Personal and behavioral factors associated with bicycling in adults from Curitiba, Paraná State, Brazil

Fatores individuais e comportamentais associados ao uso de bicicleta em adultos de Curitiba, Paraná, Brasil

Factores individuales y comportamentales asociados con el uso de la bicicleta en adulto de Curitiba, Paraná, Brasil

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Abstract

Bicycling is an important form of physical activity that can promote health benefits. The objective of this study was to analyze the association between personal and behavioral aspects in transportation bicycling and leisure time bicycling in adults. Data was drawn from a household survey involving 677 adults (53.1% female) in Curitiba, Paraná State, Brazil. The prevalence of bicycling was 11.2% for transportation and 16.7% for leisure. The frequency of leisure time bicycling was higher among men (PR = 2.08; p < 0.001), young people < 30 and adults aged between 30 and 39.9, bicycle owners (PR = 8.76; p < 0.001) and among the physically active. Transportation bicycling occurred more frequently among men (PR = 3.63; p < 0.001), individuals aged 30 to 39.9, those with a low socioeconomic status (PR = 5.00; p = 0.006), bicycle owners (PR = 10.2; p < 0.001) and individuals with a negative perception of their quality of life. The prevalence of bicycling is low in Curitiba considering its potential as a means of physical activity. Personal and behavioral factors were associated with each form of bicycling.

Bicycling; Leisure Activities; Locomotion; Motor Activity

Resumo

Ciclismo é uma importante forma de atividade física, que pode promover benefícios para a saúde. O objetivo foi analisar a associação entre os aspectos pessoais e comportamentais no uso de bicicleta no transporte e no lazer em adultos. Pesquisa domiciliar envolvendo 677 adultos em Curitiba, Paraná, Brasil. A prevalência do uso de bicicleta foi de 11,2% para o transporte e 16,7% para o lazer. A frequência de uso de bicicleta no lazer foi maior entre os homens (RP = 2,08; p < 0,001), os jovens < 30 anos e adultos com idade entre 30 e 39,9, entre os proprietários de bicicleta (RP = 8,76, p < 0,001) e entre os fisicamente ativos. O uso de bicicleta no transporte foi maior entre os homens (RP = 3,63; p < 0,001), na idade entre 30 a 39,9, baixo nível socioeconômico, com os proprietários de bicicletas e com aqueles com percepção negativa da sua qualidade de vida. A prevalência de bicicleta é baixa em Curitiba considerando o seu potencial como um meio de atividade física. Fatores pessoais e comportamentais foram associados a cada forma de andar de bicicleta.

Ciclismo; Atividades de Lazer; Locomoção; Atividade Motora

Introduction

Bicycling has the potential to promote numerous health benefits, including better cardiorespiratory fitness and a decreased risk of developing cardiovascular disease [1,2] and being overweight or obese [3]. Moreover, this mode of transportation may help to reduce physical inactivity [4], which is a leading cause of death worldwide [5] and to reduce congestion, carbon emissions and the consumption of fossil fuels [6]. Despite these benefits, the use of the bicycle for transportation and leisure is low, both in high-income countries [7,8] and in low- and middle-income countries [9,10]. In Brazil, an estimated 8 to 16% of adults commute by bicycle [11], a prevalence similar to that of Canada [7,12,13] and Australia [8] but lower than in European countries [14,15,16]. The use of the bicycle in leisure time is one of the five most common forms of physical activity among Brazilian adults [17]. Data from other countries show a wide variation. For example, between 9.7 and 42% of adults report using a bicycle during leisure time in Australia [8,18,19], while one in of four adults in the United States and Europe do so [4].

In fact, personal, behavioral and environmental factors are associated with bicycling for leisure time and transportation [8,20]. In high-income countries, bicycling is more frequent among men [8,9,13,18], younger adults [12], low socioeconomic status groups [13,21] and those reporting good health [15]. However, data from low and middle-income countries is scarce. Economic and social aspects, such as a larger low income population [9,22], social norms that do not value the bicycle as a means of transportation, the aggressive behavior of drivers [19] and a lack of facilities for bicycling [23] may present challenges to the promotion of bicycling in these countries. To identify the correlates of bicycling will help to improve interventions, programs and policies aiming at promoting the adoption of bicycling [24]. Thus, this study aims to investigate the association of personal and behavioral traits with bicycling for transportation and leisure in adults from Curitiba, Paraná State, Brazil.

