)**	**68 (13)**
Sex		
Female	65 (56%)	26 (57%)
Male	52 (44%)	20 (43%)
Location		
Belo Horizonte	37 (32%)	8 (17%)
Others	80 (68%)	38 (83%)
Smoking or ex		
NO	48 (41%)	13 (28%)
YES	32 (27%)	18 (39%)
NO INFORMATION	37 (32%)	15 (33%)
Alcoholism or ex		
NO	46 (39%)	18 (39%)
YES	29 (25%)	12 (26%)
NO INFORMATION	42 (36%)	16 (35%)
Obesity		
NO	99 (84%)	41 (90%)
YES	17 (15%)	4 (8%)
NO INFORMATION	1 (1%)	1 (2%)
CAD/HF/Heart Disease		
NO	65 (56%)	24 (52%)
YES	52 (44%)	22 (48%)
Dyslipidemia		
NO	70 (60%)	24 (52%)
YES	47 (40%)	22 (48%)
DM		
NO	69 (59%)	25 (54%)
YES	48 (41%)	21 (46%)
SAH		
NO	17 (15%)	5 (11%)
YES	100 (85%)	41 (89%)
AMI		
NO	38 (32%)	19 (41%)
YES	14 (12%)	5 (11%)
NO INFORMATION	65 (56%)	22 (48%)
STROKE		
NO	46 (39%)	20 (43%)
YES	6 (5%)	4 (9%)
NO INFORMATION	65 (56%)	22 (48%)
Transplanted		
NO	117 (100%)	44 (96%)
YES	0 (0%)	2 (4%)

Table 2 - Epidemiological and clinical data of patients in the cardiovascular care line diagnosed with CRD/CKF at a university outpatient clinic in Minas Gerais.

Laboratory profile of patients

When considering all patients included in the study compared to those with CRD/CKF, Table 3 shows that creatinine had a median of 0.91 for the non-CRD/CKF group and 1.40 for those with nephropathy. Likewise, the variable Urea (mg/dL) had a median value of 33 for non-CRD/CKF and 59 for those with the morbidity. In addition, the mean glomerular filtration rate in ml/min was 76 (63, 91) versus 43 (35, 56); the mean proteinuria in mg/24h was 278 (75, 2.173). For DRC/IRC patients versus 919 (308, 1,044).

		CRD/CKF		
Features	**Overall N = 1631**	**NO N = 1171**	**YES N = 461**	**Value p2**
Creatinine - mg/dL	1.01 (0.84, 1.30)	0.91 (0.79, 1.07)	1.40 (1.20, 1.82)	<0.001
GFR (glomerular filtration rate) - ml/min	69 (50, 82)	76 (63, 91)	43 (35, 56)	<0.001
Urea - mg/dL	40 (31, 60)	33 (29, 44)	59 (42, 66)	<0.001
Proteinuria - mg/24h	431 (164, 1,044)	278 (75, 2,173)	919 (308, 1,044)	0.4
Protein in urine - quantitative analysis by cross-linking (+)				>0.9
(1+)	2 (50%)	1 (50%)	1 (50%)	
(2+)	1 (25%)	1 (50%)	0 (0%)	
(3+)	1 (25%)	0 (0%)	1 (50%)	

[1]Median (Q1, Q3); n (%)
[2]Wilcoxon rank sum test; Chi-square test of independence; Fisher's exact test; Wilcoxon rank sum exact test
Table 3 - Laboratory data on renal function of patients in the cardiovascular care line comparing patients without a diagnosis of CRD/CKF with patients who have this pathology from a university outpatient clinic in Minas Gerais.

Thus, at a significance level of 0.05, sample evidence was found that leads us to conclude that the medians of the Creatinine, GFR, and Urea (mg/dL) groups present significant differences between their medians in relation to the CRD/CKF group. Figure 1 illustrates the difference between the medians of the groups.

