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Diabetes in the elderly: drug use and the risk of drug interaction

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Abstract *This study sought to outline the socio-demographic and health profile of elderly persons with reported diabetes, to assess the knowledge and practices regarding treatment options and describe the use of medications and potential risks for drug interactions (DI) in this subgroup. In 2008,a cross-sectional study was conducted of 1,517 elderly citizens in Campinas in which the prevalence of diabetes was estimated and its associations assessed using the Rao-Scott test ($p < 0,05$).The potential drug interactions were evaluated using the Micromedex® database. Diabetes prevalence was 21.7%, without significant difference between the sexes. A higher percentage of elderly diabetics was found aged over 70, with less schooling, per capita family income of less than 1 minimum wage and no occupational activity. The average drug intake was 3.9 in the previous 3 days. Possible interactions were identified in 413 cases and 53.1%, 7.8% and 7.2% of the subjects presented moderate, minor and serious risk of DI, respectively. The importance of adopting a healthy diet and physical activity for weight reduction, disease and complication control is stressed. The need for attention to the potential for drug interactions and the use of inappropriate medications among the elderly is highlighted.*

Key words *Diabetes Mellitus, Use of medication, Drug interaction, Health of the elderly, Health survey*

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Introduction

Diabetes mellitus (DM or diabetes) is currently one of the leading chronic non-communicable diseases (NCD's), owing to its expansion and morbidity/mortality, chiefly among the elderly, who are the main users of medicines and consequently more susceptible to inappropriate use thereof, polypharmacy and drug interactions (DI)[1,2].

The increase in the representativeness of elderly people is a world-wide phenomenon, affecting both developed and developing countries[3]. Diabetes among senior citizens is related to a higher risk of premature death, greater association with other co-morbidities and, above all, the major geriatric syndromes[4].

According to the International Diabetes Federation(IDF)[5], in the 20-to79-year-old age bracket, there are 386.7 million people who have diabetes, and the number of people afflicted with the disease is increasing all over the planet. Furthermore, around 50% of diabetics are not aware they have the disease and Brazil ranks 4th among the nations with the highest prevalence of diabetes, with an estimated 13.4 million diabetics, 6.5% of the nation's population in this age sub-group[4].

Data from 2013, compiled by the Surveillance System for Risk and Protective Factors for Chronic Diseases (Vigitel)[6] of the Brazilian Health Ministry (MS), a survey with the adult population in the nation's state capitals and the Federal District (DF), shows that the medical diagnosis frequency of diabetes in that year was 6.9%. In both sexes, the disease became more common with the advance of age. For the elderly population aged 65 and above the prevalence noted by Vigitel was 22.1%[7].

The greater prevalence of type 2 diabetes mellitus (DM2) in the elderly is related to beta cell dysfunction, with lower production of insulin and resistance to it, likewise frequent in older people owing to the bodily changes that occur with aging[4].

Although the use of medicines bea relevant issue in all age brackets, research on the subject has often been devoted to elderly patients, due to the peculiarities of this age group[8]. From a comparative standpoint, for the elderly the risks involved in the consumption of medicines are greater in relation to the rest of the population[9]. With the ongoing development of new drugs and thus prescriptions involving increasingly complex combinations, it has become very difficult for physicians and pharmacists to detect potential interactions[10].

Characterized as a clinical event, drug interaction (DI) occurs when the effects and/or toxicity of a drug are altered by the presence of another drug, herbal medicine, food, drink or some environmental chemical agent. Even though the results of DI may be either positive (enhanced effectiveness) or negative (decreased effectiveness, toxicity or idiosyncrasy), they are generally unpredictable and undesirable in pharmacotherapy[11].

A cross-sectional study that analyzed 1,553 medical prescriptions dispensed at three community pharmacies identified just over one tenth (10.5%) of DIs in all prescriptions, with almost two per cent (1.9%) corresponding to serious cases. The number of DIs increased with the rise in the number of drugs prescribed[12].

Few studies have investigated the use of medicines, knowledge thereof and behavior in relation to the treatment of elderly persons with specific chronic diseases. Thus, the objective of this study has been to characterize the sociodemographic profile and health of elderly people with DM2, evaluate their knowledge and practices regarding the treatment options available to them, and describe the use of medicines and potential DI risks in this sub-group.