Methods

The results of this study are part of the ESPAÇOS Project [25] which was conducted in Curitiba, in 2010. The ESPAÇOS Project was a cross-sectional survey conducted in census tracts selected according to walkability and income characteristics. The study included 16 census tracts with high walkability (eight low-income and eight high-income census tracts) and 16 with low walkability (eight low-income and eight high-income census tracts). After power estimations a minimum sample of 22 individuals per census tract was adopted (n = 704 persons; 50% women). For the selection of households, all were visited and a total of 10,063 households were identified (average-314 ± 111 households per census tract). Within each census tract the households were systematically selected from a list of all eligible households. Among the selected participants (n = 704) a total of 699 participants (53.1% women), completed all interviews. The overall success rate was 66.4% and was higher in high-income census tracts (71.2% and 70.9%) compared to low-income ones (62.6% and 62.3%), while the overall refusal rate was 29.5%, which was similar between the strata (χ^2 = 5.09; p = 0.165). Further details about census tract selection, sample design and data collection can be obtained elsewhere [25]. Participants were adults aged between 18 and 65 years who had lived in the neighborhood for at least one year. Individuals with physical disabilities and domestic staff were ineligible for the study [25]. The study was approved by the Ethics Committee of the Pontifícia Universidade Católica do Paraná, Brazil (protocol n. 3034/2009).

Bicycling for transportation and leisure was assessed by self-report according to the frequency (days per week) and time (minutes per day) using the *International Physical Activity Questionnaire* (IPAQ) [26]. The questions were pilot-tested, and the test-retest agreement (95.5 and 97%) and intraclass correlation coefficient (0.82 and 0.74) were deemed suitable for the study.

The data collected included gender, age, marital status (single, separated, widowed, married, or living with a partner), children (yes/no), education (elementary school, high school or university degree), and work status (yes/no). Socioeconomic status was determined according to the assets within the household and family education [27] and was categorized into three levels (high, medium or low). The individuals were also asked about bicycle and car ownership (yes/no). Bicycling and walking for transportation and leisure time physical activity were assessed through the IPAQ-long version, which was validated for the Brazilian population [28]. The participants reported the frequency (day/week) and duration (minutes/day) of walking and moderate-intensity and vigorous-intensity physical activity. The physical activity level was obtained by summing the time for walking and moderate and vigorous physical activity (which is multiplied by two) [29]. The individuals were classified

as inactive (< 10 minutes/week), insufficiently active (10 to 149 minutes/week) or active (≥ 150 minutes/week) [29]. Finally, perceptions about quality of life and general health conditions were assessed using the *World Health Organization Quality of Life Instrument* (WHOQOL-8) [30].

Double data entry was used with Epidata 3.1 (Epidata Assoc., Odense, Denmark). Absolute and relative frequencies and the chi-square test were used to describe the sample. The associations between bicycling for transportation and in leisure time with the independent variables were analyzed using a Poisson regression. Initially, the association between each independent variable with bicycling outcomes was tested (bivariate analyses), and all variables were used in the multivariable models. All analyses were conducted using Stata 11.1 (Stata Corp., College Station, USA), and the final models considered a significance level of 5%.