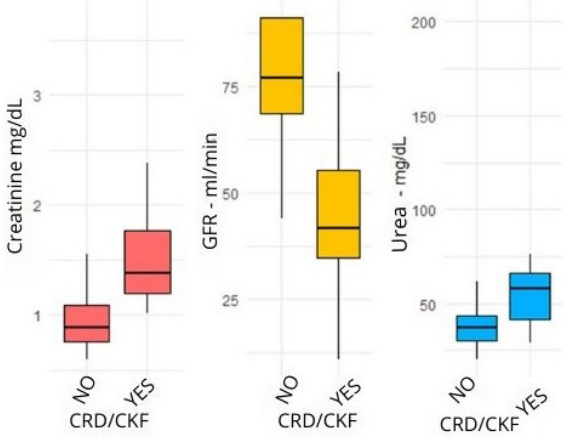

Figure 1: Box-plot of Creatinine, GFR, and Urea variables by CRD/CKF

Other data

From the data collected on patients' medication use, a "Word Cloud" was created with the information contained in this topic, and we found the medications most used by patients include Losartan potassium, Acetylsalicylic Acid (ASA), Simvastatin, Metformin Hydrochloride, Enalapril Maleate, Amlodipine Besylate, Carvedilol, Hydrochlorothiazide, and Furosemide.

DISCUSSION

The analysis of the collected data showed information on the epidemiological, clinical, and laboratory profile of patients with nephropathies included in the cardiovascular careline, reinforcing the close relationship between cardiovascular diseases and kidney diseases, especially Chronic Kidney Disease (CKD). The high rate of chronic non-communicable conditions, such as Systemic Arterial Hypertension (SAH) and Diabetes Mellitus (DM), among the patients in the study reflects the well-documented association in the literature between these factors and the progression of kidney disease. Studies on similar epidemiological profiles found that the underlying diseases, SAH and DM, are commonly identified as the primary diagnoses and are responsible for approximately half of the pathologies of patients undergoing dialysis treatment in Brazil5. In Brazil, the leading cause of CKD is hypertension, the second is DM, followed by chronic glomerulonephritis6. The pathogenesis and preferred treatment of hypertension vary with the type of kidney disease and its duration. Patients with acute glomerular disease tend to have expanded and edematous volume due to sodium retention. As a result, blood pressure elevation is primarily due to fluid overload, as evidenced by suppression of the renin-angiotensin-aldosterone system (RAAS) and increased release of atrial natriuretic peptide (ANP). Although these changes are more prominent with severe disease, the incidence of hypertension is increased even in patients with normal serum creatinine concentrations. Both a familial predisposition to hypertension and subclinical volume expansion are believed to be important in this scenario7.

DM is also a well-established risk factor for CKD in the literature. Patients with kidney disease and DM are at high risk of CKD progression and cardiovascular disease. The prevalence of CKD in patients with T2DM is currently around 40% and continues to grow. These patients have a significant impact on health resource utilization and care costs[8]. Management of CKD in patients with DM aims to preserve renal function to reduce the risk of end-stage renal disease, cardiovascular events, and mortality. In addition, another important cardiovascular risk factor analyzed in the context of CKD is dyslipidemia, which stands out as predominant in the population studied. The prevalence of dyslipidemia is related to the uremic condition, which leads to several changes in the quantity and quality of circulating lipoproteins[9]. Typically, dyslipidemia in patients with CKD is characterized by low HDL-C and high triglyceride (TG) levels, as well as other compositional changes in lipoproteins. Importantly, LDL and total cholesterol levels do not increase dramatically in patients with CKD; instead, a notable structural change occurs in LDL-C, which becomes more atherogenic than the other subfractions. Overall, such changes are thought to promote atherosclerosis, contributing to the high cardiovascular burden in patients with CKD[9].

The comparison between patients with and without kidney disease shows important differences. The average age of patients with CKD is higher than that of patients without the condition, which reinforces the idea that the disease is more prevalent in older people. The higher percentage of smokers and drinkers among patients with CKD also highlights the importance of these behaviors as risk factors. A positive relationship between tobacco and the development of CKD has also been observed in the literature. The concept of smoking as an intrinsic nephrotoxic factor is now becoming more generally accepted. A systematic review corroborates this assertion by finding that the risk of developing CKD decreases with time after smoking cessation or increases with cumulative exposure, suggesting a dose-dependence of the cause-and-effect relationship[10]. Regarding alcoholism, the literature on the impact of alcohol consumption on the progression of CKD has shown varied results. However, current

studies indicate that excessive alcohol consumption is related to the onset of albuminuria, which contributes to the worsening of renal function[11].