Methods

A population-based cross-sectional study was conducted of 1,517 elderly people (i.e., aged at least 60) who were not institutionalized and resided in the urban area of the City of Campinas, State of São Paulo (SP), in the years 2008 and 2009. It was carried out based on data from the Health Inquiry conducted in Campinas (ISACamp) by the Health Situation Analysis Collaboration Center (CCAS) of the Collective Health Department of the College of Medical Sciences of Campinas State University (UNICAMP).

The sample was obtained by means of probabilistic sampling, broken down by conglomerates and into two stages: census and household sectors. In the first stage, 50 census sectors with probability proportional to their size (number of sector households) were selected. In the second stage, households were selected by applying systematic sorting to the relations of households existing in each one of the sectors sampled.

To determine the sample size, consideration was given to the situation corresponding to the maximum variability for the frequency of the events studied ($P = 0.50$), confidence coefficient of 95% in the determination of the confidence intervals ($z = 1.96$), sampling error between 4 and 5 percentage points and delineation effect equal to 2, totaling 1,000 individuals in each age group:

adolescents (10-19), adults (20-59) and elderly (60+). Anticipating an 80% response rate, the sample size was corrected to 1,250. To obtain this sample size in each major age group, after field updating of the maps of the sectors chosen and preparation of the list of addresses, independent selection was made of 2,150, 700 and 3,900 households for adolescents, adults and elderly people, respectively. In each household, all the residents of the age bracket selected for that household were interviewed.The description of the inquiry sampling plan is available at the following website: http://www.fcm.unicamp.br/fcm/sites/default/files/plano_de_amostragem.pdf.

Data was gathered by means of a structured questionnaire that was tested before hand in a pilot study and applied in household interviews conducted by trained and supervised interviewers.

Variables selected for the sociodemographic description of the population studied were as follows: sex, age, marital status, skin color, educational level, per capita family income (measured in monthly minimum wages using the Brazilian standard) and occupation (remunerated or otherwise).

The characterization of the elderly people according to their health behaviors, health condition indicators and use of health-care services was arrived at by means of the following variables:

- *Health behaviors:*tobacco usage, consumption of alcoholic beverages, body mass index (BMI = Kg/m^2), calculated based on weight and height data, with recommended cut-off points for elderly persons[13], practice of physical activity in aleisure context, and regular consumption of fruit, as well as raw and cooked vegetables/legumes.
- *Indicators of health condition and use of health-care services:* self-perception of health, hospital internment in the past 12 months, referred morbidity in the last two months prior to the survey, seeking out of health-care service or professional in the past two weeks and reporting of arterial hypertension, cardiovascular disease and emotional problems.
- *Knowledge and conduct in relation to treatment:* diabetic elderly people answered in a specific block, with questions as to *who said* that the interviewee was diabetic, *at what age* they found out they were diabetic, *what they did to control* the disease, if *they visited the doctor/health service periodically* because of diabetes, whether *they had participated in discussion groups regarding control* of the disease and *what they knew with respect to what should be done to control* diabetes.

The variables relating to the use of medicines in the three days prior to the survey were investigated by means of the following questions (1) *Have you taken any medicine in the past three days?* (2) *How many medicines? Which ones?* These variables were used to describe the profile of use of pharmaceuticals by elderly diabetics. The recall period considered made it possible to obtain information regarding ongoing and occasional use of any medicine by the interviewee.

For identification of the medicines, interviewees were required to submit the packaging of the medicine and/or their doctor's prescription, in order to minimize any errors in the annotation of data by the interviewer. The medicines were then classified according to the Anatomical Therapeutic Chemical Code (ATC)[14] and, in identification of the composition of the medicines, use was made of the Pharmaceutical Specialties Dictionary (DEF)[15]. For medicines that the interviewee was unable to refer, an unidentified code was assigned to them; for products not contained in the ATC, codes were designated to identify them. For those medicines that did not have a specific code in the ATC, the classification was carried out up to the limit that made it possible to identify the group, class or therapeutic action.

Estimates were made of relative frequencies and the respective 95% confidence intervals of the sociodemographic variables, health-related behaviors, health condition and use of health-care services by diabetic and non-diabetic elderly people. The differences among the sub-groups were verified by the Rao-Scott test with a level of significance of 5%. For appraisal of their knowledge and practices as to options for treatment of diabetes, utilization of pharmaceuticals according to their ATC classification and drug interactions, the relative frequencies were estimated. The analyses were conducted using the 11.0 version of the Stata software computer program, employing the procedures for complex samples.

