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Walking and health care expenditures among adult users of the Brazilian public healthcare system: retrospective cross-sectional study

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Abstract *Physical inactivity is a major public health challenge due to its association with chronic diseases and the resulting economic impact on the public healthcare system. However, walking can help alleviate these problems. Aim: To verify associations between walking during leisure-time, risk factors and health care expenditure among users of the Brazilian public health care system. Methods: The sample consisted of 963 adults. Walking was evaluated using the Baecke questionnaire. The total expenditure per year was evaluated through the demand for health care services, verified in the medical records of each participant. Results: Walking was reported as a physical activity during leisure-time by 64.4% of the participants. The group with the highest engagement in walking was younger and presented lower values for BMI, WC and expenditure on medication. Participants inserted in the category of higher involvement in walking were 41% less likely to be inserted into the group with higher total expenditure (OR = 0:59; 95% CI 0.39-0.89). Conclusion: It was found that walking was the most frequent leisure-time physical activity reported by users of the Brazilian health care system and was associated with lower total and medication expenditure.*

Key words *Walking, Health care expenditure, Primary health care*

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Introduction

Physical inactivity is recognized as one of the greatest public health challenges of the 21st century due to its association with several noncommunicable diseases (NCDs) and other harmful effects to health[1]. It is estimated that 6% of heart disease, 7% of type 2 diabetes, 10% of breast and colon cancer and 9% of premature mortality worldwide are due to physical inactivity[2].

Besides increasing the risk of NCDs, studies have shown that physical inactivity can have a direct economic impact on the public health care system[3], significantly increasing medication consumption[4] and demand for medical services[5], varying from basic to high complexity.

Being characterized as an articulated network between primary, medium and high complexity health care, the Brazilian National Health System currently faces many problems, including the disorderly flow of people and the high and unscheduled demand for services, causing poor regulation of access to health care services by the population, especially in primary care, the gateway to health care services with high coverage in the country[6].

As an alternative, in order to reduce the burden of diseases, the development of policies and programs aimed at increasing physical activity at the population level have been prioritized[7], and among the types of physical activity, walking has the highest adherence rate. Walking is recommended for people with NCDs and/or the elderly, conditions that make them more susceptible to physical inactivity and functional limitation, in addition to being a low cost and widely accessible physical activity. Walking on a regular basis can provide several health benefits, among them, fitness, body composition and physiological improvements[8-10].

Due to its feasibility and the potential benefits that walking can provide as well as the growing economic impact of physical inactivity, the aim of this study was to determine, among users of the Brazilian National Health System, whether there are associations between walking during leisure-time, risk factors and expenditure related to health care services in primary care.

Methods

Study design, population and sample

This is a cross-sectional study with a retro-analytical component, conducted in the city of Bauru, Sao Paulo State, and approved by the Ethics Committee Group from the Universidade Estadual Paulista, Bauru campus, and the Ethics Committee Group of the Department of Health, Bauru/Sao Paulo State.

The present study was based on a larger study, which randomly selected a representative group of users of the Brazilian National Health System in Bauru – SP, Brazil (963 participants were randomly selected and interviewed)[11]. For this study, the nonexistence of previous parameters for this population were considered (walking among users of primary health care system), the sample size estimation equation was based on percentage values with an outcome of 50% (which generates the largest sample size in this type of equation). Added to the 50%, the following parameters were used; 3.5% error (arbitrary because there are no similar studies) and 5% statistical significance [$z = 1.96$ using a 95% confidence interval (95%CI)]. Finally, the minimum representative sample size for this study was set at 784 people. The inclusion criteria were defined as follows: i) being registered for a minimum of one year at the Basic Healthcare Unit (BHU); ii) aged ≥ 50 years; iii) having an active registration in the health care service (having scheduled at least one medical visit in the previous six months); iv) signing the standard written consent form.

Initially, in each of the five selected BHUs, the medical agendas were screened to identify all patients with at least one scheduled appointment in the previous six months. Next, the medical record numbers of the patients who met the inclusion criteria were inserted in a computer spreadsheet and 250 to 500 randomly selected from each BHU. This procedure was performed using the Statistical Package for Social Sciences (SPSS) software, version 13.0. All the selected patients were invited to attend the BHU interview[11]. The study was conducted from August to December 2010.

