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Efficacy of pharmacotherapy follow-up care in Brazilian patients with type 2 diabetes mellitus: a randomized controlled trial

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Abstract

Objective: To evaluate the efficacy of pharmaceutical care in improving outcomes of Brazilian outpatients with type 2 diabetes mellitus. **Methods:** In this single-blind, controlled trial, 71 outpatients were randomized into two groups: pharmaceutical care intervention (managed using pharmacotherapy follow-up protocol); and control (managed using standard dispensing procedures). Outcomes included hospitalization, severe complication (retinopathy, renal insufficiency, hypoglycemia, coronaropathy or foot lesion), and the values of A1c hemoglobin (HbA1c), capillary glycaemia (CG), blood pressure (BP), total cholesterol (TC) and body mass index (BMI). All patients were followed for 12 months and drug-related problems (DRP) were described in intervention group. The groups were compared using the Student´s t-test, Tukey-Kramer, Chi-square and Fisher exact tests. **Results:** No significant difference in baseline clinical characteristics of the intervention (n= 36) and control groups (n= 35) ($p>0.05$). The groups did not differ for the outcome hypoglycemia, CG, BP, HbA1c, TC and BMI ($p>0.05$), but CG and HbA1c levels decreased at 3, 6 and 12 months, in both groups ($p\leq0.05$). A total of 56 DRP were observed in intervention group and the pharmacist resolved approximately 60% of these. **Conclusion:** Improvements in the glycemic parameters of outpatients with type 2 diabetes mellitus attended within a community pharmacy were observed. Studies involving larger samples are needed to confirm the benefits of pharmacotherapy follow-up care for key clinical outcomes in these patients. The trial was registered in Clinicaltrials.gov: Record NCT03196336.

Keywords: type 2 diabetes mellitus, pharmaceutical care, pharmacotherapy follow-up, community pharmacy.

Eficácia do acompanhamento farmacoterapêutico em pacientes com diabetes mellitus tipo 2: estudo controlado randomizado

Resumo

Objetivos: Avaliar a eficácia da atenção farmacêutica na melhoria dos resultados de pacientes ambulatoriais brasileiros com diabetes mellitus tipo 2. **Métodos:** Neste ensaio clínico controlado, simples-cego, 71 pacientes ambulatoriais foram randomizados em dois grupos: intervenção farmacêutica (seguiu o protocolo do acompanhamento farmacoterapêutico); e controle (seguiu o procedimento padrão de dispensação). Os desfechos incluíram hospitalização, complicações graves (retinopatia, insuficiência renal, hipoglicemia, coronaropatia ou lesão no pé) e as medidas de hemoglobina A1c (HbA1c), glicemia capilar (GC), pressão arterial (PA), colesterol total (CT) e índice de massa corporal (IMC). Todos os pacientes foram acompanhados por 12 meses e problemas relacionados a medicamentos (PRM) foram descritos no grupo de intervenção. Os grupos foram comparados utilizando-se o teste t de Student, Tukey-Kramer, Qui-quadrado e exato de Fisher. **Resultados:** Houve nenhuma diferença significativa nas características clínicas iniciais dos grupos intervenção (n= 36) e controle (n= 35) ($p>0,05$). Os grupos não diferiram quanto aos desfechos hipoglicemia, GC, PA, HbA1c, CT e IMC, mas os níveis de GC e de HbA1c diminuíram em 3, 6 e 12 meses, em ambos os grupos ($p\leq0,05$). Um total de 56 PRM foi observado no grupo de intervenção e o farmacêutico resolveu aproximadamente 60% destes. **Conclusão:** Melhorias nos parâmetros glicêmicos de pacientes ambulatoriais com diabetes mellitus tipo 2 foram observados. Estudos envolvendo amostras maiores são necessários para confirmar os benefícios do acompanhamento farmacoterapêutico nos principais desfechos clínicos destes pacientes. O protocolo foi registrado no Clinicaltrials.gov: Registro NCT03196336.

