

Birth cohort differences in the use of medications in a Brazilian population of older elderly: the Bambuí Cohort Study of Aging (1997 and 2008)

Diferenças de coorte por nascimento no uso de medicamentos em uma população brasileira de idosos mais velhos: Estudo de Coorte de Idosos de Bambuí (1997 e 2008)

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Abstract

This study examined differences in the use of medications in two birth cohorts (born from 1916 to 1926 and from 1927 to 1937) among older elderly in the population-based cohort study in Bambuí, Minas Gerais State, Brazil. The study used data on participants who were 71-81 years of age in the baseline survey in 1997 (n = 492) and in the 11th wave, in 2008 (n = 620). The number of medications currently consumed (mean = 4.6 and 3.4, respectively) and prevalence of polypharmacy (46.6% and 29.1%, respectively) were higher in the more recent cohort as compared to the earlier one. These differences were independent of gender, age, schooling, number of medical visits in the previous 12 months, and number of chronic conditions. The more recent cohort showed significant differences in the use of psychoactive drugs, lipid modifying agents, drugs for diabetes, and antithrombotic agents, as well as changes in drugs used for arterial hypertension. In general, these changes are consistent with those observed in elderly populations in high-income countries.

Drug Utilization; Aged; Cohort Studies

Introduction

Brazil has experienced a rapid demographic change marked by population aging. From 1970 to 2000, the proportion of elderly (60 years or older) increased from 5.1% to 8.6% ¹, reaching 10% by 2009 (Departamento de Informática do SUS. *Informações Demográficas*. <http://tabnet.datasus.gov.br/cgi/tabcgi.exe?ibge/cnv/popuf.def>, accessed on 27/Oct/2010). With population aging, chronic health conditions gain greater visibility in the healthcare scenario, due to the increase in their prevalence and the presence of comorbidities ².

The high prevalence of chronic illnesses among the elderly is associated with high consumption of medications by this population group ³. In the elderly population, the risks associated with consumption of medications compete with the expected benefits, due to the physiological changes proper to aging, including the decrease in muscle mass and body water, with effects on the pharmacodynamics and pharmacokinetics of medications. Thus, unwanted effects (adverse effects and drug-drug interactions) are more likely to occur ⁴.

The prevalence of polypharmacy is high in the elderly ^{5,6,7}, and is one of the strongest predictors of health problems associated with use of medications ⁴. Polypharmacy is defined as the use of multiple medications, a basically quantita-

tive concept, which does not take the pertinence of their utilization into account⁸. The characteristics most consistently associated with polypharmacy are female gender, more advanced age, chronic illness, and greater utilization of health services^{6,7,9}. Increasing polypharmacy has been observed in elderly populations in high-income countries^{10,11}.

Studies in other countries^{12,13,14} and in Brazil^{15,16} have identified drugs for the cardiovascular system, central nervous system, metabolism, and alimentary tract as the most frequently consumed among the elderly. More recently, changes in the pattern of use of some drug classes have been observed in some populations, especially in the pattern of consumption of drugs for hypertension^{17,18}, as well as an increase in the use of lipid modifying^{5,17}, psychoactive^{19,20}, and antiepileptic drugs²¹.

In Brazil, pharmacoepidemiological studies have described the prevalence of polypharmacy and associated factors and the most widely consumed drug classes among the elderly population^{7,15,16}. However, to our knowledge, no study has been done on differences over time in drug use patterns in this population.

The current study used data from the baseline (1997) and the 11th wave (2008) from the Bambuí Cohort Study of Aging in order to investigate birth cohort differences in polypharmacy and the amounts and classes of drugs used.

Methodology

Study area and population

The Bambuí Cohort Study of Aging has been conducted in the city of the same name (with some 15,000 inhabitants), located in the State of Minas Gerais, in Southeast Brazil. The population for the baseline cohort was identified through a complete census of the city conducted in November-December 1996. Among the 1,742 residents 60 years or older on January 1, 1997, 1,606 participated in the baseline cohort. Since then, members of cohort have been followed up annually. From 1997 to 2008 (the 11th wave), 641 participants died, and only 6% were lost to follow-up. Further details have been published elsewhere^{22,23}.