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Walking

Information regarding walking was extracted using the "physical activity during leisure-time" section of the Baecke[12] questionnaire, validated by Florindo and Latorre[13] for the Brazilian population. This section evaluates the frequency of walking during leisure-time with the following options: (i) never; (ii) seldom; (iii) sometimes; (iv) often; (v) always.

Healthcare expenditure

Healthcare expenditure per year was estimated, including all items registered in the medical records of the patients for one year prior to the date of the interview. The following data were gathered: medication dispensed, laboratory tests performed and number of medical consultations. To transform the procedures into currency, a specific standard table was provided by the Department of Health for the year 2012. For statistical procedures, expenditure was ranked and stratified into quartiles and the highest quartile (> P75) was adopted as the indicator of high healthcare expenditure[14].

Potential confounders

The face-to-face interviews and anthropometric measurements were performed in a quiet room at the BHU by a researcher. The following data were obtained through interviews and confirmed in the medical records, which, for statistical procedures, were dichotomized, as follow: (i) socio-demographic variables (sex [female or male] and chronological age [structured as categorical variable: < 65 years-old (adult) and ≥ 65 years-old (elderly)]); (ii) smoking habits [categorized as "yes" (current smokers independent of number of cigarettes per day) or "no" (former smokers or non-smokers)]; (iii) economic status, assessed using a specific and previously validated Brazilian questionnaire[15], which estimates the family income (dichotomized into either low or high income) and includes level of formal education; (iv) general obesity, identified through the body mass index (BMI), calculated using measurements of weight and height[16] and obtained by dividing weight by height squared (kg/m^2). Overweight was defined as BMI ≥ 25 kg/m^2 and obesity as 30kg/m^2; (v) abdominal obesity, identified by waist circumference (WC) with the cut-off point set at 1.02 meters for men and 0.88 meters for women[17]; (vi) blood pressure was measured in a seated position at rest and values lower than 120/80 mmHg for systolic (SBP) and diastolic blood pressure (DBP) were considered normal, respectively. Diagnosis of arterial hypertension was identified through the medical records of the participant.

Statistical analysis

Categorical variables were expressed as rates and the 95%CI calculated. The chi-square test analyzed the existence of associations between walking, risk factors and healthcare expenditure. Next, binary logistic regression was performed to identify the same associations adjusted by potential confounders. This procedure generated odds ratio (OR) and 95%CI values. Statistical significance was set at p-value ≤ 0.05 and all statistical analyses were performed using the software BioEstat (release 5.0). Adjustment of the multivariable models was identified using the Hosmer-Lemeshow goodness-of-fit test [non-significant results (p-value > 5%) indicated an adequate adjustment].

Results

Considering the total sample, 963 adults of both sexes were selected and interviewed (women 73.4% [95%CI: 70.6 to 76.2]) with ages ranging between 50 and 96 years (Table 1). Walking during leisure-time was reported as follows: 15.8% never (95%CI: 13.4% - 18.1%), 4.5% seldom, 13% sometimes, 2.4% often and 64.4% always (95%CI: 61.3% - 67.4%). The groups with a higher frequency of walking during leisure-time presented lower ages ("always" group 1.5% younger compared to the "never" group; p-value = 0.009), lower BMI values ("always" group values 1.4% lower compared to the "never" group; p-value = 0.019), WC ("always" group values 4% lower compared to the "never" group; p-value = 0.001) and medicine expenditure ("always" group 25.9% lower expenditure compared to the "never " group; p-value = 0.014). In the same groups it was also possible to identify lower occurrences of abdominal obesity ("never" group 75.1% [95%CI: 68.1% - 81.8%] and "always" group 66.3% [95%CI: 62.5% - 70.1%]; p-value = 0.003) and arterial hypertension ("never" group 83.6% [95%CI: 77.6% - 89.4%] and "always" group 74.8% [95%CI: 71.4% -78.2%]; p-value = 0.015).

In the analyzed sample, walking was not associated with higher expenditure on consultations,

tests or medication (all p-values > 5%). However, it was observed that higher engagement in walking was associated with a lower percentage of patients classified in the highest total expenditure group (p-value = 0.002) (Table 2).