Palavras-chave: diabetes mellitus tipo 2, assistência farmacêutica, acompanhamento farmacoterapêutico, farmácia comunitária.

Introduction

Diabetes mellitus reaches epidemic proportions and requires constant care. The condition is considered a global epidemic and one of the most common chronic diseases affecting all countries, increasing in both number of cases and impact[1]. Global diabetes prevalence in 2017 was 8.8% affecting about 425 million of adults 20-79 years; if trends continue, by 2045, 9.9% (629 million) of people between 20 and 79 years, will have diabetes[2]. This increase of prevalence is probably due to aging population, economic development and increasing urbanization leading to more sedentary lifestyles and greater consumption of unhealthy foods linked with obesity[3].

In 2017 diabetes mellitus affected 12.5 million of Brazilian adults, placing the Brazil in fourth in the ranking of countries with more people with diabetes. The estimate of the number of Brazilian adults with undiagnosed diabetes in this same year was of 5.7 million[2].

Diabetes is one of the leading causes of cardiovascular disease[4], blindness[5], kidney failure[6] and lower-limb amputation[7]. The purpose of diabetes mellitus management is to reduce the morbidity and mortality associated with the disease, promoting educational strategies for self-care, lifestyle changes and medication use[8]. However, diabetes care standards are below optimal in most clinical settings[9]. Additional monitoring and control is required in treatments.

Pharmacists are among the most accessible health professionals and have frequent contact with patients with chronic diseases[10]. Thus, they are in a favorable position to systematically identify patients with diabetes, assess the risk of associated comorbidities and assist in disease management and preventive measures[11].

Some studies have shown that outpatient diabetes care pharmaceutical services help improve glycemic control and achieve desired therapeutic goals,[11-15] however, few national randomized controlled trials have verified the effects of pharmacotherapeutic follow-up on the management of patients with diabetes[8, 16-18]. Meta-analysis that included 2,961 patients receiving pharmacist care intervention (pharmaceutical care, medication review, solving drug-related problem, education on diabetes, among others) and 2,899 receiving the usual care intervention, showed that the pharmacist care improvement the values of HbA1c in patients of both high-income and low- and middle-income countries. Also showed that it is necessary follow-up the patient over 6 months to obtain this results[19].

The present study produced scientific data on the clinical practice of pharmacists collected through a randomized controlled trial. This study evaluated the efficacy of pharmacotherapeutic 12-month follow-up in improving outcomes in Brazilian outpatients with type 2 diabetes mellitus.

Methods

Study design

A single-blind, placebo-controlled, randomized clinical trial involving a 12-month follow-up of patients was conducted. This study was registered in Clinicaltrials.gov (Record number: NCT03196336).

Study population

Patients with type 2 diabetes mellitus with similar treatment adherence (patients attended monthly community pharmacy to withdraw their medication) and disease severity profiles (presence of at least one comorbidity and HbA1c levels greater than 7%) were divided into two groups: pharmaceutical intervention (clinical managed of pharmacist using pharmacotherapy follow-up protocol: "Pharmacotherapy Workup") and control (managed using standard dispensing procedures) groups.

Eligibility criteria

Inclusion criteria Patients adults (18 years or older) with type 2 diabetes mellitus, presence of at least one comorbidity and achieved HbA1c greater than 7%. Exclusion criteria: Patients with type 2 diabetes mellitus that was not responsible for administering their drugs, and individuals with mental deficits that could hamper understanding of the study.

Study site and patient recruitment, randomization and allocation

The study was performed at the Vital Brazil Community Pharmacy. Due to it provides free medicines to users from Sorocaba city and neighboring cities, most of the research volunteers had the pharmacy as a unique resource for access to their medicines. They were received in a room for pharmaceutical services that is apt for providing patient privacy, comfort and safety. Diabetes care was delivered by a clinical pharmacist (TRF) and pharmacy students (CTB and VGM). Patients were recruited from the Pharmacy and from two other nearby sites (Endocrinology Outpatient Clinic of the Sorocaba Hospital Complex and the Health Teaching Center of Sorocaba City Hall) during the period between August 2013 and December 2015.