All the participants in the baseline survey and 11th wave and with ages between 71 and 81 years, corresponding to the births in 1916-1926 and 1927-1937, respectively, were selected for the present study.

Data collection and study variables

Information on consumption of medications was obtained through home interviews, with verification of the product package and/or medical prescription. All the medications were identified, broken down according to their active ingredients, and classified according to the Anatomical Therapeutic Chemical (ATC) Index (World Health Organization Collaborating Centre for Drug Statistics Methodology. ATC/DDD Index 2011. http://www.whocc.no/atc_ddd_index/, accessed on Sep/2010). The current study used the classifications corresponding to levels 1 (anatomical) and 2 (therapeutic), considering over-the-counter and prescription drugs. The number of drugs consumed (counting variable) was truncated for the highest values (10 or more). Polypharmacy was defined as the use of five or more drugs^{7,24}.

The other study variables were gender, age, schooling (0-3 and ≥ 4 complete years), history of medical diagnosis for chronic illnesses (arterial hypertension, coronary disease – myocardial infarction and/or angina –, Chagas disease, diabetes, and arthritis/rheumatism), and number of medical consultations in the previous 12 months. The number of chronic conditions and number of medical consultations were dichotomized (exposure was defined as values greater than the median).

The data collection instruments and procedures were the same in the 1997 and 2008 surveys. The interviews were conducted by members of the community with more than 11 years of schooling and who were certified after training by the research team.

Data analysis

Data analysis was based on the Pearson chi-square test (for comparison of frequencies) and the Student t test (for comparison of means). Univariate and multivariate Poisson regression models with robust variance were used to estimate prevalence ratios and respective 95% confidence intervals (95%CI) to examine the factors associated with use of medications. Gender, age, schooling, number of chronic conditions or illnesses, and number of medical consultations in the previous 12 months were considered *a priori* confounding variables in these analysis, since they had been described previously as factors associated with the use of medications in the underlying population base for the Bambuí cohort^{6,25}. All the analyses used Stata, version 10 (Stata Corp., College Station, USA), with significance set at $p < 0.05$.

The Bambuí Cohort Study of Aging was approved by the Ethics Research Committee of the Oswaldo Cruz Foundation (Fundação Oswaldo Cruz), Rio de Janeiro, Brazil ^{22,23}.

Results

All 492 participants in the 1997 survey ranging from 71 to 81 years of age had information on the use of medications and were included in the present analysis. Of the 657 cohort survivors in 2008 and in the same age bracket, 620 (94.4%) had the corresponding information and were included in this study. Participants and non-participants were similar in relation to gender ($p = 0.106$), age ($p = 0.511$), and schooling ($p = 0.254$).

Table 1 shows some characteristics of the study participants in 1997 and 2008. No differences were observed between the two groups in terms of gender (60% and 64.5% were women, respectively) or mean age (75.1 years in both years). From 1997 to 2008, there were significant increases in schooling (29.7% and 39.2% had ≥ 4 years of schooling, respectively), prevalence of two or more chronic illnesses (41.2% and 54.1%, respectively), and number of medical visits in the previous 12 months (30.5% and 42% had four or more medical visits, respectively).

Prevalence of the use of at least one medication (88.8% and 93.6%, respectively), mean number of medications used (3.4 and 4.6, respectively), and prevalence of polypharmacy (29.1% and 46.6%, respectively) were higher in the more recent cohort as compared to the earlier one, as shown in Table 2. The association between birth cohort and number of medications consumed ($PR = 1.19$; 95%CI: 1.11-1.28) and prevalence of polypharmacy ($PR = 1.35$; 95%CI: 1.15-1.57) remained even after adjusting for age, gender, schooling, number of medical visits, and number of chronic illnesses. The association between birth cohort and use of at least one medication lost statistical significance after adjusting for these same variables ($PR = 1.03$; 95%CI: 0.99-1.06).

