RESEARCH ARTICLE

Prevalence of comorbidities associated with type 2 diabetes in patients attending a disease management program, Medellín, Colombia 2014 - 2019: a descriptive study. [version 1; peer review: 1 approved]

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Abstract

Background: Type 2 diabetes is a significant cause of morbidity and mortality worldwide. The prevalence has increased due to population aging, obesity, and longer life expectancy. Likewise, the development of complications related to the disease has contributed to a more significant disease burden and is the leading cause of death in people with diabetes.

Methods: A descriptive study of patients in a disease management program in Medellín, Colombia, from June 10, 2014 to March 30, 2019 was carried out. Sociodemographic and clinical data were collected from clinical records. Descriptive analysis was performed using absolute and relative frequencies and the prevalences presented by sex. The Chi-square test was used to calculate the prevalence ratio with a 95 % confidence interval, with a p-value < 0.05 being considered statistically significant.

Results: There were 1,018 patients with type 2 diabetes analyzed. The mean age was 66.0 years (SD: 12.93), the mean duration with diabetes was 12.9 years (SD:9.3), 55 % of patients were women, and 60.6 % of patients had no metabolic control. The main comorbidities were dyslipidemia in 67.9 %, obesity in 61.4 %, and hypertension in 59 % of patients. Differences were observed in the prevalence ratio (PR) of women versus men for dyslipidemia (PR 0.68 [CI: 0.52 - 0.89]), coronary artery disease (PR 0.41 [CI: 0.28 - 0.61]) and obesity (PR 0.23 [CI: 0.17 - 0.30]).

Conclusions: Patients with type 2 diabetes have a high prevalence of comorbidities: dyslipidemia, obesity and arterial hypertension. A lower

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1. Juana Patricia Sanchez Villamil
Universidad Antonio Nariño, Bucaramanga, Colombia	
Any reports and responses or comments on the article can be found at the end of the article.	

prevalence of comorbidities was observed in women than men for dyslipidemia, coronary heart disease, and obesity.

Keywords

Diabetes Mellitus Type 2, Prevalence, Comorbidity, Epidemiology, Colombia.

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Introduction

Type 2 diabetes is a critical cause of morbidity in the adult population.¹ Among the most significant risk factors for the increase of diabetes are obesity, an aging population, and a longer life expectancy.² However, the trend and magnitude of diabetes-related disease burden varies substantially across regions and countries. The global incidence, prevalence, death, and disability-adjusted life-years (DALYs) associated with diabetes has increased.³

At the time of type 2 diabetes diagnosis, patients already have some micro or macrovascular complication and an increased probability of dying from any complications developed.⁴ Although there are complications clearly associated with diabetes, information regarding their prevalence is scarce in low and middle-income countries. Therefore, the need for data that accounts for the magnitude of the disease is essential. In Colombia, information has been scarce in the last five years. Health systems need data on comorbidities to prevent or delay the development of disease complications.⁵

Given that the highest probability of dying from diabetes is given by the prevalence of comorbidities,⁶ we consider it essential to describe the patients most frequently attending an outpatient program for type 2 diabetes. There is an urgent need to delay complications of diabetes and to identify and quantify those most affected as part of the fundamental requirements for the formulation and strengthening of health policies.⁷ Valid and consistent estimates of the prevalence of diabetes and its comorbidities over time are needed to assess the effect of interventions and measure progress towards agreed health policy goals. This study aims to determine the prevalence of the main comorbidities related to type 2 diabetes in patients who attend a disease management program.

Methods

Clinical Integral de Diabetes (CLID) is a diabetes management healthcare team (endocrinologist, general practitioner, nutritionist, pharmaceutical chemist, professional nurse and psychologist) based in Medellín, Colombia. Patients with diabetes are referred to CLID by primary care providers. Once the patient is referred, an endocrinologist or a doctor of internal medicine conducts an initial assessment, following the clinical practice guidelines of Colombia and American Diabetes Association (ADA) standards of appropriate physical and laboratory exams and specialist referrals. Hemoglobin A1C (A1C) is monitored, lipids, urine microalbumin, thyroid stimulating hormone (TSH), and retinal exams are completed yearly or as often as required. At each visit, the patient receives medication instruction, recommendations on lifestyle changes, nutritional assessment, and general recommendations in the disease management.

The dietician and pharmaceutical chemist are the case managers responsible for following up on missed patient appointments and identifying the individual service and access needs of their panel of patients. The dietician and pharmacologist also communicate with the primary care physician regarding clinical care issues. The program operates as ambulatory care. CLID have a diabetes electronic management system software. The database contains demographic, health status, treatment, laboratory, and behavioral factors for each patient and collects this information over time. This study included data from June 10, 2014 to March 30, 2019 and was approved by the CES university ethics committee.

