Who, When, and How Much?

Epidemiology of Walking in a Middle-Income Country

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Background: Physical inactivity is one of the leading causes of morbidity and mortality worldwide. Walking, an inexpensive and accessible activity, is protective against unhealthy outcomes. Little data on walking practices are available outside developed countries. This study estimated the prevalence and correlates of compliance with physical activity recommendations through leisure-time and all-domain (combined leisure time, commuting, and work-related) walking in individuals aged ≥20 years in a southern Brazilian city.

Methods: Data from two population-based surveys carried out in 2002 and 2003 in Pelotas, Rio Grande do Sul, were compared and analyzed in 2004. Multistage sampling procedures were undertaken in both surveys. Compliance with physical activity recommendations was defined as ≥150 minutes/week of walking during the previous week, although other cut-off points were estimated. The International Physical Activity Questionnaire was used in both studies.

Results: Samples comprised 3182 (2002 study) and 3100 (2003 study) individuals. Nonresponse rates were 5.6% and 3.5%, respectively. Both prevalence and correlates of leisure-time and all-domains walking were markedly different. Compliance with physical activity guidelines (≥150 minutes/week) through walking was 40.6% (all domains) and 15.0% (leisure time). Poor and uneducated participants had a lower likelihood of walking than higher-income and more educated people, particularly in leisure time. Walkers were also more likely to practice other vigorous and moderate-intensity activities.

Conclusions: Although the results derive from a single Brazilian city, they are likely to be relevant to similar environments/locales in middle-income countries, where the obesity epidemic is rapidly increasing. Due to the low levels of walking detected, particularly during leisure time, healthcare professionals are encouraged to recommend walking to their patients.
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Introduction

Although the benefits of physical activity were described >50 years ago, physical inactivity has become a global concern only the last decade.[1] At present, encouraging physical activity is a public health priority; for instance, a goal of the U.S. Department of Health and Human Services is to reduce the prevalence of physical inactivity to 20% of the population by 2010.[2] Walking is the most common physical activity both in developed[3] and developing countries.[4] It is an inexpensive and accessible activity for a large proportion of the general population. Furthermore, it is an effective intervention for improving health, since it has been shown that regular walking decreases the risk of type 2 diabetes, coronary heart disease, stroke, and all-cause mortality.[5–9]

Few studies have investigated the epidemiology of walking, and none of these was carried out in developing countries. While some focused only on leisure-time walking, others evaluated walking in all domains (work related, commuting, and leisure time). However, none of these linked the category of activity (leisure time vs all domains) with the correlates of walking. Data from two population-based studies in Pelotas, Rio Grande do Sul, a medium-sized city in southern Brazil, were used to (1) estimate the compliance with physical activity recommendations through walking, (2) investigate correlates of leisure-time and all-domains walking, and (3) explore relationships between walking and other physical activities.

Methods

Both samples included over 3000 individuals aged ≥20 years; sample selections are fully described elsewhere.[10] In brief, random samples of census tracts were selected, with the probability of selection proportionate to tract size. In each

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Table 1. Compliance with physical activity recommendation patterns in all-domains study and association with sociodemographic variables