Table 3 shows the number of medications consumed in each cohort, stratified by gender and age bracket. Significant increases were observed in the mean number of medications used in the more recent cohort as compared to the earlier one, both among men (from 2.6 to 3.6) and women (from 3.9 to 5.1). These increases were observed consistently in the 71-75-year age bracket (from 2.0 to 2.7 in men and from 2.8 to 4.1 in women) and the 76-81-year bracket (from 2.5 to 2.9 in men and from 4.0 to 5.2 in women). Overall, the mean number of medications consumed was consistently higher among women in both cohorts.

Table 1

Selected characteristics of study participants. The Bambuí Cohort Study of Aging, 1997 and 2008.

Characteristics	1997 (n = 492) % or mean (SD)	2008 (n = 620) % or mean (SD)	p-value *
Gender			
Male	40.0	35.5	
Female	60.0	64.5	0.119
Age	75.1 (3.2)	75.1 (3.0)	0.995
Schooling (in complete years)			
0-3	70.3	60.8	
≥ 4	29.7	39.2	0.001
Number of chronic conditions **			
0-1	58.9	45.9	
≥ 2	41.2	54.1	< 0.001
Number of medical consultations in the previous 12 months			
0-3	69.5	58.0	
≥ 4	30.5	42.0	< 0.001

SD: standard deviation.

* p-value: Pearson chi-square test for differences between frequencies and Student t test for differences between means;

** History of medical diagnosis of hypertension, coronary disease (angina and/or myocardial infarction), diabetes, Chagas disease and arthritis/rheumatism.

Table 2

Use of medications by older elderly in the earlier cohort (born 1916-1926) and more recent cohort (born 1927-1937). The Bambuí Cohort Study of Aging, 1997 and 2008.

Use of medications	Earlier cohort (n = 491)	Recent cohort (n = 620)	Adjusted PR * (95%CI)	Adjusted PR ** (95%CI)	Adjusted PR *** (95%CI)	Adjusted PR # (95%CI)
Use of at least 1 medication (%)	88.8	93.6	1.05 (1.01-1.09)	1.05 (1.01-1.09)	1.04 (1.00-1.08)	1.03 (0.99-1.06)
Number of medications [mean (SD)]	3.4 (2.5)	4.6 (3.0)	1.31 (1.21-1.41)	1.31 (1.21-1.41)	1.24 (1.15-1.34)	1.19 (1.11-1.28)
Polypharmacy ## (%)	29.1	46.6	1.56 (1.33-1.83)	1.58 (1.35-1.85)	1.46 (1.25-1.71)	1.35 (1.15-1.57)

PR (95%CI): prevalence ratio (95% confidence interval) estimated by multivariate Poisson regression with robust variance.

* Adjusted by gender and age;

** Adjusted by gender, age, and schooling;

*** Adjusted by gender, age, schooling, and number of medical consultations;

Adjusted by gender, age, schooling, number of medical consultations, and number of chronic conditions/illnesses;

Use of five or more medications.

Table 3

Mean number of medications consumed by older elderly in the earlier cohort (born 1916-1926) and more recent cohort (born 1927-1937). The Bambuí Cohort Study of Aging, 1997 and 2008.

Gender/Age bracket (years)	Earlier cohort Mean (DP)	More recent cohort Mean (DP)	p-value *
Men			
71-75	2.4 (2.0)	3.3 (2.7)	0.003
76-81	2.8 (2.6)	4.1 (3.2)	0.003
Women			
71-75	3.9 (2.5)	5.0 (2.9)	< 0.001
76-81	4.0 (2.3)	5.2 (3.1)	< 0.001
All men	2.6 (2.3)	3.6 (2.9)	< 0.001
All women	3.9 (2.5)	5.1 (3.0)	< 0.001
p-value *	< 0.001	< 0.001	

SD: standard deviation.

* Student t test.

