

ORIGINAL ARTICLE

## Epidemiological profile of patients with type 2 diabetes mellitus treated at a teaching-assistance unit in Northeast Brazil

Perfil Epidemiológico dos pacientes com diabetes tipo 2 atendidos em uma unidade docente-assistencial no nordeste brasileiro

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### KEYWORDS

Epidemiology  
Health Profile  
Diabetes Mellitus

### PALAVRAS-CHAVE

Epidemiologia  
Perfil de Saúde  
Diabetes Mellitus

### ABSTRACT

**Objective:** To determine the epidemiological profile of patients with type 2 diabetes mellitus in a teaching unit. **Method:** In this observational, cross-sectional, and descriptive study, data from the medical records of consultations conducted between February 2020 and May 2022 at an endocrinology outpatient clinic in a teaching unit in Northeast Brazil were evaluated. A descriptive analysis of the data was performed, with percentage values, medians, and interquartile ranges (IQRs) reported. **Result:** Data were collected from the medical records of 118 patients, and the medical records of 95 patients were used for statistical analysis after the exclusion of records with insufficient data. Seventy patients (73.6%) were female, with a median age of 57 years (IQR 51.5-65), a median body mass index (BMI) of 28.9 kg/m<sup>2</sup> (IQR 25.7-33.1) and a median age at diagnosis of 47.5 years (IQR 38-55). The median glycated hemoglobin (HbA1c) and fasting blood glucose levels during follow-up were 7.6% (IQR 6.6-9.7) and 132.8 mg/dL (IQR 113.5-201.7), respectively, and only 36.8% (n=35) of patients were within their HbA1C therapeutic target range. Approximately 73.6% (n=70) of the patients used statins, but only 18 (18.9%) had LDL-c within their therapeutic target range. Twenty-seven patients (28.4%) had kidney dysfunction, either albuminuria or a glomerular filtration rate (GFR) reduction, and 6 of them (22.2%) did not use any nephroprotective medication. Fewer than half of the patients underwent fundoscopy, and 32.5% of them showed some degree of retinopathy. Neuropathy was present in 33 patients (34.7%), with 3 patients (3.16%) presenting with amputations. **Conclusion:** Adequate glycemic control was achieved in just under half of the patients, and a relevant proportion of patients experienced microvascular complications. Strategies for the early detection of complications and more aggressive treatment of the disease and its comorbidities are necessary.

### RESUMO

**Objetivo:** Traçar o perfil epidemiológico de pacientes com Diabetes Tipo 2 de uma unidade docente-assistencial. **Método:** Estudo observacional, transversal e descritivo com dados de prontuário de consultas realizadas entre fevereiro de 2020 e maio de 2022 no ambulatório de endocrinologia de uma unidade docente-assistencial no nordeste brasileiro. Procedeu-se à análise descritiva dos dados, sendo informados

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os valores percentuais, mediana e intervalo interquartil. **Resultado:** De um total de 118 prontuários, foram analisados 95 pacientes após a exclusão daqueles com dados insuficientes. Destes, 73,6% (n=70) são do sexo feminino, com idade mediana de 57 anos (IIQ 51,5-65), mediana do IMC 28,9kg/m<sup>2</sup> (IIQ 25,7-33,1) e idade ao diagnóstico de 47,5 anos (IIQ 38-55). As medianas da última HbA1C e glicemia em jejum foram 7,6% (IIQ 6,6-9,7) e 132,8 mg/dL (IIQ 113,5- 201,7), e apenas 36,8% (n=35) foram classificados como dentro da meta pela HbA1C. Cerca de 73,6% (n=70) dos pacientes utilizavam estatinas, mas somente 18 (18,9%) tinham LDL-c dentro da meta terapêutica. Vinte e sete pacientes (28,4%) apresentavam disfunção renal, seja albuminúria e/ou redução da TFG, e 6 (22,2%) não usavam nenhuma medicação nefroprotetora. Menos da metade dos pacientes realizou fundoscopia, e, destes, 32,5% apresentavam algum grau de retinopatia. Neuropatia está presente em 33 pacientes (34,7%), com 3 pacientes (3,16%) apresentando amputações. **Conclusão:** O controle glicêmico adequado foi obtido em pouco menos da metade dos pacientes e uma proporção relevante apresenta complicações microvasculares. Estratégias de detecção precoce de complicações e de tratamento mais agressivo da doença e suas comorbidades são necessárias.