Variable	Pattern 1 (%)	Pattern 2 (%)	Pattern 3 (%)	Pattern 4 (%)
Gender	$p=0.16$[a]	$p=0.02$[a]	$p=0.01$[a]	$p=0.001$[a]
Male	71.8	43.0	41.9	37.1
Female	74.3	38.8	37.4	31.2
Age (years)	$p=0.02$[a]	$p=0.19$[a]	$p=0.16$[a]	$p=0.12$[a]
20–29	77.9	41.3	40.0	35.7
30–39	71.0	41.2	39.8	33.0
40–49	73.4	40.7	39.2	34.4
50–59	73.5	43.3	41.7	35.3
60–69	73.9	40.7	40.6	33.3
≥70	63.9	31.4	30.2	26.0
Socioeconomic status	$p=0.35$[b]	$p=0.31$[b]	$p=0.48$[b]	$p=0.12$[b]
A (highest)	69.9	38.4	37.0	28.1
B	73.1	41.2	40.1	32.6
C	72.8	39.5	38.5	33.9
D	74.2	40.7	39.2	34.0
E	74.8	50.8	46.8	41.3
Education (years)	$p=0.002$[b]	$p=0.05$[b]	$p=0.03$[b]	$p=0.34$[b]
0	62.1	29.2	27.9	23.7
1–4	71.9	40.2	38.9	34.1
5–8	73.3	42.8	41.1	36.4
9–11	75.5	39.3	38.4	32.9
≥12	76.0	44.0	42.9	33.6
Overall	73.2	40.6	39.3	33.8

[a]Wald test for heterogeneity.
[b]Wald test for trend.
Pattern 1, any walking during the previous week; Pattern 2, ≥150 minutes of walking during previous week; Pattern 3, ≥150 minutes of walking, three or more times during previous week; Pattern 4, ≥30 minutes per day, five or more times during previous week.

sampled tract, systematic samples of households were selected. The study of all domains of walking (all-domains study) was carried out in the first half of 2002, while the leisure-time walking study (leisure-time study) was conducted in the second half of 2003. All analyses presented in this paper had power >90% to detect odds ratios of ≥1.25.

Both studies used the International Physical Activity Questionnaire (IPAQ) to evaluate physical activity.[11] However, as the names suggest, the first study addressed all domains of physical activity (using the short IPAQ), whereas the second one investigated only leisure-time activities (using the leisure-time section of the long IPAQ). Analyses were restricted to the frequency and duration of walking in the week before the interview. Activities performed for <10 consecutive minutes were not computed. In the all-domains study, the intensity of walking was assessed using the IPAQ activity-intensity gradations. This scale takes into account self-perception of breath and heart rate, and individuals are classified in one of the following groups according to the most frequent walking intensity in the week before the interview: fast, moderately fast, or slow.

The following interpretations of current recommendations[12,13] were used.

Pattern 1: Any walking in previous week
Pattern 2: ≥150 minutes/week of walking during previous week, regardless of frequency
Pattern 3: ≥150 minutes/week of walking on ≥3 days of previous week
Pattern 4: ≥30 minutes/day of walking on ≥5 days of previous week

The independent variables in this analysis were gender, age, schooling (years of formal education), socioeconomic status (SES) (according to the Brazilian National Agency of Research Institutes, which takes into account education of household head and household assets). Standardized and predefined cut-off points were used to classify households into SES groups A (highest), B, C, D, or E.

Trained interviewers carried out face-to-face interviews in the participant's home. Field supervisors re-visited a random sample of 10% of all interviewees to ensure quality control. All statistical tests took sample clustering into account, using the "svy" group of commands in Stata (Stata Corp, Version 7, College Station TX, 2001). The Wald statistic was used to calculate p values. Tests for trend were used when applicable.

The Ethics Committee of the Universidade Federal de Pelotas Medical School approved the protocols for both studies. Informed consent was obtained from each participant.

Results

Nonresponse rates were 5.6% and 3.5% for the all-domains study and leisure-time study, respectively. The first study included 3182 individuals, and the second study, 3100. Both samples matched current census data in terms of gender, age, and SES,[10] and were also very similar to each other. Men accounted for 43.3% and 43.2% of the all-domains and leisure-time study participants, respectively. Approximately 5% of all individuals were classified in the highest SES in both samples (4.6% and 4.8%, respectively). Average years of education were 7.4 in the all-domains study, and 7.7 in the leisure-time study.