Sample size calculation was made for quantitative variables with the delineation of repeated measures over time. The sample size of 71 patients provided a power test of 0.80 and level of significance of 5% for a mean effect size according to Cohen(20) All patients were informed about procedures and asked to take part in the study. After acceptance, patients were randomly allocated in blocks of 10 (block randomization) into one of the two groups. Patients in the intervention group were given even numbers and the control group odd numbers. Random numbers generated by SAS 9.2 (for Windows) were used until five odd or even numbers were obtained, with a further five numbers of the opposite group then produced to give a total of ten. This procedure ensured equal sample sizes for every sequence of ten patients.

The care protocol for both groups was placed in sequentially numbered, opaque sealed envelopes ensuring blinded allocation. Patients were seen in the order of the sequence of the envelopes. Envelopes contained all the records and forms required to collect the information for each respective group. Patients were allocated blindly by the researchers conducting the interview according to the designated protocol in the sealed envelopes. The researcher in charge of data analysis was also blinded.

Study protocol and interventions

The outpatient allocation sequence was created by the researcher (CCB). Patients were informed about the details of the study by

the researchers (CTB, VGM and TRF) responsible for attributing the interventions to participants, and were told they would be part of one of the groups as determined by block randomization procedure.

Control group patients were given, at each of the dispensing procedures, information on their treatment (drug-based or otherwise) according to the dispensing routine, aimed at improving adherence to drug-based treatment and modifying life-style.

Intervention group patients were managed using the Pharmacotherapy Workup method[20-21] where objectives of this service are to identify, prevent and resolve drug-related problems concerning indication, effectiveness, safety and adherence. The drug-related problems were identified according to this method. The results were described only in intervention group, since their identification is not the usual procedure adopted in control group.

The intervention program included diabetic education and interviews. The pharmacist discussed with the patients about knowledge of type 2 diabetes mellitus, risk of diabetes complications, adverse effects of oral ant diabetics and insulin, medication adherence, signs or symptoms of hypoglycemia and self-management, appropriate self-blood glucose monitoring, and healthy lifestyle. Interviews were performed once every per month for twelve months.

Both groups underwent seven sessions (initial consultations, and follow-up sessions at one, two, three, six, nine and twelve months after initial consultation).

The activities run during each interview (conversation between research team and patient) and description of study phases (provided by research team) were conducted according to the forms for the method. Health problems, drug therapy prescribed for these issues, and whether the drug treatment complied with the indication, effectiveness, safety and adherence criteria, were established.

Adherence to drug treatment was determined of indirect way, based on patient reports during the interviews with the pharmacist; and it was checked whether they had withdrawals their medications monthly from the Vital Brazil Community Pharmacy.

For both groups, information on the variables CG (capillary glycaemia), SBP (systolic blood pressure), DBP (diastolic blood pressure) and BMI (body mass index), were obtained at six consultations. The results of A1c hemoglobin (HbA1c) and TC (total cholesterol), as well as hospitalization and severe complications of diabetes were obtained at the initial consultation, and at 6 and 12 months after the start of intervention. Changes observed on the glycaemia, TC, SBP and DBP were disclosed to patient, and possible causes investigated. When necessary, the patient was referred to the doctor´s office.

The interviews and dispensing procedures were carried out by the researchers (TRF and CTB). Interviews in the intervention group took around 50 minutes to perform, whereas dispensing procedures in the control group took a maximum of 30 minutes. Both groups took their drugs at the pharmacy, when available.

Outcomes assessed

The clinical outcomes were hospitalization and severe complications (ischemic or proliferative retinopathy, severe renal insufficiency, hypoglycemia, coronaropathy and evolving foot lesion). The surrogate outcomes were mean values of A1c hemoglobin (HbA1c), capillary glycaemia (CG), systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), body mass index (BMI).