## INTRODUCTION

Type 2 diabetes mellitus (T2DM) is characterized by hyperglycemia, insulin resistance, and a progressive nonautoimmune decrease in insulin secretion<sup>1</sup>. In 2021, Brazil was ranked 6<sup>th</sup> among countries with the most diabetes mellitus (DM) patients<sup>2</sup>, and data from Vigitel for 2023 indicate that the prevalence of the disease in adults in Brazil is approximately 10.2%<sup>3</sup>. Studies in general outpatient clinics show that although a wide variety of health problems are encountered, patients with very frequent demands, such as those with T2DM, are responsible for a large number of clinic visits in the population<sup>4</sup>. Therefore, the importance of better characterizing these demands is directly linked to defining the user profiles of patients with the most prevalent and lethal diseases. By defining these profiles, a list of priorities and intervention alternatives can be created for these demands<sup>4</sup>.

T2DM, and even prediabetes, results in several patient health complications, mainly diabetes kidney disease, diabetic retinopathy and neuropathy, and cardiovascular diseases<sup>5</sup>. Such complications result in a decrease in quality of life and limitations in people of working age, and T2DM is currently the leading cause of visual loss in the economically active population in the United States<sup>6</sup> and the second leading cause of renal replacement therapy in Brazil<sup>7</sup>. In addition, cardiovascular diseases are the leading causes of early mortality in diabetic patients; in 2015, cardiovascular diseases were responsible for 4 million deaths in diabetic patients aged between 20 and 79 years, accounting for 10.7% of all deaths worldwide<sup>8</sup>.

To control and prevent the progression of diabetes and the emergence of its complications, the Brazilian Society of Diabetes (SBD) and the American Diabetes Association have established therapeutic goals based on blood glucose control and the clinical condition of the patient. The laboratory parameter targets used are a fasting glucose level < 130 mg/dL and a glycyated hemoglobin (HbA1c) level < 7%<sup>9,10</sup>. Achieving these goals can significantly reduce micro- and macrovascular complications, especially when achieved early in the course of the disease. Thus, to prevent these complications, appropriate and personalized treatment must be implemented in a timely manner to avoid therapeutic inertia<sup>11</sup>.

The main objective of this study was to trace the epidemiological profile of patients with T2DM treated at the endocrinology outpatient clinic of a private higher education institution polyclinic located in Northeast Brazil to identify gaps and difficulties in care to promote the optimization of care for these individuals.

## METHODS

This observational, cross-sectional, and descriptive study was conducted at a private higher education institution polyclinic located in Northeast Brazil. Data from the outpatient records of consultations held between February 2020 and May 2022 of patients with T2DM treated at the endocrinology outpatient clinic were evaluated. All patients with T2DM aged 18 years or older in regular follow-up were included. Patients with type 1 diabetes and those whose medical records regarding clinical and laboratory information were insufficient for analysis were excluded. The sample size was determined by the number of patients who were followed up at the teaching-care unit. The study was approved by the Research Ethics Committee of the institution under opinion number 5,548,247 (CAAE 61014122.0.0000.5641) and was performed according to CNS Resolution 466/2012.

Demographic, clinical, and laboratory data, such as sex, age, body mass index BMI, risk factors, family history, other associated chronic diseases, age at diagnosis of T2DM, complications resulting from T2DM, treatment regimen, last HbA1c, fasting glucose, lipid profile, urinary albumin/creatinine ratio, and serum creatinine, were stored in the collection form. Patients were classified according to whether they had reached their glycemic goal according to the last recorded HbA1c values, as recommended by the SBD<sup>10</sup> and the American Diabetes Association<sup>9</sup>: patients younger than 60 years of age and without debilitating comorbidities have a target HbA1c < 7%; elderly patients with nonlimiting comorbidities have a target HbA1c < 7.5%; and frail patients with severe comorbidities, limited life expectancy, and/or cognitive changes have more permissive goals, with a target HbA1c < 8.0%. Medical records without measured HbA1c levels were excluded from the two subgroups.

Statistical analysis was conducted using IBM SPSS Statistics Client version 21.0 Multilingual® software, with a confidence level of 95% ( $p < 0.05$ ). The normality of the data distribution was assessed using the Shapiro–Wilk test. Comparisons between categorical variables were performed using the chi-square test, and nonparametric variables were compared using the Mann–Whitney U test.