In the appraisal of the drug interactions, the pharmaceuticals were classified using the Micromedex®[16] database. This base has an interactive system to check occurrence. Updated every quarter, the base includes all the medicines approved by the US Food & Drug Administration (FDA) and permits access to the multiple interaction tool by means of 2 to 50 fields to introduce the main active ingredients or to visualize the interactions that a medicine has. For some pharmaceuticals not regulated in the US, and which are used and prescribed in Brazil, the Micromedex®[16] database does not present information. Accordingly, the appraisal of these cases was conducted by means of consulting the following references: Martindale[17], Tatro[10], FormulárioTerapêuticoNacional[18] and Katzung[19].

The research project was approved by the Ethics Commission of Campinas State University.

Results

Out of the 1,517 elderly people interviewed, 94.2% ($CI_{95\%}$: 92.6 – 95.7) responded personally to the interview and the rest responded through their care-givers, relatives or guardians, owing to the impossibility of the elderly person in question responding at the time the survey was conducted. Average age of the interviewees was 69.9 ($CI_{95\%}$: 69.3 – 70.6) and more than half (57.3%) were women. Around 56% were married or living in stable relationships, 76.7% were white and 63.5% reported their educational level as equal to or less than 4 years of schooling. Among the elderly people interviewed, 69.2% reported per capita family income of less than 2 minimum monthly wages and 78.6% said they were not engaged in any occupational activity at the time of the survey.

The prevalence of diabetes reported by the elderly people interviewed in the survey was 21.7% ($CI_{95\%:}$ 19.3 – 24.1), without significant difference between the sexes (p = 0.35).Of the 333 elderly diabetics interviewed, 16.3% ($CI_{95\%}$: 9.8 – 22.9) reported some restriction in carrying out their daily activities.

From a comparative standpoint in relation to other elderly people, it was noted that there was a higher percentage of diabetics in the age bracket of 70 or more (p = 0.02), those with less schooling (p < 0.05), per capital family income of less than 1 minimum monthly wage (p = 0.03) and among those who were not engaged in any type of occupational activity, paid or otherwise, at the time of the survey (p < 0.05) (data not presented in table form).

Insofar as concerns health behaviors, it was noted that there was lower consumption of alcoholic beverages among diabetics (p < 0.01) and higher proportion of obesity (p < 0.01), but also consumption of fruits equal to or greater than 4 times per week (p = 0.03) (Table 1).

Table 1. Behavior related to health according to the presence of diabetes among the elderly. Campinas, São Paulo, Brazil, 2008-2009.

Variables and Categories	Diabetics		Non-diabetics		p value*
	n	% (CI 95%)	n	% (CI 95%)	
Smoking					
Non-smoker	220	65.6 (58.3 - 72.2)	817	68.3 (64.4 - 72.0)	
Smoker	33	9.8 (6.5 - 14.5)	139	11.9 (9.7 - 14.4)	
Ex-smoker	80	24.6 (18.8 - 31.5)	227	19.8 (16.4 - 23.7)	p = 0.17
Ingestion of alcoholic beverages					
Non-drinker	264	78.8 (72.5 - 84.0)	797	66.3 (61.8 - 70.6)	
Less than once per week	54	16.8 (12.8 - 21.7)	255	22.1 (18.6 - 26.1)	
Two or more times per week	14	4.4 (2.3 - 8.3)	129	11.6 (9.4 - 14.1)	**p < 0.01**
Body Mass Index (kg/m^2)					
< 22	33	9.8 (7.0 - 13.5)	217	18.2 (15.8 - 20.9)	
22 - 27	143	43.8 (38.7 - 49.1)	540	45.9 (42.7 - 49.2)	
> 27	157	46.4 (41.5 - 51.3)	427	35.9 (32.8 - 39.0)	**p < 0.01**
Leisure-time physical activity					
Yes	240	71.5 (63.3 - 78.5)	796	66.7 (61.4 - 71.5)	
No	93	28.5 (21.4 - 36.7)	387	33.3 (28.5 - 38.6)	p = 0.18
Consumption of fruit					
Up to 3 times per week	71	21.1 (16.5 - 26.7)	321	26.9 (22.8 - 31.5)	
≥ 4 times per week	262	78.9 (73.3 - 83.5)	863	73.1 (68.5 - 77.2)	**p = 0.03**
Consumption of vegetables - raw greens					
Up to 3 times per week	70	20.8 (15.7 - 26.9)	289	24.4 (20.6 - 28.7)	
≥ 4 times per week	263	79.2 (73.1 - 84.3)	895	75.6 (71.2 - 79.4)	p = 0.18
Consumption de greens - cooked vegetables					
Up to 3 times per week	91	27.1 (21.6 - 33.4)	367	31.1 (26.9 - 35.7)	
≥ 4 times per week	242	72.9 (66.6 - 78.4)	817	68.9 (64.3 - 73.1)	p = 0.13

n: number of individuals in the non-weighted sample. * p-value of the Rao-Scott test.