Measurement of clinical parameters

Glycemic control was assessed by the HbA1c and CG tests as per recommendations of the Brazilian Diabetes Association. CG control was achieved with the aid of a glucose meter (Accu-Check Active®, Roche). HbA1c and TC exams were performed at the same laboratory or tests done by the patient within 30 days of the first consultation were used. SBP and DBP readings were taken by indirect measurement using the auscultation technique with aneroid sphygmomanometer and stethoscopes as per recommendations of the Brazilian Cardiology Society. A 12cm cuff was used as standard, while a large adult cuff (16cm) was employed for obese patients. Two readings were taken on the left arm. Normal values were defined as: SBP less than 130 mmHg and DBP equal to 80 mmHg. BMI was calculated as weight (Kg) divided by height squared (m^2). BMI values > 25 Kg/m^2 indicated overweight and >30 Kg/m^2 obesity. Anthropometric scales were used for weighing.

Data Analysis

The subjects were compared for sex, age, marital status, race, educational level, occupation, health insurance level, family history of diabetes mellitus, comorbidities and use of medicines, in order to assess the homogeneity between the groups (control and intervention). For this comparison Student´s *t*-test, Chi-square, Fisher's exact test and were applied at 5% significance level.

The exploratory analysis of HBA1c and BMI data showed that them the assumptions of a parametric analysis. Thus, the analysis was performed using mixed models with time-repeated measures (with the covariance structure of compound symmetric that presented lower value to AICC - Akaike information criterion) to verify the group effects, time and the interaction of the group versus time. Multiple comparisons were made using the Tukey-Kramer test, after mixed models.

The data of CT, CG, SBP and DBP presented an asymmetric distribution. Thus, for the comparison between groups and times, generalized linear models were adjusted according to a design in repeated measures for in group and time effects and the interaction of the group versus time. The robust standard error was used by the procedure Proc mixed. Statistical significance was defined as 5% and SAS Institute Inc. 2011 version 9.4, NC, USA was employed.

Ethical approval

The study was approved by the Research Ethics Committee of Sorocaba University under approval number 244.488 and registered at clinicaltrials.gov (Record NCT03196336, clinicaltrials.gov/ct2/show/NCT03196336). Patients that agreed to take part in the study formalized their participation by signing the informed consent form.

Results

A total of 104 potentially eligible patients were contacted, of which 78 agreed to take part in the study. Seven patients were later excluded due to loss of follow-up (failed to attend interviews during study), consisting of 4 from the intervention group and 3 from the control group. The final sample comprised 36 participants in the intervention group and 35 in the control group; all participants were included in the analysis of primary outcomes (Figure 1).

No significant difference in baseline clinical characteristics of the groups was observed, demonstrating homogeneity between the groups. Both groups comprised predominantly women, elderly, Caucasians, non-smokers, individuals with hypertension, and patients in use of polypharmacy (p>0.05) (Table 1).

The groups did not differ for the outcome hypoglycemia (p>0.05), while the other clinical outcomes were not found in patients (hospitalization, ischemic or proliferative retinopathy, severe renal insufficiency, coronaropathy and evolving foot lesion).

The biochemistry parameters did not differ between the groups at baseline (p>0.05, equal uppercase letters means no difference between groups). There was a reduction of HbA1c and CG levels, in both the intervention and control groups (p≤0.05, different lowercase letters means difference between the times), but no difference was observed between the groups (p>0.05, equal uppercase letters means no difference between the groups). Most patients were hypertensive, whereas mean SBP and DBP values were within normal range in the measure of 12 months. TC and BMI measures did not differ between the groups (p>0.05, equal uppercase letters means no difference between the groups) (Table 2).