For the purpose of this analysis, we selected patients with type 2 diabetes, reducing the population size to 1,018. To avoid selection bias the entire population was used, atypical or missing data were reviewed and recovered from the clinical records. The information was reviewed by Uriel Palacios-Barahona. Patients were only excluded if they did not have HbA1c, clinical and sociodemographic variable records.

Demographic variables included sex, age, educational level (primary, secondary, university), marital status, and type and regime of social security system affiliation. Clinical variables were measured dichotomously (yes or no): hypertension, obesity (Body Mass Index, $\text{kg/m}^2 \geq 30$), dyslipidemia, retinopathy, nephropathy, neuropathy, amputation, peripheral arterial disease (PAD), coronary heart disease, and cerebrovascular disease (CVD). HbA1c is a laboratory value that indicates glycemic control over a two-to-three-month period. Values less than 7 % are considered optimal. The variables were measured when the patient entered the program.⁸

Continuous variables were presented as mean $\pm$ standard deviation (SD). Categorical variables are shown as numbers (valid percentage). An exploratory analysis of the prevalence according to sex was carried out, since for diabetes there are differences by sex in comorbidities and complications. An overall crude prevalence ratio (PR) was measured using the Chi-square test with a 95 % confidence interval (CI95 %). A Statistical significance threshold was considered using a p-value < 0.05 . The analysis was performed with Stata 12 software,⁹ licensed by CES University. Informed consent was obtained from all patients following clinical research standards in Colombia. The study protocol was reviewed and approved by the Institutional Review Board of CES University (Project number 734/2017).

Results

There were 1,018 patients with type 2 diabetes; the mean age was 66 ± 12.93 (median: 66.4 [min: 21.2 - max: 99.4]), mean HbA1c on admission was 7.8 ± 1.86 (median: 7.3 [min: 4.3 - max: 17.1]), mean years with diabetes: 12.7 ± 9.3 (median: 10.3 [min: 0.4 - max: 56.7]); 25.6 % of the patients had basic primary education, 53.4 % were married. At the time of entry into the program, 60.6 % of the patients did not have metabolic control ($\text{HbA1c} \geq 7\%$) (Table 1).

The main comorbidities associated with diabetes were dyslipidemia (67.9 %), obesity 61.4 %, and arterial hypertension (59 %). When comparing women versus men, a prevalence ratio (PR) of 0.68 (CI: 0.52-0.89) was observed for dyslipidemia, 0.41 (CI: 0.28-0.61) for coronary disease and 0.23 (CI: 0.17-0.30) for obesity of (Table 2).

Discussion

This study describes the prevalence of the main comorbidities and complications associated with type 2 diabetes in a population of patients attending a disease management program. This description contributes to updating the implications of the disease upon the healthcare system. Furthermore, this information contributes to health risk management activities and prioritizing health policies in Colombia.

The main comorbidities were dyslipidemia, obesity and hypertension. These findings are consistent with previous studies in Colombia;^{10,11} however, obesity prevalence has increased (previous studies were 35 %) in people with diabetes.¹² This finding can be a warning of how the prevalence of risk factors is changing. National studies have shown an increase in the prevalence of obesity (body mass index of 13.9 % in 2005 and 16.4 % in 2010 [difference in prevalence = 2.7 %; CI95 %: 1.9-3.4 %]).¹³

Likewise, a high prevalence of coronary disease and microvascular disease stands out, consistent with previous studies that have observed a high disease burden in these patients.¹⁰ These are factors that contribute to mortality from diabetes. Tancredi et al.¹⁴ analyzed the excess mortality of people with type 2 diabetes in a cohort with 4.5-year follow-up, observing that the rate of mortality from cardiovascular disease was 7.9 % among the patients compared to 6.1 % between controls (adjusted hazard ratio, 1.14, CI 1.13-1.15). Excess all-cause and cardiovascular disease mortality risk increased

Table 1. Sociodemographic and clinical characteristics of patients, disease management program, 2014-2019.

Variables	Women (n = 563) %	Men (n = 455) %	Overall
Age, mean (SD)			66.0 ± 12.93
HbA1c on admission, mean (SD)			7.8 ± 1.86
Years with diabetes, mean (SD)			12.9 ± 9.3
Education level			
Primary	28.6	21.98	25.64
Secondary	44.58	31.65	38.8
Tertiary	26.82	46.37	35.56
Marital status			
Single	52.0	32.1	46.57
Married	48.0	67.9	53.43
Social security affiliation			
Contributory	97.8	98.2	98.8
Subsidized	2.2	1.8	2.0
HbA1c on admission			
HbA1c < 7	42.1	36.1	39.4
HbA1c ≥ 7	57.9	63.9	60.6
Smoke			
Yes	16.7	31.4	23.3
Physical activity			
Yes	30.1	32.1	30.99

Table 2. Comorbidities by sex and prevalence ratio.