Moreover, even after adjustment for potential confounders, it was identified that patients with the highest engagement in walking during leisure-time (when compared to patients inserted in the "Never" category) were 41% less likely to be in the highest quartile of total expenditure (OR = 0.59 [0.39 - 0.89]). The multivariate model also showed that obesity (BMI ≥ 30 kg/m²; OR = 1.32 [1.01 - 1.74]) and a diagnosis of arterial hypertension (OR = 2.07 [1.34 - 3.22]) remained associated with higher total expenditure, regardless of walking.

It is noteworthy that the created multivariate model explained 75.4% of variation related to outcome, and the Hosmer-Lemeshow goodness-of-fit test showed that all models were well fitted to the data (p-value > 5%) (Table 3).

Regarding expenditure according to frequency of walking, there was a significant difference

Table 1. General characteristics of the sample according to engagement in walking during leisure-time.

Variables	Never (n = 152) Median (IR)	Seldom (n = 43) Median (IR)	Sometimes (n = 125) Median (IR)	Often (n = 23) Median (IR)	Always (n = 620) Median (IR)	p-value
Age (years)	64.2 (17.5)	67.7 (13.4)	64.5 (13.6)	60.5 (16.6)*	63.3 (12.7)*	**0.009**
BMI (kg/m²)	28.7 (7.8)	30.3 (8.2)	28.9 (6.8)	30.3 (8.5)	28.3 (6.5)*	**0.019**
WC (cm)	101.9 (16.1)	103.2 (20.5)	99.6 (18.1)	96.5 (27.2)*	97.9 (16.6)*	**0.001**
SBP (mmHg)	130 (30)	120 (30)	120 (30)	120 (30)	130 (30)	0.869
DBP (mmHg)	80 (10)	80 (10)	80 (10)	70 (10)	80 (10)	0.539
Health expenditure (Reais [R$])						
Consultations	68 (49.5)	80 (56)	75 (48.5)	73 (45)	68 (47.5)	0.573
Tests	15.6 (40.8)	29.4 (53.5)	11.9 (46.1)	27.1 (50.7)	14.3 (41.1)	0.368
Medications	25.9 (48.8)	22.6 (52.8)	29.1 (47.6)	14.9 (23.5)*	19.2 (39.9)*	**0.014**
Total	124.2 (120.4)	134.6 (108.2)	138.3 (105.3)	104.9 (74.1)	121.8 (93.7)	0.074
General obesity (%)	42.1%	53.5%	43.2%	52.2%	38.2%	0.125
Abdominal obesity (%)	75.1%	79.1%	80.1%	69.6%	66.3%	**0.003**
AH (%)	83.6%	79.1%	80.1%	65.2%	74.8%	**0.015**
Female (%)	71.7%	81.4%	77.6%	73.9%	72.4%	0.619
Age ≥ 65 yrs (%)	49.3%	62.8%	48.1%	39.1%	42.1%	0.019

* = Statistical difference (p-value < 5%) when compared to group "never"; IR = Interquartile Range (P75 – P25); BMI = Body Mass Index; WC = Waist circumference; SBP = Systolic blood pressure

Table 2. Association between walking during leisure-time and healthcare expenditure in primary care.

Independent variable	Dependent variable: High expenditure in primary care			
	Consultations (≥ P75) N (% [95%CI])	**Tests (≥ P75)** N (% [95%CI])	**Medications (≥ P75)** N (% [95%CI])	**Total (≥ P75)** N (% [95%CI])
Walking during leisure-time				
Never	40 (26.3 [19.3-33.3])	33 (21.7 [15.1-28.2])	44 (28.9 [21.7-36.1])	**48 (31.6 [24.1-38.9])**
Seldom	15 (34.9 [20.6-49.1])	14 (32.6 [18.5-46.5])	13 (30.2 [16.5-43.9])	**14 (32.6 [18.5-46.5])**
Sometimes	34 (27.2 [19.4-35.1])	33 (26.4 [18.6-34.1])	36 (28.8 [20.8-36.7])	**39 (31.2 [23.1-39.3])**
Often	04 (17.4 [1.9-32.8])	08 (34.8 [15.3-54.2])	02 (8.7 [1.1-20.2])	**05 (21.7 [4.8-38.6])**
Always	149 (24.1 [20.6-27.4])	153 (24.7 [21.2-28.1])	146 (23.5 [20.2-26.8])	**135 (21.8 [18.5-25.1])**
χ^2 (p-value)	0.263	0.818	0.080	**0.002**

χ^2 = chi-square test; 95%CI = 95% confidence interval.