Table 2. Compliance with physical activity recommendation patterns in leisure-time study and association with sociodemographic variables

Variable	Pattern 1 (%)	Pattern 2 (%)	Pattern 3 (%)	Pattern 4 (%)
Gender	$p=0.43$[a]	$p=0.29$[a]	$p=0.58$[a]	$p=0.97$[a]
Male	27.9	14.2	13.6	10.0
Female	29.2	15.5	14.3	10.0
Age (years)	$p=0.004$[b]	$p<0.001$[b]	$p<0.001$[b]	$p<0.001$[b]
20–29	28.4	10.7	9.4	6.5
30–39	24.2	13.2	12.3	7.8
40–49	25.9	14.4	13.1	9.0
50–59	31.6	20.1	19.5	13.2
60–69	39.4	20.9	20.5	17.9
≥70	31.1	17.4	17.3	14.5
Socioeconomic Status	$p<0.001$[a]	$p<0.001$[b]	$p<0.001$[b]	$p=0.006$[b]
A (highest)	41.6	25.5	24.2	10.1
B	38.2	20.0	18.7	13.6
C	26.1	14.1	13.5	10.0
D	25.0	12.0	11.1	8.3
E	22.7	11.6	10.1	7.1
Education (years)	$p<0.001$[a]	$p=0.005$[b]	$p=0.01$[b]	$p=0.28$[b]
0	24.2	11.2	11.2	8.5
1–4	22.8	12.8	11.9	8.7
5–8	25.6	14.2	13.2	10.3
9–11	32.1	16.2	15.4	10.7
≥12	38.7	18.8	17.3	10.5
Overall	28.7	15.0	14.0	10.0

[a]Wald test for heterogeneity.
[b]Wald test for trend.
Pattern 1, any walking during the previous week; Pattern 2, ≥150 minutes of walking during previous week; Pattern 3, ≥150 minutes of walking, three or more times during previous week; Pattern 4, ≥30 minutes per day, five or more times during previous week.

As mentioned previously, several criteria were used to describe patterns of walking. In the all-domains study (Table 1), 73.2% of participants reported any walking of ≥10 consecutive minutes in the previous week. As expected, the more rigorous the criterion, the lower the percentage of compliance. Men were more likely to achieve Patterns 2, 3, and 4. Elderly people were less likely to achieve Pattern 1, but other thresholds were similarly achieved across the age groups. Socioeconomic status was not significantly associated with any pattern, although it should be noted that an increase in the proportion of achievement of all patterns was observed from highest to the lowest categories. Education was positively related to Patterns 1, 2, and 3.

Table 2 shows the equivalent analysis for the leisure-time study. Overall, 28.7% of the subjects reported walking for ≥10 consecutive minutes at least once in the previous week. Gender was not associated with any pattern. Engagement in all patterns tended to increase with age until 70 years, and then a decline was observed. Both SES and education alone were strongly directly related to Patterns 1, 2, and 3. The most rigorous walking practice was not strongly related to socioeconomic indicators.

Table 3 explores the relationship between walking patterns and other (nonwalking) moderate- and vigorous-intensity physical activities. In the all-domains study, vigorous activity practice was more frequent among individuals with walking Patterns 2, 3, and 4. In the leisure-time activity study, vigorous-intensity physical activity was also consistently higher among walkers. In the all-domains study, individuals who walked were more likely to achieve the threshold of 150 minutes/week (based on physical activity score: minutes/week of moderate activity + minutes/week of vigorous activity × 2). These tendencies were stronger in the leisure-time study.

Table 4 shows effect sizes (odds ratios) of the variables associated with walking for ≥150 minutes per week regardless of weekly frequency (both studies). Trends for gender, age, and SES in the two studies were markedly different. The association between education and walking was similar in all domains.

As mentioned above, the intensity of walking was addressed in the all-domains study. The greater the age, the higher the proportion of slow walking, and the lower the proportion of fast and moderately fast walking. Next, the higher the SES, the lower the proportion of slow walking, and the higher the proportion of moderately fast and fast walking (data not shown).