With respect to health conditions and use of health-care services, a higher percentage of elderly diabetics ranked their health as poor or very bad at the time of the survey. The use of health-care services, the presence of three or more chronic diseases and specific pathologies was also significantly higher among the diabetics interviewed (Table 2). There was no statistical difference in relation to affiliation with a health coverage plan (data not presented in table form).

In terms of their knowledge and practices as to treatment options for diabetes, excluding two elderly people who did not know or were unable to answer the questions put to them, it was verified that almost two thirds (65.7%) of the elderly interviewed had been living with the disease for more than 6 years. For controlling diabetes, the chief strategies reportedly used were as follows: routine use of oral medication and insulin, as well as following a regular food diet. It was further ascertained that 90.5% of the elderly persons interviewed ($CI_{95\%}$:86.7 – 94.4) periodically visited their doctor/health-care service; moreover, when queried as to the date of their last visit to keep track of the disease, most reported lengths of time between 1 and 6 months (54.4%) (Table 3).

On the other hand, participation in discussion groups on the subject of the disease was infrequent (10.4%; $CI_{95\%}$: 5.5 – 15.2) and complications resulting from diabetes were reported by 37.3% ($CI_{95\%}$:27.6 – 48.2) of the elderly people interviewed in the survey. In relation to the evaluation of knowledge on their part as regards what should be done to control the disease, besides routine use of oral medication, three key factors were frequently mentioned by the interviewees: regular healthy diet, physical activity and other such practices in order to lose/maintain weight (Table 3).

As to the use of medicines in elderly diabetics, 92.8% ($CI_{95\%}$:86.2 – 96.4) of the men and 99.5% ($CI_{95\%}$: 96.5 – 99.9) of the women reported having consumed at least one type of medicine in the three days preceding the survey. The average number of medicines used by the elderly interviewed was 3.9 ($CI_{95\%}$: 3.6 – 4.1), with almost half (41.6%) reporting the use of at least five medicines in the three days prior to the interviews.

Table 2. Health condition and use of health services, according to the presence of diabetes among the elderly. Campinas, São Paulo, Brazil, 2008-2009.

Variables and Categories	Diabetics		Non-diabetics		p value*
	n	% (CI 95%)	n	% (CI 95%)	
Self-perception of health					
Excellent/Very good	45	14.0 (10.2 - 19.0)	316	27.3 (22.8 - 32.3)	
Good	230	68.7 (61.2 - 75.3)	740	62.1 (57.2 - 66.7)	
Bad/Very bad	58	17.3 (12.6 - 23.3)	128	10.6 (8.7 - 12.9)	**p < 0.01**
Hospitalization in the last 12 months					
None	278	83.4 (77.7 - 87.8)	1.021	86.3 (83.8 - 88.4)	
1 or more	55	16.6 (12.2 - 22.3)	163	13.7 (11.6 - 16.2)	p = 0.20
Morbidity in the last 15 days					
No	235	70.8 (63.8 - 77.0)	892	75.5 (71.8 - 78.8)	
Yes	98	29.2 (23.0 - 36.2)	291	24.5 (21.2 - 28.2)	
Use of the health services in the last 15 days					
No	224	67.0 (60.7 - 72.7)	912	76.9 (73.9 - 80.0)	
Yes	109	33.0 (27.3 - 39.3)	272	23.1 (20.0 - 26.5)	**p < 0.01**
Number of chronic ailments**					p = 0.17
None	32	10.2 (6.6 - 15.5)	288	24.9 (20.9 - 29.4)	
One or two	170	52.5 (45.4 - 59.6)	588	50.2 (46.8 - 53.6)	
Three or more	122	37.3 (30.5 - 44.6)	297	24.9 (21.1 - 29.1)	**p < 0.01**
Report of the following chronic conditions/ ailments***					
Hypertension	252	74.8 (68.6 - 80.1)	565	47.2 (43.6 - 50.9)	**p < 0.01**
Cardiovascular disease	91	27.8 (22.6 - 33.7)	176	14.9 (12.8 - 17.3)	**p < 0.01**
Emotional problems	92	27.4 (20.7 - 35.3)	253	21.1 (17.2 - 25.7)	**p = 0.02**

n: number of individuals in the non-weighted sample. * p-value of the Rao-Scott test. ** Excluding diabetes. *** Percentage of those who replied yes (class of reference: negative reply to chronic condition/ailment).