## RESULTS

Data were collected from the medical records of 118 patients who attended consultations between February 2020 and May 2022. After screening, the medical records of 95 patients were used for statistical analysis, and those of 23 patients were excluded because of insufficient clinical and laboratory data. The medical records of nine patients that did not include measured HbA1c levels were considered only for the general population.

Among the 95 patients whose medical records were analyzed, 73.6% ( $n=70$ ) were female, with a median age of 57 years (interquartile range [IQR] 51.5–65) and a median BMI of 28.9 years (IQR 25.7–33.1), and the median age at diagnosis was 47.5 years (IQR 38–55). The two main comorbidities reported were systemic arterial hypertension (SAH) and dyslipidemia. Other diseases and significant cardiovascular events included acute myocardial infarction (AMI), cerebrovascular accident (CVA), and peripheral arterial disease (PAOD). Other demographic data are presented in Table 1.

The median HbA1c level at baseline was 7.8% (IQR 6.6–9.7), whereas the median HbA1c level at the time of the last HbA1c measurement was 7.6% (IQR 6.6–9.7). For 48 patients (50.5%), only HbA1c data from the beginning of follow-up were available (i.e., no data after the procedures were instituted during medical consultation were available), and no HbA1c values were recorded in the medical records of 9 patients. Following the target established by the SBD

**Table 1** – Clinical and demographic characteristics of the participants.

	Total	Inside the glycemic target range	Outside the glycemic target range	p ( $\chi^2$ )
<b>Total participants</b>	95	35 (36.8%)	51 (53.6%)	NA
<b>HbA1c%</b>	7.6 (IQR 6.6–9.6)	6.4 (IQR 5.7–6.7)	8.9 (IQR 7.8–10.3)	<0.0001 <sup>f</sup>
<b>Female sex</b>	70 (73.6%)	28 (80.0%)	36 (70.5%)	0.33
<b>Age in years</b>	57 (IQR 51.5–65)	60 (IQR 52.5–67)	54 (IQR 51–62.5)	0.08
<b>Age &lt; 60 years</b>	57 (60.0%)	16 (45.7%)	36 (7.5%)	0.02 <sup>f</sup>
<b>Age at diagnosis &lt; 35 years</b>	15 (15.7%)	4 (11.4%)	10 (19.6%)	0.29
<b>BMI kg/m<sup>2</sup></b>	28.9 (IQR 25.7–33.1)	28.2 (IQR 2.9–32.5)	29.9 (IQR 25.1–33.5)	0.70 <sup>f</sup>
<b>Obesity</b>	39 (41.0%)	13 (37.1%)	24 (47.0%)	0.33
<b>Physical activity</b>	27 (28.4%)	12 (34.2%)	14 (27.4%)	0.48
<b>Habits (current or previous)</b>				
Smoking	11 (11.5%)	4 (11.4%)	7 (13.7%)	0.94
Alcoholism	15 (15.7%)	2 (5.7%)	13 (25.4%)	0.09
<b>Comorbidities</b>				
Hypertension	69 (72.6%)	25 (71.4%)	38 (74.5%)	0.64
Dyslipidemia	52 (54.7%)	22 (62.8%)	28 (54.9%)	0.46
Heart failure	9 (9.4%)	5 (14.2%)	3 (5.8%)	0.15
<b>Cardiovascular events</b>				
Acute myocardial infarction	8 (8.4%)	5 (14.2%)	3 (5.8%)	
Stroke	7 (7.3%)	2 (5.7%)	5 (9.8%)	0.41*
Peripheral arterial disease	3 (3.1%)	0	3 (5.8%)	
<b>Medications</b>				
Oral antidiabetic only	51 (53.7%)	24 (68.5%)	21 (41.2%)	0.005 <sup>#</sup>
Insulin with or without oral antidiabetic drugs	40 (42.1%)	8 (22.8%)	29 (56.9%)	
No use of medication	4 (4.2%)	3 (8.7%)	1 (1.9%)	

Nine patients did not have glycated hemoglobin information in their medical records and were not classified according to their glycemic status. HbA1C: glycated hemoglobin. BMI: body mass index. NA: not evaluated.  $\chi^2$ : chi-square test. <sup>f</sup>Mann–Whitney test. \*Comparison between having any of the three cardiovascular events <sup>#</sup>Comparison among the three groups.

for HbA1c, 36.8% (n = 35) of patients were classified as being within their glycemic target range. The median fasting glucose level recorded in the medical records was 150.2 mg/dL (IQR 112.5-199.5), and the median glucose level recorded in the medical records was 132.8 mg/dL (IQR 113.5-201.7). Among patients classified as being within their HbA1c target range, there was a lower proportion of patients younger than 60 years of age and lower insulin use than among patients classified as being outside their HbA1c target (Table 1).