Discussion

Rough differences might be found in terms of both the prevalence and correlates of physical activity, depending on whether only leisure time or all domains of activity are considered. This is particularly relevant in developing countries, where a substantial proportion of

Table 3. Compliance with PA guidelines according to walking patterns

	All-domains study				Leisure-time study			
	Vigorous PA		Moderate and vigorous PA		Vigorous PA		Moderate and vigorous PA	
Walking criteria	**%**	***p* value**	**%**	***p* value[a]**	**%**	***p* value**	**%**	***p* value[a]**
Pattern 1		0.32		0.11		**<0.001**		**<0.001****
No	27.8		47.6		8.2		11.2	
Yes	29.8		51.6		18.5		22.0	
Pattern 2		**0.002***		**0.003***		**<0.001****		**<0.001****
No	27.0		52.5		9.7		12.9	
Yes	32.6		44.9		19.3		22.3	
Pattern 3		**0.003***		**0.002***		**<0.001****		**<0.001****
No	27.0		52.5		9.6		13.0	
Yes	32.6		44.7		20.3		22.5	
Pattern 4		**0.001***		**0.003***		**<0.001****		**<0.001****
No	27.2		52.1		10.1		13.5	
Yes	33.2		44.4		20.1		21.1	

[a]Wald test for heterogeneity.
*$p<0.01$;
**$p<0.001$ (bolded).
PA, physical activity; Pattern 1, any walking during the previous week; Pattern 2, ≥150 minutes of walking during previous week; Pattern 3, ≥150 minutes of walking, three or more times during previous week; Pattern 4, ≥30 minutes per day, five or more times during previous week; vigorous PA, vigorous-intensity nonwalking physical activity for ≥60 minutes per week; moderate and vigorous PA, moderate- and vigorous-intensity nonwalking physical activity for ≥150 minutes per week (calculated as follows: minutes per week moderate activity + [minutes per week of vigorous activity × 2]).

physical activity occurs outside leisure time. Furthermore, policymakers should be aware of the correlates of both all-domain and leisure-time physical activities, so that interventions to increase levels of activity among various populations are better targeted.

Adherence to physical activity recommendations during leisure-time and all-domains walking in Pelotas, Brazil was quite similar to U.S. study results.[14,15] The prevalence of any walking found in this Brazilian leisure-time study (28.7%) was somewhat lower than in the U.S. study (38.6%) by Rafferty et al.[14] In the all-domains study, the prevalence of any walking was 73.2% in Pelotas, compared to 79.6% in the U.S. study by Eyler et al.[15] In the all-domains study in Pelotas,

Table 4. Variables associated with walking for at least 150 minutes per week

Variable	All-domains study OR (95% CI)	Leisure-time study OR (95% CI)
Gender		
Male	1.19 (1.03–1.38)	0.90 (0.75–1.09)
Female	1.00	1.00
Age (years)		
20–29	1.00	1.00
30–39	1.00 (0.81–1.23)	1.27 (0.92–1.76)
40–49	0.98 (0.78–1.23)	1.41 (1.03–1.93)
50–59	1.09 (0.84–1.42)	2.10 (1.52–2.90)
60–69	0.98 (0.73–1.31)	2.21 (1.50–3.24)
≥70	0.65 (0.47–0.91)	1.76 (1.21–2.57)
Socioeconomic status		
A (highest)	1.00	1.00
B	1.12 (0.68–1.87)	0.73 (0.47–1.14)
C	1.05 (0.65–1.70)	0.48 (0.32–0.72)
D	1.10 (0.67–1.82)	0.40 (0.27–0.60)
E	1.66 (0.94–2.92)	0.38 (0.20–0.74)
Education (years)		
0	1.00	1.00
1–4	1.63 (1.14–2.33)	1.16 (0.68–1.97)
5–8	1.81 (1.43–2.48)	1.32 (0.82–2.11)
9–11	1.56 (1.14–2.15)	1.53 (0.93–2.52)
≥12	1.90 (1.29–2.80)	1.83 (1.07–3.14)

CI, confidence interval; OR; odds ratio.