Table 3. Knowledge and practices regarding options of treatment for diabetes among the elderly. Campinas, São Paulo, Brazil, 2008-2009.

Characteristics	Total	
	n	% (CI 95%)
How long ago was diabetes diagnosed (years)		
0 to 5	112	34.3 (27.8 - 40.7)
6 to 10	83	25.2 (20.3 - 30.2)
11 years or more	113	40.5 (34.1 - 46.9)
What do you do to control diabetes**		
Diet	130	39.6 (32.4 - 47.3)
Special diet to lose/maintain weight	15	4.5 (2.3 - 8.9)
Physical activity	35	10.9 (7.3 - 15.9)
Take insulin regularly	75	22.3 (17.3 - 28.2)
Take insulin when you have a problem	6	1.8 (0.7 - 4.2)
Take oral medication regularly	222	66.3 (59.2 - 72.6)
Take oral medication when you have a problem	9	2.8 (1.5 - 5.0)
Don't do anything	8	2.5 (1.0 - 5.7)
Visit physician/health service periodically because of diabetes		
No	32	9.5 (5.6 - 13.3)
Yes	301	90.5 (86.7 - 94.4)
When was the last time you went to a physician/health service because of diabetes		
In the last month	128	38.9 (32.6 - 45.2)
1 to 6 months ago	181	54.4 (48.0 - 60.8)
More than 6 months ago	22	6.7 (3.8 - 9.6)
Do you participate in discussion groups about diabetes		
No	229	89.6 (84.8 - 94.5)
Yes	34	10.4 (5.5 - 15.2)
What do you think should be done to control diabetes*		
Diet	215	65.1 (56.4 - 72.8)
Special diet to lose/maintain weight	74	22.4 (15.7 - 30.7)
Physical activity	106	32.1 (24.3 - 41.1)
Take insulin regularly	38	11.4 (7.3 - 17.4)
Take insulin when you have a problem	6	1.7 (0.7 - 4.3)
Take oral medication regularly	151	44.7 (36.9 - 52.9)
Take oral medication when you have a problem	6	2.0 (0.6 - 6.2)
Complication because of diabetes**		
No	208	62.7 (51.8 - 72.4)
Yes	123	37.3 (27.6 - 48.2)
Problem with eyesight	94	27.9 (18.5 - 39.9)
Problem with kidneys	64	19.0 (10.3 - 32.2)
Problem with blood circulation	77	23.1 (14.4 - 34.8)
Other	13	4.0 (1.8 - 8.6)

n: number of individuals in the non-weighted sample. * Questions that allowed for more than one reply.

In relation to the pharmacological groups, as shown in Table 4, greater frequency was noted for the medicines that act on the Cardiovascular System (40.7%), which encompass various types of antihypertensive drugs and pharmaceuticals that act on cardiac functions such as anti-arrhythmic and hypolipidemic agents. Next come the medicines that act on the Digestive System and Metabolism (32.1%), among which the specific drugs for DM are found, with the most frequent being metformin, glibenclamid and insulins–besides anti-pyretics, vitamins and minerals specified as "other drugs". Then come those affecting the Blood and Hemopoietin organs (8.1%), the principal class of which is made up of anti-rhomboids and, finally, drugs that act on the Nervous System (7.4%), which encompass classes such as anti-epileptics, anti-depressants and anti-psychotics.

Among the elderly diabetics interviewed who reported use of 2 or more medicines (n=299),

Table 4. Frequency of use of drugs according to the ATC classification (anatomic group/system of interaction among elderly diabetics). Campinas, São Paulo, Brazil, 2008-2009.