Results

The study included 704 adults (53.1% female) between 18 and 65 years old (66.4% of success rate) [25]. After checking for missing data, 27 adults (3.8%) were excluded, and the final analytical sample was made up of 677 subjects. Bicycling for transportation and in leisure time was reported by 11.2% (95%CI: 9.0-14.0) and 16.7% (95%CI: 14.0-20.0) of the sample, respectively. Overall, men reported more frequent bicycling for transportation (19.1% men, 4.2% women; p < 0.001) and in leisure time (25.3% men, 9% women; p < 0.001) than did women. Additionally, men also reported higher bicycle ownership (49.1% men, 37.3% women; p = 0.002), socioeconomic status (13.4% men, 9.8% women; p = 0.011), car ownership (82.2% men, 70.9% women; p = 0.001), positive perception of quality of life (78.4% men, 67.2% women; p = 0.001) and positive perception of health (76.9% men, 67.2% women; p = 0.005) than did women. Other sociodemographic characteristics of the sample are presented in Table 1.

Overall, bicycling in leisure time was more frequent among men, young adults, bicycle owners, physically active individuals and those with a positive perception of their health (Table 2). In the multivariable analysis, bicycling in leisure time was higher among men (PR = 2.08; 95%CI: 1.66-2.60; p < 0.001), young adults (< 30 years old: PR = 2.03; 95%CI: 1.25-3.30; p = 0.006; 30.0 to 39.9 years: PR = 1.64; 95%CI: 1.02-2.62; p = 0.03), bicycle owners (PR = 8.76; 95%CI: 4.86-15,78; p < 0.001) and physically active individuals (PR = 2.41; 95%CI: 1.50-3.87; p = 0.001).

In the bivariate analysis (Table 3), most of the variables were associated with bicycling for transportation. After adjusting for all confounding variables, men (PR = 3.63; 95%CI: 2.45-5.35; p < 0.001), bicycle owners (PR = 10.2; 95%CI: 5.35-19.58; p < 0.001), those aged between 30 and 39.9 (PR = 1.68; 95%CI: 1.04-2.73; p = 0.034), those of low socioeconomic status (PR = 5.00; 95%CI: 1.65-15.17; p = 0.006), and those with a negative perception of their quality of life (PR = 1.59; 95%CI: 1.04-2.43; p = 0.033) reported using a bicycle for transportation more frequently.

Discussion

The results of this study demonstrate the personal and behavioral aspects that are associated with bicycling in Curitiba. The analyses were conducted for separate bicycling outcomes (e.g., leisure and transportation), which, to the best of the authors' knowledge, has not previously been explored in low or middle-income countries. Bicycling was more frequent for leisure than for transportation (16.7% for leisure, 11.2% for transportation; p < 0.001). Only one in five individuals (17.7%) demonstrated behavior related to the use of a bicycle as a form of physical activity in leisure time. This result is similar to that reported in Australia (19%) but lower than that found in the Netherlands (27.2%) [4,18]. The prevalence of using a bicycle for transportation (11.2%) was similar to that found in other studies in Brazil [11,31]; however, the prevalence was lower than in European cities (prevalence 39.7% to 67.5%) [4,16]. This difference may be attributed to environmental and social characteristics that can encourage or inhibit bicycling. For example, countries like the Netherlands and Denmark have a wide road network dedicated to bicycling that is integrated with the public transportation system [32]. Moreover, the availability of squares, parks and streets with bicycle path facilitates encourage the use of bicycling for leisure time [18,32]. On the other hand, in low- and middle-income countries, such facilities are not a priority [11]. Furthermore, social aspects such as a lack of public security are barriers for cyclists. For instance, one study found that a community's perception of dangerous surroundings was correlated with greater adult physical inactivity [33].

These aspects can significantly contribute to a lower use of bicycling during leisure time. In this study, men cycled for leisure time more often than did women. Evidence suggests that women perceived more barriers to physical activities [19] and activities of a moderate and vigorous intensity. Moreover, women report less confidence

Table 1

Characteristics of the study participants according to gender. Curitiba, Paraná State, Brazil (N = 677).