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between the median of the "always" group "and the cluster of the other groups for medication (5.9 Reais per patient; p-value for Mann-Whitney test = 0.012) and total expenditure (9.5 Reais per patient; p-value for Mann-Whitney test = 0.010).

Discussion

The main findings of the present study were: (i) a high adherence to walking as a leisure-time physical activity; (ii) the association of walking with lower expenditure on medication and a lower percentage of people engaged in walking classified in the highest total expenditure group. In addition, obesity and the diagnosis of arterial hypertension were associated with higher total expenditure regardless of walking.

Regarding the high adherence to walking, it was found that 64.4% of participants reported walking as a leisure-time physical activity. This finding is consistent with other studies conducted in Brazil that assessed physical activity patterns through a telephone survey, and found that 67.9% of men and 79.8% of women aged less than 45 years old walk for at least 30 minutes on five or more days per week[18]. In agreement with data from Brazil, an American study found that the prevalence of walking increased significantly from 2005 to 2010, being a common type of physical activity for 62% of the population[19]. These findings indicate that in Brazil and other countries, walking presents itself as an important manifestation of physical activity during leisure-time and thus should be considered as an important promotional agent of physical activity in adults.

Although walking has become popular among the adult population, this does not mean that the number of minutes performed by participants reaches the recommendations of the American College of Sports Medicine, which defines that health benefits can be achieved with an accumulation of at least 150 minutes of physical activity at moderate intensity during the week. In this sample, among subjects reporting walking with the frequency "always", only 19.5% (95%CI: 16.4% - 22.6%) met these recommendations. Likewise, the inclusion of this variable in the multivariate model did not affect the association between walking and health care expenditure (OR = 0.62 [0:41 - 0.94]) and did not increase the explanation power of the model (maintained at 75.4%). These findings demonstrate that, even when below current recommendations, walking can be associated with health benefits. Thus, for additional health benefits, public health strategies should provide the population with information on the current recommendations for walking, regarding optimal intensity, duration and frequency.

Moreover, it was found that participants engaged in walking presented a lower age, BMI and WC, corroborating the findings of CDC[19]. Contrary to these results, Malta et al.[18] observed an increase in walking levels with an increase in age for both sexes, with the explanation that, when older, physical activity motivation becomes more related to health maintenance than leisure practice[20]. However, it should be considered that the sample in the present study was composed of

Table 3. Adjusted association between walking during leisure-time and healthcare expenditure in primary care.

	Dependent variable: Total expenditures (≥ P75)		
	N (%)	OR (95%CI)	$OR_{adjusted}$ (95%CI)*
Walking during leisure-time			
Never	48 (31.6)	1.00	1.00
Seldom	14 (32.6)	1.04 (0.50-2.15)	0.92 (0.43-1.95)
Sometimes	39 (31.2)	0.98 (0.59-1.63)	0.98 (0.58-1.66)
Often	05 (21.7)	0.60 (0.21-1.71)	0.63 (0.21-1.89)
Always	135 (21.8)	**0.60 (0.40-0.89)**	0.59 (0.39-0.89)
$\chi 2$ (p-value)	0.002	---	---
Hosmer-Lemeshow (p-value)		---	0.286
Model's explanation		---	75.4%

95% CI = 95% confidence interval; χ^2 = chi-square test; OR = odds ratio; * = Multivariate model simultaneously adjusted by: BHU, age, sex, economic status, smoking habit, SBP, DBP, WC, BMI and AH.

people treated at BHUs of 50+ years old, unlike the sample in the Malta study[18].

Regarding the association between health care expenditure and walking, it was found that the most active group presented lower expenditure on medicine and was 41% less likely to be classified in the highest total expenditure group. Consistent with these findings, a Brazilian study showed that a one-year intervention of a guided walking program was able to reduce medication use by 25% and the outpatient expenditure among women with hypertension by 35%[21].

In this respect, Bertoldi et al.[4] found that insufficiently active individuals used 39% more medication compared to active participants, and, similarly, Codogno et al.[5] found that insufficiently active diabetic patients presented 63% more expenditure on consultations and 128% more on medication for the treatment of other diseases when compared to the active group.