ATC Classification	n	% (CI 95%)
A - Digestive system and metabolism	**413**	**32.1**
Metformin	151	11.7
Glibenclamide	98	7.5
Insulins and analogous medication	61	4.7
Glimepiride	23	1.8
Others	80	6.4
B - Blood and blood formation organ	**104**	**8.1**
Acetylsalicylic acid	89	7.0
Others	15	1.1
C - Cardiovascular System	**525**	**40.7**
Captopril	135	10.4
Hydrochlorothiazide	71	5.4
Propranolol	31	2.4
Simvastatin	31	2.4
Nifedipine	25	1.9
Atenolol	17	1.3
Enalapril	17	1.3
Amlodipine	16	1.2
Losartan	13	1.0
Furosemide	12	0.9
Amiodarone	9	0.7
Digoxin	6	0.4
Others	142	11.4
D - Dermatological Medication	**4**	**0.3**
G - Genito-urinary system and sex hormones	**6**	**0.5**
H - Systemic hormonal preparations. excluding sex hormones and insulins	**21**	**1.6**
J - Anti-infection agents in general for systemic use	**8**	**0.6**
L - Antineoplastic agents and immunomodulators	**2**	**0.2**
M - Musculoskeletal System	**43**	**3.3**
N - Nervous System	**94**	**7.4**
Fluoxetine	11	0.8
Paracetamol	6	0.5
Ginkgo biloba	5	0.4
Diazepam	5	0.4
Others	73	5.3
R - Respiratory System	**12**	**0.9**
S - Sensory organs (ontological and ophthalmic)	**12**	**1.0**
Others	**43**	**3.3**
Total	**1,287**	**100.0**

413 potential drug interactions (DI) were reported, with 53.1%, 7.8% and 7.2% of them featuring risk of moderate, lesser and serious interactions, respectively, and 31.9% not featuring any interaction possibility at all. Table 5 describes the10 moderate interactions most frequently encountered, all ranked as moderate risks, along with their potential risk.

For potentially serious interactions, the pharmaceuticals most involved were as follows: amiodarone, which interacts with amlodipine, atenolol, amitriptyline, fluoxetine, digoxinand nepheline; aspirin or acetylsalicylic acid (ASA), which interacts with ginkgo biloba and warfarin; digoxin, which interacts with calcium, hydrochlorothiazide and spironolactone; simvastatin, which interacts with amlodipine, diltiazem, phenofibrate, verapamil; fluoxetine, which interacts with amitriptyline, haloperidol anddiclofenac (data not presented in table form).

Table 5. Potential moderate interactions more frequents in elderly diabetics who used two or more medicines in the three days prior to the research (n = 299). Campinas, São Paulo, Brazil, 2008-2009.

Moderate Drug Interaction	n	% (CI 95%)*	Potential risk**
Captopril + Aspirin	47	15,7 (10,9 – 20,5)	Reduction in anti-hypertensive efficacy
Captopril + Hydrochlorothiazide	45	14,8 (9,8 – 19,8)	Postural Hypotension (first dose)
Hydrochlorothiazide + Glibenclamide	30	9,9 (6,1 – 13,7)	Reduction of the Hypoglycemic Effect
Glibenclamide + Aspirin	29	9,5 (6,1 – 13,0)	Increase in hypoglycemia
Insulin + Aspirin	25	8,3 (5,1 – 11,4)	Hypoglycemia (depression of the CNS, convulsions)
Hydrochlorothiazide + Aspirin	25	8,4 (4,8 – 12,0)	Reduction of the diuretic and anti-hypertensive efficacy
Propranolol + Metformin	16	5,2 (2,8 – 7,6)	Hypoglycemia, hyperglycemia, or hypertension
Propranolol + Aspirin	13	4,2 (1,9 –6,5)	Reduction of the anti-hypertensive effect
Atenolol + Metformin	11	3,6 (1,2 – 6,2)	Hypoglycemia, hyperglycemia, or hypertension
Enalapril + Metformin	8	2,7 (0,8 – 4,7)	Hyperkalemic lactic acidosis

n: number of de individuals in the non-weighted sample. * Percentage in the weighted sample. (CI95%): Confidence Interval to 95%.
** Classification in accordance with the Micromedex® database.

Discussion

The profile of the elderly diabetic population resident in the City of Campinas in 2008/2009 was similar to that noted for the elderly population resident in the urban areas of two other major cities in the Southeastern and Southern Regions of Brazil – São Paulo[20] and Porto Alegre[21]. It was likewise similar to that of persons stricken with chronic diseases in the areas covered by basic health-care units in the Southern and Northeastern Regions of Brazil[22], as well as among elderly diabetics in the State of Minas Gerais, in the Southeast[23].