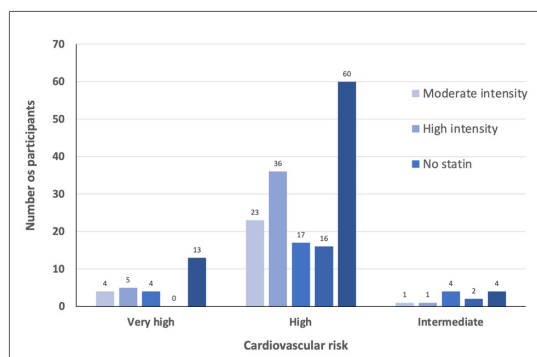
Regarding the cardiovascular risk of T2DM patients, 13.7% (n=13) were classified as having very high risk, 80.0% (n=76) as having high risk, and 6.3% (n=6) as having intermediate risk. In the analysis of the lipid profile, 87 medical records contained lipid data, with a median total cholesterol of 184 mg/dL (IQR 150-226), LDL-cholesterol (LDL-c) of 103.7 mg/dL (IQR 76.5-142, 9), HDL-cholesterol (HDL-c) of 46 mg/dL (IQR 39-55) and triglycerides of 140 mg/dL (IQR 99.5-142.9). Only 18 patients (18.9%) had LDL-c values within the therapeutic target range, and all 13 patients classified as having very high cardiovascular risk had LDL-c levels above the target. Approximately 73.6% (n=70) of the patients used statins, and the distribution of statin use according to cardiovascular risk and lipid-lowering therapy intensity is shown in Figure 1.

The last blood pressure measurement of the patients was also classified as within the target range in 41.7% (n = 38) of the patients. The most commonly used classes of antihypertensive drugs were angiotensin receptor blockers (ARBs) (63.2%; n=60), thiazide diuretics (35.8%; n=34), calcium channel blockers (CCBs) (29.5%; n=28), beta-blockers (24.2%; n=23), spironolactone (9.5%; n=9) and angiotensin-converting enzyme inhibitors (ACEIs) (6.3%; n=6).

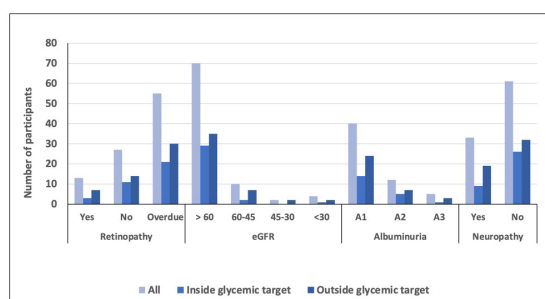
Regarding renal disease associated with diabetes, albuminuria was detected in 50 medical records, with a median urinary albumin level of 12 mg/g (IQR 6.9-31.5). A total of 82.4% (n=70) had a glomerular filtration rate (GFR)>60 mL/min/m<sup>2</sup> (Figure 2). Twenty-seven patients (28.4%) had some degree of renal dysfunction, either albuminuria or a reduced GFR, with no difference between the groups regarding glycemic control (p=0.77). Of these 27 patients, 6 (22.2%) did not use any class of nephroprotective medication, such as ACEIs, angiotensin 2 receptor blockers, or SGLT2 inhibitors. Regarding other microvascular complications, the medical records of 40 patients included retinopathy investigation data, 27 (67.5%) of whom experienced no changes, while the remaining patients had proliferative retinopathy (7.5%; n=3), macular edema (2.5%; n=1), visual loss (7.5%, n=3) and retinopathy present but without description in the report (20.0%, n=8). Neuropathy was present in 33 patients (34.7%), with 3 patients (3.16%) presenting with amputations. There was no difference between the groups regarding retinopathy (p=0.27) or neuropathy (p=0.57). The distribution of the prevalence of microvascular complications in relation to glycemic control is shown in Figure 2.

## DISCUSSION

The present study showed that, even in a specialized endocrinology outpatient clinic of a teaching-care unit,



**Figure 1** – Distribution of the use of different potencies of statin therapy according to cardiovascular risk and LDL-c target. LDL-c: LDL-cholesterol.