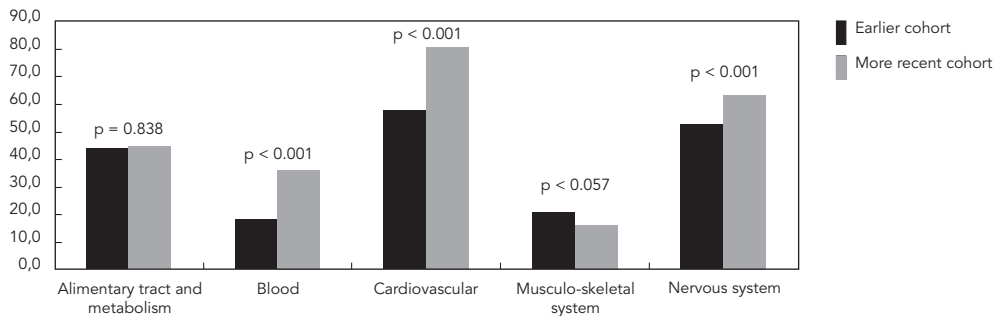
As shown in Figure 1, the most frequently consumed medications in both cohorts were those acting on the cardiovascular system (57.7% and 80.7%, respectively), followed by the nervous system (52.6% and 63.4%), and alimentary tract and metabolism (43.9% and 44.5%). The use of medications acting on the cardiovascular system (code C), nervous system (code N), and blood and blood forming organs (code B) was significantly higher in the more recent as compared to the earlier cohort. No statistically significant differences were observed between the two cohorts in the use of medications for the alimentary tract and metabolism (code A) or for drugs acting on the musculoskeletal system (code M).

As shown in Table 4, the five classes of medications (level 2 therapeutic classification) most widely used by the elderly in the older cohort were, in decreasing order: diuretics (29.1%), vitamins (25.6%), cardiac therapy (24.8%), psycholeptics (22.4%), and analgesics (19.5%). Among individuals from the more recent cohort, the highest prevalence rates were for consumption of agents acting on the renin-angiotensin system (48.2%), diuretics (41.6%), beta blocking agents (35.3%), antithrombotic agents (33.1%), and analgesics (26.3%).

Differences between the two cohorts (Table 4) also included significant increases in various medications acting on the cardiovascular

Figure 1

Use of medications by older elderly in the earlier cohort (born 1916-1926) and more recent cohort (born 1927-1937), according to level 1 of the Anatomical Therapeutic Chemical (ATC) Index *. The Bambuí Cohort Study of Aging, 1997 and 2008.



* World Health Organization Collaborating Centre for Drug Statistics Methodology (ATC/DDD Index 2011. http://www.whocc.no/atc_ddd_index/, accessed on Sep/2010).

Table 4

Use of medications by older elderly in the earlier cohort (born 1916-1926) and more recent cohort (born 1927-1937), according to level 2 of the Anatomical Therapeutic Chemical (ATC) Index *. The Bambuí Cohort Study of Aging, 1997 and 2008.

Medications (codes)	Earlier cohort	More recent cohort	PR (95%CI)
	%	%	
Cardiovascular system (C)			
Cardiac therapy (C01)	24.8	19.2	0.76 (0.61-0.95)
Antihypertensives (C02)	8.5	6.6	0.76 (0.50-1.14)
Diuretics (C03)	29.1	41.6	1.41 (1.20-1.67)
Beta blocking agents (C07)	6.1	35.3	5.71 (3.97-8.20)
Calcium channel blockers (C08)	13.2	18.9	1.40 (1.06-1.84)
Agents acting on the renin-angiotensin system (C09)	10.4	48.2	4.61 (3.51-6.06)
Lipid modifying agents (C10)	0.8	13.7	16.48 (6.09-44.57)
Nervous system (N)			
Analgesics (N02)	19.5	26.3	1.33 (1.06-1.65)
Antiepileptics (N03)	6.9	21.6	3.10 (2.17-4.42)
Psycholeptics (N05)	22.4	20.2	0.88 (0.70-1.10)
Psychoanaleptics (N06)	9.6	22.4	2.28 (1.68-3.10)
Alimentary tract and metabolism (A)			
Drugs used in diabetes (A10)	6.9	18.4	2.64 (1.83-3.80)
Vitamins (A11)	25.6	12.3	0.47 (0.36-0.61)
Musculo-skeletal system (M)			
Antiinflammatory and antirheumatic products (M01)	15.5	12.1	0.76 (0.57-1.02)
Blood and blood forming organs (B)			
Antithrombotic agents (B01)	17.5	33.1	1.88 (1.51-2.35)

PR (95%CI): prevalence ratio (95% confidence interval) estimated according to univariate Poisson regression with robust variance.