With respect to health behaviors, around 46% of elderly diabetics were overweight and did not engage in regular physical activities in the context of leisure. Overweightness was accentuated in individuals with DM2 and who had resistance to insulin, chiefly from the age of 40[4] onwards. Studies point to the importance of reducing one's weight and practicing regularly physical activities[24], in order to prevent and control chronic diseases[4,25,26]. Nonetheless, counseling patients to engage in physical activity in Brazil is still not very effective among professionals, not just as a health education strategy in the basic network, but also as support for treatment of hypertension, diabetes, cardiovascular diseases, depression, etc. In a study conducted in São Paulo, the measure most widely practiced to control diabetes was *taking routine oral medication* (60.8%) and, among the least used, the highlights were *going on a diet to lose weight* (3.3%) and *getting some exercise, engaging in physical activity* (2,2%)[27].

Among the main pathologies reported among elderly diabetics, arterial hypertension had a percentage similar to that found by Viegas-Pereira et al.[23], while cardiovascular disease was reported in a lower percentage than that observed in the latter study. In this study, appraisals were also conducted of the presence of other diseases and complaints, highlighted by the importance of circulatory problems, arthritis/rheumatism/arthrosis, pain in the spinal column, emotional alterations and insomnia in the elderly population surveyed.

Even if they had two or more chronic diseases, in addition to diabetes, the subjective perception of their health was positive for most of the elderly diabetics interviewed (about 69% considered their health "good" at the time of the survey). Despite this, it is known that non-communicable chronic diseases (NCD's) cause a significant impact on the quality of life (QoL) index of people, with a direct influence on their own self-appraisal of their health[20,28-30]. Studies analyzing data in the State of São Paulo and its capital city have verified a greater prevalence of poor perception of health among elderly diabetics[27]. It can be supposed that the good perception of health among the elderly persons studied is due to the fact that most of them are asymptomatic, without complications such as target organ injuries (cardiovascular apparatus, kidney, retina, peripheral nervous system), in that functional decline resulting from limitations of the disease can have a direct relationship to the health perceived[29-31]. In this study, 62.7% did not report any complication due to diabetes, and only around 16% reported some limitation imposed by the disease in carrying out their daily activities.

Some studies indicate that self-reported information regarding arterial hypertension, DM, cerebral vascular accidents and strokes can be considered valid, while information on cardiac insufficiency, obstructive pulmonary disease and duodenal ulcers tend to be less accurate[32,33]. According to Barros et al.[34], recognition of a disease by the individual depends on the degree of perception of signs and symptoms, access to medical services and diagnostic testing, as well as the type and quality of the orientations obtained from health-care professionals. Accordingly, studies demonstrate high specificity (above 96%), but low sensitivity (between 50 and 60%) for self-reported diagnosis of diabetes, which means underestimation[32,35]. In this study, drug treatment for the control of diabetes also entails access to medical services and professionals in Campinas.

As to the medicines, almost all of the elderly diabetics surveyed (96.8%) reported use of at least one. Around 42% were using five or more medicines at the time of the survey, which corresponds to polypharmacy. Use of medicines by the elderly population in general is high[21,36-38], which according to Flores et al.[37], is partially explained by ready access to medications and the low frequency of use of non-pharmacological resources in dealing with health problems. In this study, just 3.2% of the elderly diabetics surveyed did not report the use of medicines.

The anatomic-functional groups most used were precisely those corresponding to the most prevalent co-morbidities, that is, those that act on the cardiovascular system, which encompass several classes of pharmaceuticals, such as distinct anti-hypertensive and anti-arrhythmic drugs that act on cardiac and hypolipidemicfunctions. This fact probably collaborated to the greater prevalence in relation to the second group, relating to acting on the digestive system, the pharmaceuticals most used for which are those specific for DM (oral anti-hypoglycemiadrugs and insulin). Such data is similar to that found in Brazilian studies conducted in Porto Alegre[21], Belo Horizonte[38] and Bambuí[39], as well as in international studies[40,41]. Even so, in such cases, since the population studied was more all-encompassing and did not include just diabetics, the most prevalent therapeutic groups were cardiovascular pharmaceuticals, as well as drugs for the nervous system and agents that act on the gastrointestinal tract and on metabolism.