Figure 1. Flowchart of the study

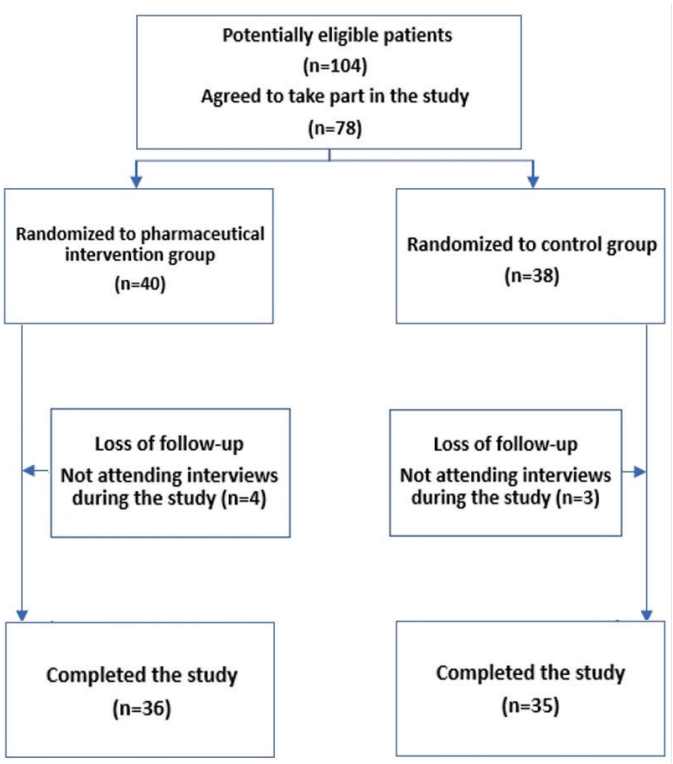

Table 1. Sociodemographic and clinical variables of patients.

Information	Intervention Group n=36 (%)	Control Group n= 35 (%)	p-value
Female[1]	21 (58.3)	20 (57.1)	0.9199
Age (years)			
≥ 60 years	29 (80.5)	27 (77.1)	
Age[#] (mean ± SD)	64.8 ± 10.6	64.5 ± 7.3	0.7303
Marital status Single, widowed or divorced[1]	14 (38.9)	13 (37.1)	1.0000
Caucasian[1]	27 (75.0)	32 (91.4)	0.0851
Educational level (years)			
Illiterate or ≤ 3	4 (11.1)	10 (28.6)	
Up to primary	19 (52.8)	15 (42.9)	0.1809
Secondary and higher education	13 (36.1)	10 (28.6)	
Not actively employed[1]	17 (47.2)	19 (54.7)	0.9002
Health insurance plan[1]	21 (58.3)	18 (51.4)	0.5645
Family history of DM[1]	23 (63.9)	25 (71.4)	0.5063
2 to 4 comorbidities[1]	20 (55.6)	25 (71.4)	0.1747
Obesity (BMI ≥ 30 kg/m²)	14 (38.9)	13 (37.1)	0.8820
Hypertension	29 (80.5)	30 (85.7)	0.1082
Hypercholesterolemia	24 (66.7)	22 (62.9)	0.7404
Hypertriglyceridemia	21 (58.3)	14 (40.0)	0.1297
Medications in use			
Polypharmacy (3-16)	34 (94.4)	33 (94.3)	1.0000
Monotherapy for diabetes[2]	16 (44.4)	12 (34.3)	0.3898
Use of oral hypoglycemic drugs[2]	12 (33.3)	12 (34.3)	0.9327
Use of antihyperglycemic drugs[2]	31 (86.1)	33 (94.3)	0.4290
Use of insulin	8 (22.2)	7 (20.0)	0.8252

SD=standard deviation; DM=diabetes mellitus [1] Dichotomous variable, presented only one category [2]may use more than one drug. (No statistically significant difference, Student´s t-test[#], Fisher´s exact test and Chi-squared test, p≤0.05)

Table 2. Results of outcomes assessed in groups for measurements at baseline, 1, 3, 6 and 12 months.