Comorbidities	Overall		Sex				Prevalence ratio (PR)	95 % confidence interval		p-value
			Women		Men					
	N	%	n	%	n	%		Lower	Upper	
Arterial hypertension										
Yes	601	59	332	59	269	59.1	0.99	0.77	1.28	0.96
Obesity										
Yes	625	61.4	264	46.9	361	79.3	0.23	0.17	0.3	0.00
Dyslipidemia										
Yes	691	67.9	361	64.1	330	72.5	0.68	0.52	0.89	0.00
Retinopathy										
Yes	122	12	66	11.7	56	12.3	0.95	0.65	1.38	0.78
Neuropathy										
Yes	127	12.5	73	13	54	11.9	1.11	0.76	1.61	0.60
Nephropathy										
Yes	94	9.2	45	8	49	10.8	0.72	0.47	1.1	0.13
Coronary heart disease										
Yes	129	12.7	47	8.3	82	18	0.41	0.28	0.61	0.00
Cerebrovascular disease (CVD)										
Yes	18	1.8	11	2	7	1.5	1.28	0.49	3.32	0.62
Peripheral arterial disease										
Yes	41	4	20	3.6	21	4.6	0.76	0.41	1.42	0.39
Amputation										
Yes	12	1.2	7	1.2	5	1.1	1.13	0.36	3.59	0.83

the younger the diabetic patient was, the lower the glycemic control and the greater the severity of kidney complications. A systematic review also shows that cardiovascular complications contribute directly to mortality from diabetes. Therefore, the health system must strive to control risk factors for diabetes and avoid or delay the development of micro and macrovascular complications.¹⁵

The prevalence ratio was lower in women than men for dyslipidemia, coronary heart disease, and obesity. A cardioprotective effect has been reported in women with coronary heart disease, the same in dyslipidemia. However, in obesity, the findings are contrary to the national reports of obesity, which have found a prevalence of obesity of 22.4 % in women and 18.7 % in men.¹⁶ This finding requires a review of the obesity trend in diabetes by sex.

At the time of admission to the clinical management program, only 41.5 % of the patients had HbA1c levels < 7 %, which indicates a high prevalence of no metabolic control (60.6 %). The number of patients in a clinical management program in Colombia who achieve metabolic control have been reported between 27 to 53.4 %.^{10,17,18} Although treatment must be individualized,¹⁹ it is clear that it has been difficult for healthcare teams and patients to achieve more significant metabolic control figures. It has been observed that 80 % of patients with diabetes have some associated comorbidity,^{18,20} however a high prevalence of comorbidities suggests a failure in care or disease prevention. Mortality is associated with complications,²¹ deterioration in the quality of life of patients²² and increased costs in health-care.^{13,23}

In this study, administrative data were used. There could be underreporting to the extent that patients may not have reported all the conditions of interest or the health professional did not record important information for identifying a

clinical condition. Furthermore, the patients could have consulted in other institutions, and the related interventions or diagnoses are unknown. This study is grounded in the reported data, and there is a systematic process of collecting the information. Up-to-date information is reported with a large patient sample, which can help health professionals to gain insight into the behavior of diabetes comorbidities.

Conclusion

Patients with type 2 diabetes have a high prevalence of comorbidities: dyslipidemia, obesity and arterial hypertension. A lower prevalence of comorbidities was observed in women than men for dyslipidemia, coronary heart disease, and obesity.

Data availability

Underlying data

This project contains the anonymized raw data for each patient assessed in the study and are available at;

Zenodo: Prevalence of comorbidities associated with type 2 diabetes in patients attending a disease management program, Medellín, Colombia 2014-2019: a descriptive study. <http://doi.org/10.5281/zenodo.4644290>.⁸

Data are available under the terms of the [Creative Commons Attribution 4.0 International license](#) (CC-BY 4.0).

Ethical approval

The study protocol was reviewed and approved by the Institutional Review Board of CES University (Project number 734/2017).

Consent statement

Written consent was obtained from all patients following clinical research standards in Colombia.

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It is a very small study, but as the authors describe it is important for monitoring of morbidity and risk factors trends in our country and establishment of public health policies.

- Introduction is short but is concise with current references.
- Methods: I found the methodology well described. However, it is necessary to say if CLID is a unique diabetes management healthcare center in Medellín, with the intention to assess external validity and of course relevance of the results.
- I am left wondering if reference 8 is this same article.
- Tables: In table 1, it is desirable that the decimals be uniform in the numerical figures. Some numerical data have two and others a single decimal.
- Discussion: In the last paragraph, it is reported that patients could have under-reported information. So, it is necessary to list the variables that are exclusively reported by the patients or variables subject to error or not determined by clinical parameters or medical diagnosis.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Epidemiology and biomedical sciences

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

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