**Figure 2** – Distribution of microvascular complications according to glycemic control. GFR: glomerular filtration rate expressed in mL/min/1.73 m<sup>2</sup>. Delayed: patients without an evaluation of diabetic retinopathy in the last year. A1: albuminuria < 30 mg/g creatinine. A2: Albuminuria between 30 and 300 mg/g creatinine. A3: Albuminuria > 300 mg/g creatinine.

slightly more than half of the patients were outside the target range of good glycemic control recommended by different national and international societies. Despite the modest improvement in the overall median HbA1c and fasting glucose levels, most patients did not reach the goals established by the SBD and the American Diabetes Association, which recommend values below 7.0% and 130 mg/dL, respectively<sup>9,10</sup>. In addition, almost half of the medical records did not have a record of HbA1c levels after the initial medical procedures, and among those that had such data recorded, only 38.2% of the patients had reached their HbA1c goal at the last exam. This finding raises concerns regarding continuous monitoring and the efficacy of the therapeutic approach because the control of these laboratory parameters is essential for preventing the progression of the disease and its micro- and macrovascular complications, and good early control of the disease has a legacy effect on the prevention of future complications<sup>10-12</sup>.

The intensification of drug treatment in patients who do not reach their therapeutic goals cannot and should not be postponed<sup>11</sup>. The incorporation of highly effective agents that reduce cardiovascular and renal risk, such as GLP-1 analogs and SGLT2 inhibitors, should be considered, with special consideration given to the particularities of the

patient's health status and comorbidities of the patient<sup>11,13</sup>. Despite the benefits of these drug classes, the low rate of use of these medications in the management of patients is worsened by the economic fragility of a large part of the population, since these medications are not widely offered free of charge by the Unified Health System. In a study conducted in Minas Gerais, socioeconomic vulnerability was generally associated with several difficulties in the diagnosis and treatment of T2DM, as socioeconomic concerns can limit the physician's treatment choices, which ultimately limits the optimization of the therapeutic approach<sup>14</sup>.

The financial cost of treating diabetes is highly burdensome for patients and their families as well as for countries and health care systems. The expenses of diabetic patients are two to three times greater than those of patients without this disease. Outpatient expenses associated with diabetes cost the Unified Health System an average of US\$ 2,108 per patient. In Brazil, approximately US\$ 22 billion was spent in 2015 alone on diabetes-related costs, with a projection of an increase to US\$ 29 billion in 2040<sup>8</sup>.

T2DM is associated with microvascular complications as the disease progresses with time and severity. Diabetic retinopathy is the leading cause of preventable blindness in people of working age<sup>15</sup>. In the present study, the low rate of periodic ophthalmological examinations may also reflect the difficulty patients have in accessing a specialized consultation, even within a teaching-care polyclinic. National data obtained through triangulation among information obtained by the National Health Survey, National Program for the Improvement of Access and Quality of Primary Care, and Popular Pharmacy Program showed that fundoscopy is performed in only approximately 40% of patients with diabetes, with wide regional variation, and that fundoscopy is less common in Northeast Brazil<sup>16</sup>. In addition, only 67.7% of the population reported regular visits to the health service for diabetes monitoring<sup>16</sup>. Factors such as the waiting list, difficulty commuting to the place of care, and dependence of the patient on the care of family members are some of the main limitations that patients face in seeking treatment for their morbidities<sup>17</sup>.

GFR and albuminuria are important parameters used to characterize kidney function and/or damage in patients with T2DM. Decreases in the GFR to  $< 45 \text{ mL/min/1.73 m}^2$  reflect a more significant reduction in renal function, with the need for dose adjustment of various hypoglycemic medications, and at levels  $< 30 \text{ mL/min/1.73 m}^2$ , certain commonly used oral antidiabetic drugs, such as metformin, should be discontinued<sup>11,13</sup>. In addition, medications aimed at promoting nephroprotection, such as ACEIs, angiotensin 2 receptor blockers, mineralocorticoid receptor antagonists, and SGLT2 inhibitors, should be used to delay the progression of kidney injury<sup>18</sup>. In the present study, 28.4% of patients had some degree of kidney injury, and 22.2% of these patients did not use any medication with nephroprotective potential, which may have accelerated the progression of kidney disease from diabetes to the possible need for dialysis therapy over the years.