Variables	Groups	Baseline	1 month	3 months	6 months	12 months
		Mean (SD)	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**
A1c hemoglobin (%) (HBA1c)	Intervention	8.3 (1.1) Aa	-	-	7.3 (0.7) Ab	7.0 (0.7) Ab
	Control	8.5 (1.5) Aa	-	-	8.0 (1.4) Ab	7.6 (0.8) Ab
Body mass index (kg/m²) (BMI)	Intervention	30.7 (4.5) Aa	31.1 (4.8) Aa	30.5 (4.6) Ab	30.3 (4.5) Aab	30.4 (4.4) Aab
	Control	28.7 (5.1) Aa	28.7 (5.0) Aa	27.2 (6.8) Ab	28.0 (4.5) Aab	28.0 (4.4) Aab
		Median (min-max)	**Median (min-max)**	**Median (min-max)**	**Median (min-max)**	**Median (min-max)**
Capillary glycaemia (mg/dL) (CG)	Intervention	190.0 (101.0-586.0) Aa	156.0 (90.0-298.00) Ab	140.0 (82.0-272.0) Ac	133.0 (76.0-318.0) Acd	133.0 (75.0-231.0) Ad
	Control	175.0 (61.0-391.0) Aa	156.0 (79.0-310.0) Aab	142.0 (65.0-333.0) Ab	149.0 (91.0-342.0) Ab	143.0 (70.0-298.0) Ab
Systolic Blood Pressure (mmHg) (SBP)	Intervention	120.0 100.0-150.0) Aa	120.0 (100.0-150.0) Aa	120.0 (100.0-150.0) Aa	120.0 (110.0-150.0) Aa	120.0 (100.0-140.0) Aa
	Control	120.0 (110.0-50.0) Aa	120.0 (110.0-150.0) Aa	120.0 (100.0-140.0) Aa	120.0 (108.0-140.0) Aa	120.0 (100.0-140.0) Aa
Diastolic Blood Pressure (mmHg) (DBP)	Intervention	80.0 (60.0-100.0) Aa	80.0 (50.0-90.0) Aa	80.0 (60.0-90.0) Aa	80.0 (60.0-90.0) Aa	80.0 (60.0-90.0) Aa
	Control	80.0 (60.0-100.0) Aab	80.0 (50.0-100.0) Aa	70.0 (60.0-100.0) Bb	80.0 (50.0-90.0) Aa	80.0 (60.0-90.0) Aa
Total Cholesterol (mg/dL) (TC)	Intervention	203.0 (18.0-298.0) Aa	-	-	200.0 (143.0-234.0) Aa	192.0 (123.0-226.0) Aa
	Control	201.0 (109.0-249.0) Aa	-	-	200.0 (134.0-254.0) Aa	198.0 (125.0-282.0) Aa
		N (%)			**N (%)**	**N (%)**
*Hypoglycemia (%)	Intervention	3 (8.3)	-	-	2 (5.6)	-
	Control	4 (11.4)	-	-	-	-
*Hypertensive emergency (%)	Intervention	8 (22.2)	-	-	2 (5.6)	2 (5.6)
	Control	6 (17.1)	-	-	-	2 (5.7)

SD= standard deviation. Min-max= minimum-maximum. N= number of patients. Mean or median followed by different letters (uppercase between groups and lowercase over time) differ from each other (p≤0.05). – (outcome not collected in this time).*No statistically significant difference (Fisher´s exact test, p>0.05). All p-values were adjusted for multiplicity.

Thirty-six patients in the intervention group had 56 drug-related problems, predominantly due to non-compliance to daily dose or frequency and non-adherence to drug treatment (patients reported that they preferred not taking medications). Of the drug-related problems detected, 36 (64.3%) were resolved by the pharmacist while the remainder were referred to the physician for resolution. The reasons for physician referral were need for an additional drug (n=9), need to use another drug (n=9) and adjusting dose (n=2) (Table 3). These drug-related problems were not identified in patients in the control group because they were not part of the usual procedure of this group.