In relation to potential DIs, it was noted that the most prevalent ones were those in which pharmaceuticals are used to deal with the most frequent co-morbidities, which corroborates the high frequency of such potential events. A study conducted based on a nation-wide Brazilian mail inquiry of 3 thousand elderly people, selected based on the register of the National Social Security Institute (INSS), evaluated that the pharmaceuticals employed in cardiovascular therapy were involved in the majority of confirmed interactions[42]. Depending on the pharmaceuticals involved, the spectrum is broad for outcomes resulting from DIs. It is not only possible that a decrease or increase of the therapeutic effect of the drugs will occur, with toxic results for the organism, but it is also possible for them to be used to empower therapy in some cases, such as the association of anti-hypertensive classes in the treatment of HAS at the most advanced or complex stages[43]. The presence of potential DI events should be carefully investigated, chiefly in senile individuals, as reported in a European study in which, out of 1,601 elderly people surveyed, 46% had a least one clinically significant DI and, of the latter, no fewer than one tenth (10%) were considered highly serious. Not all potential DIs actually caused a significant clinical event[44] and, moreover, the DI databases do not always have data that matches[45], which can lead to over-estimation in analyzing them[46].

According to Secoli[47], DIs should be investigated, since the potential for them increases with advancing age, which is justified by the change in the process of aging and resulting pharmacological profile.

It should be stressed that several pharmaceuticals involved in DIs classified as more serious are potentially inappropriate for elderly people, according to the criteria compiled by Beers[48], as updated by Fick et al.[49]. The most relevant of these are amiodarone, which can lead to alterations in the QT interval and serious arrhythmia, such as Torsades de Pointes; nifedipine, which intensifies hypotension and constipation; digoxin, which involves a greater risk of digitalis toxicity; fluoxetine, which causes stimulation of the Central Nervous System (CNS), agitation and sleep disturbances; andamitriptyline, which leads to anticholinergic effects and orthostatic hypotension. A study conducted in Brazil regarding the use of medicines that are potentially inappropriate for elderly people, involving data of the survey entitled Health, Well-being and Aging (SABE Study), indicated greater concern with cardiovascular medicines, chiefly represented by nifedipineand amiodarone[50].

There are, furthermore, two medicines that are not part of the group considered as inappro-

priate for the elderly, but which should nevertheless be considered owing to the serious nature of their interaction risks: warfarin and ginkgo biloba. Both can heighten the risk of bleeding, with the latter being increasingly prescribed, which would indicate inappropriate use[51].

Although not analyzed in this study, interactions between drugs and foods are also relevant, since they can decrease or increase their absorption via the gastrointestinal tract, altering the concentration of serum.Interactions between drugs and herbal medicines, which are made up of pharmacologically active substances, can produce clinically serious situations, even though there is no extensive documentation in this regard[11].

Among the limitations of this study, the three-day recall period may influence the prevalence of use of medicines, since the longer the time, greater the likelihood of occasional use of some drug[52,53]. However, at the same time, it can improve the quality of the information in relation to medicine without prescription. It should be highlighted that medicines involving ongoing use, such as for treatment of DM, are equally appraised in any period considered[52-54].

It should be pointed out that this study employed data from a wide-ranging health inquiry that did not just consider elderly and diabetic people, and that data on the dosage and posology of the pharmaceuticals, which is relevant for analyzing correct use and the possibility of DI (in as much as some are dose-dependent), was not gathered. Furthermore, the objective of this study was not to appraise the use of medicine as prescribed by a doctor, even though of the elderly diabetics that reported use of medicines just 4.7% of the cases involved use without prescription (data not presented).

Another methodological limitation occurred in analyzing the pharmaceuticals using theMicromedex®[16] database, which, owing to its US origin, does not present data on certain pharmaceuticals not regulated in the US but which are nevertheless prescribed and used in Brazil.This makes it impossible to analyze the total occurrences with pharmaceuticals on the same database.

Conclusions

The elderly diabetic needs specialized treatment and there is a need to raise the awareness of the patientregarding the importance of non-drug treatment, as well as the effects thereof on control of the disease.

There is a need, evidenced in this study and in the following list of bibliographic references, for attention to the potential risk of drug interactions, and also the use of medicines that are inappropriate for the elderly.

In the context of this scenario, it becomes necessary for pharmaceutical professionals, given the Pharmaceutical Clinical Model that advances throughout our nation, to contribute to more appropriate use of medicines, with greater concern for identification of the DIs highlighted in this study and other studies on the issue.

Hence, the results of this study, besides demonstrating the importance of the rational use of medicines for the elderly, reinforce the need for health education in terms of Primary Care, with recommendations for non-drug practices that will benefit the health of the elderly diabetic, so that there is an alignment of the strategies for confronting the disease in light of the rising demand on the part of elderly persons for healthcare services.

Collaborations

MAMB Prado and PMSB Francisco prepared the proposal and article, planned and programmed the statistical analyses and conducted the review of the literature. MBA Barros contributed to the critical review and wording of the text, and developed and coordinated the ISA-Camp project.

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