In a study conducted in the Brazilian population, screening for kidney disease in patients with T2DM in

primary care was insufficient. In this study, a 41% prevalence of renal involvement was observed, and 61.2% of the patients used nephroprotective medications. However, only 21.9% of the patients had isolated albuminuria, and only 12.1% had their albumin/creatinine ratio measured<sup>19</sup>.

Approximately 35% of the study population was diagnosed with neuropathy. Comparatively, a study conducted in the interior of the state of Pernambuco reported a prevalence of diabetic neuropathy of 25.7% in patients with newly diagnosed diabetes<sup>20</sup>. There is a recommendation for screening for all microvascular complications at disease diagnosis because of its high prevalence<sup>8</sup>, but it is known that prediabetes also increases the risk of complications. A retrospective study conducted in Taiwan showed that patients with prediabetes have a hazard ratio of 1.26 for major adverse limb events (peripheral arterial disease and/or critical limb ischemia) with HbA1c elevations starting at 5.0%, values considered euglycemic<sup>21</sup>. The same study also demonstrated a hazard ratio of 1.46 for major cardiovascular events (cardiovascular mortality, nonfatal AMI, and nonfatal stroke) from HbA1c elevations starting at 5.5%<sup>21</sup>.

Another worrying finding regarding cardiovascular risk is the failure to control the lipid profile of patients, as only 18.9% of patients achieved LDL-c values within the expected target range and 26.3% were not using statins. Even more alarmingly, all patients with very high cardiovascular risk were outside their target range, and 30.8% of them were not even taking statins. Cardiovascular diseases are the leading causes of early mortality in diabetic patients; in 2015, 4 million deaths occurred in diabetic patients aged between 20 and 79 years, accounting for 10.7% of all deaths worldwide<sup>8</sup>.

Statins are the drug of choice for LDL-c reduction, and the discontinuation of these medications leads to the return of LDL-c to its original level. A Finnish study with patients with T2DM showed that at the end of follow-up, 41.9% of patients were not using statins and had LDL-c levels that were considered to be increasing or high and stable<sup>22</sup>. Similarly, 59% of patients with T2DM in a French cohort were outside their LDL-c target, with a lower prevalence in those receiving secondary prevention, i.e., those with very high cardiovascular risk<sup>23</sup>. The reason for not using statins was not retrieved in this study, and this was a limitation of the retrospective evaluation of medical records. The incidence of the main side effects of statins, myalgia and rhabdomyolysis, is low in safety studies during the blinding phase, but the frequency of side effect reports is much higher when participants know they are using the medication, clearly demonstrating a placebo effect<sup>24</sup>. Such statin intolerance is increasingly prevalent in populations that typically use popular online search engines to obtain information about used medications, including the Brazilian population, which, speculatively, could be one of the causes of the reduction in medication use<sup>25</sup>.

The present study was based on data recorded in medical records by medical students and their supervisors; therefore, one of the main limitations of this study is the subjectivity and inconsistency in the information recorded at each appointment. The lack of adequate reporting of information in medical records can present a challenge

for the staging of the disease and treatment of patients. The findings of the present study are in agreement with national data obtained from the triangulation of information from the Unified Health System<sup>16</sup> but may not reflect the reality of other regions of the national territory. Adequate collection and recording of information on risk factors, diagnostic parameters, and treatment is essential for developing personalized intervention strategies that reduce cardiovascular risks and improve the quality of life of patients with T2DM. The gaps identified in this study may serve as a basis for the standardization of medical record-keeping for all patients with diabetes, facilitating systematization and allowing data relevant to follow-up to be quickly located and updated. Such measures may promote the optimization of care for these patients, with better identification of the problems and particularities of the individual.

## CONCLUSION

Despite specialized monitoring, adequate glycemic control was achieved in just under half of the patients, with similar findings for the LDL-c goal for primary and secondary prevention of cardiovascular diseases. A significant proportion of patients have microvascular complications in addition to difficulty in accessing funduscopy, which requires specialized care. This reflects a lack of glycemic control, accessibility, and possible delay in referring primary care patients to a specialized outpatient clinic.

Strategies for the early detection of complications and more aggressive treatment of the disease and its comorbidities are necessary in primary care, with the expansion of the specialized services required according to demand, as well as guidance on referral to a specialized outpatient clinic at an opportune time. Thus, the prevention of disease complications and sequelae will be optimized, thereby avoiding healthcare costs, a loss of quality of life, and potential years of productive life.

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