Extrapolating data on economic impact and physical activity, an Australian study estimated that, if all inactive adults in the country walked for an hour a day at least five days a week, the annual savings would be A$419.9 million[22]. A similar study conducted in Pelotas/RS found that, if all citizens were active, savings to the Brazilian public healthcare system, including medication and hospitalizations from arterial hypertension and diabetes, would be approximately RS$2.2 million[3].

In the present sample, the median difference between the "always" group and the cluster of other walking groups for medication (R$5.9 per patient; p-value for Mann-Whitney test = 0.012) and total health care expenditure (R$9.5 per patient; p-value for Mann-Whitney test = 0.010) were significant. If we consider that the population of Bauru city includes 83,104 adults over 50 years old living in the urban area[23], of which 60% would be exclusively attended by the Brazilian National Health System (49,862 inhabitants) and 35.6% of these (17,751 inhabitants) are not engaged in walking in the "always" frequency, if all these patients became more active, i.e., reporting the frequency "always" in walking during leisure-time, the projected annual savings would be R$104,730.90 on medication expenditure and R$168,634.50 on total expenditure in primary care alone, without considering the demand for specialized care, the costs of which are potentially higher. It is important to mention that this sample is representative only of users of primary care in the city of Bauru/SP and, thus, implications for the general population cannot be assumed. On the other hand, even considering this limitation, this simple estimation, provides interesting information about the association between walking and lower health care expenditure in the general population.

It is also important to highlight the low percentage of participants reporting "always" walking that did not meet the recommendations for physical activity of moderate to vigorous intensity in the preceding four months[24,25], demonstrating that if this type of physical activity were better supervised, the observed associations could be strengthened.

With regard to obesity and arterial hypertension being associated with higher total expenditure, there is worldwide evidence confirming the findings of the present study. A Brazilian study on diabetes mellitus found that a higher BMI and waist-hip ratio were significantly related to higher expenditure on medications for chronic diseases other than diabetes[14]. In addition, Bahia et al.[26] found that estimated total costs in one year on all diseases related to overweight and obesity were US$2.1 billion, 68.4% being due to hospitalizations, and US$679,000 due to outpatient procedures. In our sample, medication use was significantly affected by walking and represented a total burden of 35% of total health expenditure. These findings indicate that interventions aimed at increasing physical activity levels during leisure-time could affect a significant portion of primary care costs.

Regarding the economic impact of hypertension, there is a consensus that the medical, monetary and human costs of untreated and/or inadequately controlled blood pressure are enourmous[27]. A population-based survey in southern Brazil showed that treatment for this disease costs around 23% of income per capita of hypertensive patients[28]. In addition, another study indicated that, in 2001, blood pressure above recommended levels cost US$370 million, which represented about 10% of total health care expenditure in the world[29]. In Brazil, the Ministry of Health has programs for the treatment of patients with hypertension and/or diabetes and increased access to medication, known as HiperDia[30] and Farmácia Popular[31]. Such initiatives increase knowledge on the epidemiological profile of these diseases in the country and give patients regular and systematic access to medicines, however, none of the programs have recommendations for physical activities, since inclusion of a physical education trainer is new in the context of the national health care system[32].

Thus, taking into account the highlighted benefits of walking to reduce mortality[33], its advantages for diabetic[34] and cardiovascular patients[35,36] as well as those with mental diseases[37], the gains in physiological components and functional capacity[8], in addition to the contribution of walking in reducing expenditure related to health care services[3], the stimulation of programs and actions to promote walking is recommended, since control of risk factors has been identified as a priority for the Brazilian government action plan[38].

The following can be considered limitations of the present study: i) the self-reporting of walking as a leisure-time physical activity, which may have been overestimated due to the high awareness of the importance of physical activity; ii) the lack of quantitative data on walking, since interpretation of the categories of perception "seldom, sometimes, often and always" can differ from person to person, and iii) the cross-sectional design, which does not establish causal relationships.

In conclusion, it was found that among the study population, there was an association between walking during leisure-time and lower expenditure on medication, as well as a lower percentage of walking participants entered in the highest total expenditure group. In addition, obesity and a diagnosis of hypertension were associated with higher total expenditure regardless of walking.

Collaborations

BC Turi worked collecting data, interpretation of results and paper writing; JS Codogno worked collecting data, interpretation of results and revising paper; RA Fernandes assisted with statistical analysis, interpretation of results and revising paper; HL Monteiro guided the research project, analysis and interpretation of results and final revision of the paper.

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