Variables/Categories	Male		Women		p-value	Total	
	n	%	n	%		n	%
Age (years)							
< 30.0	89	27.8	73	20.4	**0.013**	162	23.9
30.0-39.9	72	22.5	84	23.5		156	23.0
40.0-49.9	77	24.1	79	22.1		156	23.0
≥ 50.0	82	25.6	121	33.9		203	30.0
Marital status							
Single/Separated/Widowed	137	42.8	146	40.9	0.614	283	41.8
Married/Living with a partner	183	57.2	211	59.1		394	58.2
Children							
No	119	37.2	84	23.5	**< 0.001**	203	30.0
Yes	201	62.8	273	76.5		474	70.0
Socioeconomic status							
Low	103	32.2	147	41.2	**0.011**	250	36.9
Medium	174	54.4	175	49.0		349	51.6
High	43	13.4	35	9.8		78	11.5
Education							
Elementary school	79	24.7	117	32.8	0.084	196	29.0
High school	110	34.4	104	29.1		214	31.6
Higher education	131	40.9	136	38.1		267	39.4
Own bicycle							
No	163	50.9	224	62.7	**0.002**	387	57.2
Yes	157	49.1	133	37.3		290	42.8
Own car							
No	57	17.8	104	29.1	**0.001**	161	23.8
Yes	263	82.2	253	70.9		516	76.2
Quality of life							
Negative	69	21.6	117	32.8	**0.001**	186	27.5
Positive	251	78.4	240	67.2		491	72.5
Health perception							
Negative	74	23.1	117	32.8	**0.005**	191	28.2
Positive	246	76.9	240	67.2		486	71.8
Working status (days/week)							
Does not work	35	10.9	117	32.8	**< 0.001**	152	22.5
1-5	158	49.4	156	43.7		314	46.4
> 6	127	39.7	84	23.5		211	31.2
Physical activity							
Inactive	44	13.8	40	11.2	**0.002**	84	12.4
Insufficiently active	79	24.7	113	37.3		212	31.3
Active	197	61.6	184	51.5		381	56.3
Bicycling for transportation							
No	259	80.9	342	95.8	**< 0.001**	601	88.8
Yes	61	19.1	15	4.2		76	11.2
Bicycling during leisure time							
No	239	74.7	325	91.0	**0.001**	564	83.3
Yes	81	25.3	32	9.0		113	16.7

Note: values in bold indicate significant association: p < 0.05.

Table 2

Factors associated with bicycling during leisure time among adults. Curitiba, Paraná State, Brazil (N = 677).

Variables/Categories	Leisure time bicycling		Crude analysis			Adjusted analysis *		
	n	%	PR	95%CI	p-value	PR	95%CI	p-value
Gender								
Male	81	25.3	2.82	2.05-3.88	< 0.001	2.08	1.66-2.60	< 0.001
Female	32	9.0	Reference			Reference		
Age (years)								
18.0-29.9	39	24. 1	2.57	1.56-4.23	0.001	2.03	1.25-3.30	0.006
30.0-39.9	28	17.9	1.91	1.09-3.35	0.024	1.64	1.02-2.62	0.038
40.0-49.9	27	17.3	1.84	1.11-3.05	0.018	1.39	0.89-2.17	0.135
> 50.0	19	9.4	Reference			Reference		
Marital status								
Single/Separated/Widowed	54	19.1	1.27	0.90-1.79	0.161	1.1	0.74-1.64	0.613
Married/Living with a partner	59	15.0	Reference			Reference		
Children								
No	40	19.7	1.27	0.92-1.76	0.129	1.13	0.76-1.69	0.521
Yes	73	15.4	Reference			Reference		
Economic level								
Low	35	14.0	Reference			Reference		
Medium	62	17.8	1.26	0.87-2.44	0.137	1.07	0.65-1.75	0.762
High	16	20.5	1.26	0.90-1.77	0.158	1.01	0.49-2.11	0.957
Education								
Elementary school	29	14.8	Reference			Reference		
High school	35	16.4	1.10	0.69-1.75	0.660	1.04	0.67-1.63	0.830
Higher education	49	18.3	1.24	0.84-1.82	0.266	1.25	0.76-2.06	0.352
Own bicycle								
No	13	3.4	Reference			Reference		
Yes	100	34.5	10.26	5.80-18.14	< 0.001	8.76	4.86-15.78	< 0.001
Own car								
No	28	17.4	1.05	0.71-1.56	0.780	1.47	0.89-2.42	0.119
Yes	85	16.5	Reference			Reference		
Quality of life								
Negative	26	14.0	Reference			Reference		
Positive	87	17.7	1.26	0.83-1.92	0.257	0.79	0.50-1.26	0.323
Health perception								
Negative	22	11.5	Reference			Reference		
Positive	91	18.7	1.62	0.98-2.68	0.057	1.12	0.65-1.92	0.654
Working status (days/week)								
Does not work	22	14.3	Reference			Reference		
1-5	45	14.3	0.99	0.56-1.73	0.971	0.63	0.35-1.13	0.122
> 6	46	21.8	1.50	0.92-2.44	0.096	0.85	0.51-1.39	0.508
Physical activity								
Inactive	5	5.9	0.74	0.27-2.03	0.551	0.78	0.30-2.03	0.606
Insufficiently active	17	8.0	Reference			Reference		
Active	91	23.9	2.97	1.77-4.99	< 0.001	2.41	1.50-3.87	0.001