Table 3. Description of drug-related problems (DRP) in intervention group in according to pharmacotherapy follow-up protocol Pharmacotherapy Workup.

Drug-related problems	n (%)
INDICATION	
Need of treatment	9 (16.1)
EFFECTIVENESS	
Need for another drug	9 (16.1)
Non-compliance to daily dose or frequency	19 (33.9)
SAFETY	
Adverse effect	5 (8.9)
Very high dose	2 (3.6)
ADHERENCE	
Preferred not taking drug	12 (21.4)
Total	56 (100.0)

Discussion

This clinical trial, performed in patients with type 2 diabetes mellitus attended within a community pharmacy showed that the pharmacotherapy follow-up was no superior to standard dispensation procedure in improving the clinical parameters of HbA1c and CG over time.

Other clinical trials were performed in Brazil evaluating pharmaceutical services patients with type 2 diabetes. The study of Cani *et al.*[17], involving 70 patients with type 2 diabetes of a teaching hospital in Brazil in use of insulin and with HbA1c level higher than 8%, observed a significant reduction in HbA1c levels of outpatients followed-up for 6 months in a clinical pharmacy program. A quasi-experimental non-randomized controlled study of 96 Brazilians with type 2 diabetes mellitus, seen at six community pharmacies in the region of the Curitiba city, revealed reduction in HbA1c levels after 12 months of pharmacotherapy follow-up intervention, similar to that performed in the present study[8].

The reduction in HbA1c levels observed in the present study was similar to those reported in a clinical trial of 77 patients with type 2 diabetes mellitus, performed in University of Washington Medicine Neighborhood Clinics. The study observed a reduction in HbA1c levels in patients with type 2 diabetes mellitus that received the usual treatment of dispensation and the pharmaceutical intervention, followed for 12 months, but without differences between groups[22]. Another study that involved 239 patients

with diabetes in North Carolina, USA, too observed no statistical difference between the groups (pharmaceutical care and usual care) in improvement of HbA1c level[23].

Another randomized controlled clinical trial was conducted for 6 months in six health units of the Brazilian public health system in the city of Ouro Preto. The sample included 100 patients in use of oral antidiabetic medications with HbA1c levels higher than 7%. It was observed reduction in HbA1c, fasting glycaemia, cholesterol, triglycerides and systolic blood pressure values in patients given usual health care plus pharmaceutical intervention compared to usual health care alone[16].

It is important to emphasize that differences observed in results of studies may be associated with the particularities of interventions. Besides, the fact that the control group patients were regularly attended at a pharmacy to measure clinical parameters may have improved their drug adherence to use of drugs, with consequent better glycemic levels. This fact could justify the results observed in the present study.

A total of 56 drug-related problems were observed, mainly due to non-adherence to drug treatment and non-compliance with the daily dose or frequency of drugs used. Non-adherence is the most common problem found in patients with diabetes mellitus[18,24-25]. Poor adherence, including medication and lifestyle adjustment adherence, may influence treatment outcomes[26].

Most of the drug-related problems were resolved by the pharmacist, others were related to untreated or undiagnosed diabetes and such cases need be referred to the physician. This procedure was due to the manner the patients were recruited, since a search for patients whose disease was undiagnosed was also performed. National data showing a high rate (46.0%) of undiagnosed diabetes, corresponding to 5.7 million Brazilians[2].

Non-adherence to drug treatment (21.4%) was similar to that observed in a study published by Correr *et al.*,[8] which reported a 27.7% rate of non-adherence to drug treatment among 96 Brazilians with type 2 diabetes mellitus. The collection of this information was also based on patient self-report, as performed in the present study.

In the present study, it was observed that there was intentional non-adherence, since patients reported that they did not take medications what can occur due to lack of capacity or resources to take medicines[27], however, this was not reported in study, since community pharmacy donated drugs. The literature has shown that depression may be associated with worse clinical outcomes in patients with diabetes. The presence of depression may be associated with worse quality of life, self-care and adherence to the treatment[28-29].