* World Health Organization Collaborating Centre for Drug Statistics Methodology (ATC/DDD Index 2011. http://www.whocc.no/atc_ddd_index/, accessed on Sep/2010).

system: lipid modifying agents (PR = 16.48; 95%CI: 6.09-44.57); beta blocking agents (PR = 5.71; 95%CI: 3.97-8.20); agents acting on the renin-angiotensin system (PR = 4.61; 95%CI: 3.51-6.06); diuretics (PR = 1.41; 95%CI: 1.20-1.67), and calcium channel blockers (PR = 1.40; 95%CI: 1.06-1.84); meanwhile, the use of cardiac therapy decreased significantly (PR = 0.76; 95%CI: 0.61-0.95). As for medications acting on the nervous system, there was an increase in the use of antiepileptics, psychoanaleptics, and analgesics, especially in the first two (PR = 3.10; 95%CI: 2.17-4.42 and PR = 2.28; 95%CI: 1.68-3.10, respectively). Medications acting on the alimentary tract and metabolism showed an increase in drugs used in diabetes (PR = 2.64; 95%CI: 1.83-3.80) and a decrease in the use of vitamins (PR = 0.47; 95%CI: 0.36-0.61). Finally, the more recent cohort showed an increase over the earlier cohort in the use of antithrombotic agents (PR = 1.88; 95%CI: 1.51-2.25).

Discussion

The current study's findings showed an important increase in the number of medications consumed and in the prevalence of polypharmacy in the more recent cohort as compared to the earlier cohort. The association between birth cohort and use of medications was not affected by age, gender, or schooling. Adjustments according to number of medical visits and number of chronic illnesses attenuated these associations, but they still remained statistically significant.

The results are consistent with findings in elderly populations in high-income countries. Studies in Finland and the United States have shown an increase in both the number of medications consumed by the elderly and polypharmacy^{10,11}. The explanations for this increase relate to socio-cultural and political issues linked to healthcare and technological advances in this area. This includes issues with a greater supply and expanded access to health services, greater participation by medications in healthcare, expansion of the therapeutic armamentarium, changes in treatment approaches, and prescription habits^{10,12}, in addition to growing availability of over-the-counter drugs²⁶.

In the current study, women in both cohorts used more medications than men. These findings are consistent with previous observations in studies both in Brazil¹⁶ and elsewhere^{9,13,14}. Greater use of medications by women can be explained, at least in part, by greater use of healthcare services, greater knowledge of medications, quantitative and qualitative differences in dis-

ease patterns, and greater attention to their own health problems¹⁶.

In the current study, the most widely used drug classes (cardiovascular, nervous system, alimentary tract and metabolism, blood and blood forming organs, and musculoskeletal system) reproduce a consumption pattern observed in elderly populations in different countries^{13,14} and in Brazil^{15,16}. The use of these drug classes relates to treatment and prevention of typical health events for this phase of life, like hypertension, coronary disease, diabetes, and chronic pain.

Considering the therapeutic classification, the study showed important differences between the two cohorts in the medications used for management of hypertension and more specifically, an increase in the use of beta blocking agents, agents acting on the renin-angiotensin system, diuretics, and calcium channel blockers. The increase in the use of medications is consistent with findings from other studies^{17,18} and the prevailing guidelines for treatment of hypertension²⁷, as well as Brazilian Ministry of Health (Ministério da Saúde) protocols for re-organization of treatment of hypertension²⁸. Importantly, there was an important increase in the use of lipid modifying agents, a trend also present in other populations^{5,17}, as well as in the use of antithrombotic agents. Both medications are used to decrease cardiovascular risk^{17,29}.