33.8% walked ≥30 minutes/day on ≥5 days per week, compared to 34.0% in the study by Eyler et al.[15]

Correlates of leisure-time and all-domains walking were markedly different. Men walked more than women in the all-domains study, but gender differences disappeared in the leisure-time study. Age was not clearly associated with all-domains walking, whereas it was strongly and positively related to leisure-time walking. It should be noted that both studies showed a decrease in the proportion of walking in individuals aged ≥70 years, which has been previously linked to retirement.[16] This hypothesis seems to have been confirmed, because the decrease in leisure-time walking is less marked than the decrease in all-domains walking. These age differences were slight for Pattern 1 (any walking in the previous week). One possible explanation is that young and middle-aged adults are more involved in work-related and commuting walking, which accounts for the greatest proportion of walking activity in Brazil. Another hypothesis would be that young and middle-aged adults engage in other activities in their leisure time, while older adults are encouraged by healthcare professionals to engage in light or moderate activity, such as walking.

Socioeconomic indicators showed interesting relationships with walking, particularly during leisure time. Physical activity is now a global concern, and information on its benefits is becoming available. It has been previously shown that higher-income people tend to adopt new public health messages earlier than low-income people.[17] This theory might explain why high-income and well-educated individuals present higher levels of compliance with physical activity guidelines, particularly during leisure time. In terms of all-domains walking, the pattern is different, and higher-income people are not more likely to realize walking recommendations. This result is consistent with previous research in Brazil,[10] and it means that leisure-time physical activity is more common among high-income people, but activity in other domains is more common among low-income people in Brazil. The analyses presented also show that besides walking less frequently, low-income individuals walk slower than higher-income individuals, therefore obtaining less protection against chronic diseases. These socioeconomic disparities might also reflect the likelihood that poor individuals have less knowledge about the benefits of physical activity, as recently shown in another Brazilian study.[18]

These socioeconomic differences are particularly important because chronic morbidity, such as hypertension and dyslipidemia, is becoming more prevalent among lower-income than among higher-income people in Brazil.[19–21] In addition, the studies in Pelotas, consistent with others, shows that risky behaviors—such as physical inactivity, smoking,[22] and alcohol abuse[23]—are more common among low-income people.

What This Study Adds . . .

Although previous studies have shown that walking reduces the risk of chronic diseases, the prevalence of walking is low in developed countries, and few studies are available for developing nations.

The epidemiology of leisure-time walking and walking for all purposes (all-domain walking) had not been compared previously.

Using data from two comparable population-based surveys carried out in the same Brazilian city, both the prevalence and the correlates of walking are shown to be markedly different according to domain.

One might be concerned that individuals who walk on a regular basis are less likely to engage in other types of moderate or intense physical activities, and thus fail to achieve recommended activity levels. The results in Table 4 suggest that this is not the case, because there was a positive association between walking and engaging in more vigorous types of activity. An Australian study[24] found that compliance with vigorous activity guidelines was positively related to recreational walking. A Brazilian study[25] found that individuals engaged in vigorous activities are also more engaged in moderate activities (including walking). All of these results indicate that practice of one kind of activity increases the likelihood of becoming engaged in other types of physical activity. Thus, concurrent promotion of diverse physical activities is warranted in terms of public health.

Although our results derive from a single Brazilian city, they are likely to be relevant to other locales in middle-income countries, where the "obesity epidemic" is underway.[26] Due to the low levels of walking detected in this study, particularly during leisure time, healthcare professionals are encouraged to recommend walking to their patients, as it has been previously shown that this inexpensive and accessible activity by itself decreases the likelihood of stroke, diabetes, coronary heart disease, and all-cause mortality.[5–9] An important initiative would be to include physical activity experts in Brazilian healthcare services in order to routinely and adequately prescribe physical activity for patients when necessary.

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