According to the literature, the self-reported measure of adherence to treatment is a limitation of this study, mainly due to the probability of reporting bias. However, it is generally accepted that all available accession measures have their strengths and limitations, so there is no consensus on what constitutes a gold standard[30], nor is it clear how the intentionality of non-adherence can be assessed in the absence of self-report[29]. The communication between patients and clinicians and/or clinical pharmacists can promoted better adherence to treatment and more satisfactory glycemic control, and other clinical outcomes of patients[14,31].

The fact that the control group patients were regularly attended at a community pharmacy to measure clinical parameters may have improved their drug adherence to use of drugs, with consequent better glycemic levels. In addition, this pharmacy is a health care establishment focused on the training of pharmacists and this may have influenced the longer time of patient care and consequently the quality of service provided to the community.

In this small study, it was not possible to assess all the clinical outcomes relevant for the care of patients with type 2 diabetes mellitus such as retinopathy, coronaropathy and evolving foot lesion, among others; in order to verify whether the pharmacotherapeutic follow-up was able to reduce these comorbidities associated with the diabetes. Although the study intended to collect results from these clinical outcomes, study with larger sample size is needed to gauge the significance of these findings and, consequently, to demonstrate the difference between the groups.

In this way, further clinical studies should investigate these and others outcomes (such as humanistic and economic outcomes), for longer time and with enough sample to detect differences, in order to confirm the benefits of this intervention. On the order hand, the results of this study showed that the pharmacotherapy follow-up allowed modifications that improving quality in the use of drugs, such as the initial treatment of diabetes and improvements in compliance with dosage regimens, drug administration, and patient adherence to drug treatment. Importantly, the loss of follow-up of the study was small and occur due to the difficulty of locomotion of participants to the local and therefore, the active participation in consultations.

People with diabetes should be regularly screened to avoid potential complications and provided with close monitoring by healthcare professionals, since most complications can be detected at early stages of the disease, allowing for prompt treatment and prevention of disease progression[32].

Diabetes requires a comprehensive management plan in which patients are educated to make informed decisions about diet, exercise, and weight; can effectively monitor their blood glucose, lipids, blood pressure and cholesterol; enjoy access and correct use of drugs; and regularly attend screening for complications[2]. The pharmacist is the professional with greatest accessibility to patients and this contact may contribute to their care[13,33].

These results showed that pharmaceutical care had a positive role in type 2 diabetes mellitus management, since most of the drug-related problems detected were resolved by the pharmacist. This service too allowed the implementation of interventions promoting improvements in drug treatment.

Conclusion

The improvement observed in glycemic control of the patients who participated in the pharmacotherapy follow-up and standard dispensing procedure demonstrated that both interventions improved the care of patients with diabetes. Further studies involving larger samples are needed to confirm the benefits of this pharmacotherapy care follow-up for key clinical outcomes in these patients.

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Collaborators

Barros CT: Development of methodology; Conducting a research and investigation process, carrying out the methods and collecting data / evidence; Management and coordination responsibility for the planning and execution of research activities. Miranda VG: Implementation of methods and data / evidence collection. Cortellazzi KL: Application of statistical analysis. Lopes LC: Elaboration and creation of the published work, specifically visualization / presentation of the data; Responsibility for supervision and leadership for the planning and execution of the research activity. Barberato-Filho S: Elaboration and creation of the published work, specifically visualization / presentation of the data. Ferreira TR: Formulation and evolution of comprehensive research objectives and goals; Methodology development; Supervision and responsibility of the leadership for the planning and execution of the research activity; Management and coordination responsibility for the planning and execution of research activities. Motta CC: Formulation and evolution of comprehensive research goals and objectives; Responsibility for supervision and leadership for the planning and execution of the research activity. All authors discussed the results and contributed to the final manuscript.

Conflict of interest statement

The authors declare that there are no conflicts of interest regarding this article.

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