Among agents acting on the nervous system, there were important increases in the use of antiepileptics and psychoanaleptics in the more recent cohort. Recent increases have been observed in the use of antiepileptics in other elderly populations^{21,30}. The prevalence of epilepsy among the elderly is relatively low, varying from 1% to 3%^{31,32}. Thus, it is unlikely that increases in the incidence and/or prevalence of this condition would explain the increase from 7% to 22% in the use of antiepileptics in the current study. It is more likely that these medications are being used for other therapeutic purposes, such as pain relief, prevention of migraine, management of bipolar disorder, or neurological treatment of patients with a history of stroke^{21,30}. In addition, studies in high-income countries^{19,20} have shown an increase in the use of psychoactive drugs, both psychoanaleptics and psycholeptics³³. The current study showed an increase in the use of the former, but not the latter.

As for medications for the alimentary tract and metabolism, there was an increase of 2.6 times in the prevalence of drugs used in diabetes, which is consistent with the increase in the prevalence of diabetes mellitus among the older elderly in the Bambuí cohort³⁴. Meanwhile, there

was a decrease in the use of vitamins in the more recent cohort as compared to the earlier. Vitamins are viewed as maintaining overall health³ and as a source of essential nutrients, and their consumption has decreased in recent years as a result of changes in eating habits^{3,35}. They are commonly used in the absence of health problems and without a medical prescription³⁶ and concurrently with other prescribed medications, which increases the risk of drug-drug interactions⁵. Thus, and given the lack of evidence of the benefits of using such medications to prevent chronic illnesses³⁷, the decrease in prevalence of their use, as observed here, can be considered a positive trend.

This study has advantages and limitations. The advantages include its population-based design and the uniformity of its data collection procedures, making the data comparable, in addition to the small losses to follow-up, which reduced the probability of a non-participation bias. The response rate was high in both 1997 and 2008. In the first year, all the participants had information on the use of medications. In 2008, the corresponding response rate was somewhat

lower (94.5%). However, this appears not to have affected the results, since participants and non-participants were similar in terms of age, gender, and schooling. Finally, this study was done in a population of older elderly living in the city of Bambuí, and it may not be possible to generalize the results to other populations. Still, it is important to highlight that the most important findings were consistent with those in elderly populations in other countries.

In short, the current study's findings show important changes in the pattern of medication use in the more recent birth cohort as compared to the earlier one. The main differences were increases in the number of medications consumed, polypharmacy, psychoactive drugs, lipid modifying drugs, drugs used in diabetes, and antithrombotic agents, as well as changes in the drugs used to control hypertension. In general, these changes are consistent with findings in elderly populations in high-income countries. Further studies are recommended to examine the benefits or disadvantages of these changes for health conditions in the elderly.

Resumo

Foram examinadas diferenças de coorte (entre nascidos em 1916-1926 e em 1927-1937) no uso de medicamentos entre idosos participantes do Estudo de Coorte de Idosos de Bambuí. Foram utilizados dados dos participantes com 71-81 anos de idade da linha de base em 1997 (n = 492) e do 11º ano de seguimento em 2008 (n = 620). O número de medicamentos consumidos (média = 4,6 e 3,4, respectivamente) e a prevalência da polifarmácia (46,6% e 29,1%, respectivamente) foram mais altos na coorte recente, em comparação à antiga. Essas diferenças foram independentes do sexo, idade, escolaridade, número de consultas médicas e número de doenças crônicas. Na coorte mais jovem, observaram-se aumentos significativos no uso de psicofármacos, agentes modificadores de lipídios, hipoglicemiantes e antitrombóticos, assim como mudanças nos medicamentos utilizados para o controle da hipertensão arterial. De maneira geral, essas mudanças são consistentes com o observado em populações idosas de países de alta renda.

Uso de Medicamentos; Idoso; Estudos de Coortes

Contributors

A. I. Loyola Filho conceived the project, was responsible for the data analysis and interpretation, drafted the article, and approved the final version. J. O. A. Firmo participated in the data collection, interpretation of the results, and critical analysis of the article. E. Uchôa and M. F. Lima-Costa collaborated in the project's conceptualization, data collection, critical revision of the article, and approval of the final version.

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