CKD is defined as a glomerular filtration rate (GFR) <60 mL/min/1.73 m2, or with changes in a marker of kidney damage (e.g., albuminuria) or with structural/anatomical changes, even with a GFR equal to or greater than 60 mL/min/1.73 m2, for a period longer than three months[12]. By estimating GFR using previously validated formulas, it is possible to assess the presence of CKD and its current stage, allowing a treatment plan to be established with the aim of preventing the progression of the disease to more advanced stages. It was observed that this topic was a limitation of the study, since many medical records did not present the results of the tests necessary to perform this stratification, which made it difficult to analyze with more reliable data. Furthermore, this study has some limitations, such as its retrospective design and the fact that it was conducted in a single reference center, which may limit the generalization of the results to other populations. Furthermore, subjective data, such as adherence to treatment and socioeconomic factors, were not explored, but could have a relevant impact on the results. The research also did not include a long-term assessment of the progression of CKD cases, which could provide a more complete view of the prognosis of these patients.

CONCLUSION

It is noteworthy that in the present study, data were collected on the individuals' lifestyle, such as smoking and alcohol consumption, which are risk factors for the development of nephropathies from cardiovascular damage, due to the strong relationship between the two systems. In addition, the patients' previous pathological history, such as AMI and Stroke, increases the chances of cardiovascular damage, and consequently of nephropathies. Therefore, the inclusion of a nephrology care line would be essential for the systematic monitoring of patients with nephropathies and to ensure effective intervention from prevention to treatment and rehabilitation, since the cardiovascular care line already plays this role in the outpatient clinic studied.

Declaration of interests

There are no conflicts of interest with the topic covered in the article or with the products or items mentioned.

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REFERENCES

1. Liu, M; et al. "Cardiovascular disease and its relationship with chronic kidney disease." European review for medical and pharmacological sciences vol. 18,19 (2014): 2918-26.
2. Bastos MG, Bregman R, Kirsztajn GM. Doença renal crônica: frequente e grave, mas também prevenível e tratável. Rev Assoc Med Bras [Internet]. 2010;56(2):248–53. Disponível em: https://doi.org/10.1590/S0104-42302010000200028
3. Marinho AWGB, Penha A da P, Silva MT, Galvão TF. Prevalência de doença renal crônica em adultos no Brasil: revisão sistemática da literatura. Cad Saúde Coletiva. 2017;25(3):379-388. doi:10.1590/1414-462x201700030134
4. Kirsztajn GM; et al. Estimativa da taxa de filtração glomerular na prática clínica: posicionamento consensual da Sociedade Brasileira de Nefrologia (SBN) e Sociedade Brasileira de Patologia Clínica e Medicina Laboratorial (SBPC/ML). Published online 2024. doi:10.1590/2175
5. Mesquita Batista CM, Lopes Moreira RS, Luís J, et al. Artigo Original Perfil epidemiológico dos pacientes em lista de espera para o transplante renal Epidemiological profile of patients on the waiting list for renal transplantation. 2017;30(3):280-286. doi:10.1590/1982
6. Stein Tt. Universidade Estadual Do Centro-Oeste-Unicentro Departamento De Enfermagem Setor De Ciências Da Saúde Tayná Traspadini Stein. 2022.
7. Mann JF. Overview of Hypertension in Acute and Chronic Kidney Disease.; 2024.
8. Shubrook JH, Neumiller JJ, Wright E. Management of chronic kidney disease in type 2 diabetes: screening, diagnosis, and treatment goals, and recommendations. Postgrad Med. 2022;134(4):376-387. doi:10.1080/00325481.2021.2009726
9. Suh SH, Kim SW. Dyslipidemia in Patients with Chronic Kidney Disease: An Updated Overview. Diabetes Metab J. 2023;47(5):612-629. doi:10.4093/dmj.2023.0067
10. Chapman JR, O'Connell PJ, Nankivell BJ. Chronic renal allograft dysfunction. J Am Soc Nephrol. 2005;16(10):3015-3026. doi:10.1681/ASN.2005050463
11. Aguiar LK de, Prado RR, Gazzinelli A, Malta DC. Fatores associados à doença renal crônica: inquérito epidemiológico da Pesquisa Nacional de Saúde. Rev Bras Epidemiol [Internet]. 2020;23:e200044. https://doi.org/10.1590/1980-549720200044
12. Ministério da Saúde. Doenças Cardiovasculares: Principal Causa de Morte Não Pode Ser Prevenida. 2022. https://www.gov.br/pt-br/noticias/saude-e-vigilancia-sanitaria/2022/09/doencas-cardiovasculares-principal-causa-de-morte-no-mundo-pode-ser-pr…2/