PR: prevalence ratio; 95%CI: 95% confidence interval.

* The analysis was adjusted for all other variables.

Note: values in bold indicate significant association: p < 0.05.

Table 3

Factors associated with bicycling for transportation among adults. Curitiba, Paraná State, Brazil (N = 677).

Variables/Categories	Bicycling for transportation		Crude analysis			Adjusted analysis *		
	n	%	PR	95%CI	p-value	PR	95%CI	p-value
Gender								
Male	61	19.0	4.53	2.49-8.24	< 0.001	3.63	2.45-5.35	< 0.001
Female	15	4.2	Reference			Reference		
Age (years)								
18.0-29.9	22	13.6	1.72	0.87-3.38	0.110	1.55	0.86-2.78	0.132
30.0-39.9	21	13.4	1.7	1.04-2.78	0.033	1.68	1.04-2.73	0.034
40.0-49.9	17	10.9	1.38	0.60-2.75	0.346	1.20	0.66-2.17	0.525
≥ 50.0	16	7.9	Reference			Reference		
Marital status								
Single/Separated/Widowed	36	12.7	1.25	0.78-1.99	0.332	1.28	0.94-1.75	0.118
Married/Living with a partner	40	10.1	Reference			Reference		
Children								
No	25	12.3	1.14	0.71-1.81	0.557	0.89	0.57-1.40	0.624
Yes	51	10.8	Reference			Reference		
Economic status								
Low	44	16.6	4.57	1.60-13.08	0.006	5.00	1.65-15.1	0.006
Medium	29	8.3	2.16	0.73-6.36	0.156	2.18	0.80-5.93	0.122
High	3	3.9	Reference			Reference		
Education								
Elementary school	33	16.8	2.8	1.50-5.25	0.002	1.35	0.68-2.68	0.368
High school	27	12.6	2.1	1.24-3.57	0.007	1.28	0.73-2.25	0.369
Higher education	16	6.0	Reference			Reference		
Own bicycle								
No	8	2.1	Reference			Reference		
Yes	68	23.4	11.34	5.65-22.74	< 0.001	10.2	5.35-19.5	< 0.001
Own car								
No	29	18.0	1.97	1.38-2.82	0.001	1.23	0.94-1.61	0.110
Yes	47	9.1	Reference			Reference		
Quality of life								
Negative	24	12.9	1.21	0.76-1.93	0.391	1.59	1.04-2.43	0.033
Positive	52	10.6	Reference			Reference		
Health perception								
Negative	64	13.2	Reference			Reference		
Positive	12	6.3	2.09	1.13-3.88	0.020	1.76	0.98-3.14	0.055
Working status (days/week)								
Does not work	16	10.5	1.27	0.61-2.62	0.506	1.59	0.95-2.65	0.071
1-5	26	8.3	Reference			Reference		
> 6	34	16.1	1.94	1.23-3.07	0.006	1.23	0.86-1.77	0.232
Physical activity								
Inactive	6	7.1	0.89	0.46-1.70	0.719	0.79	0.42-1.51	0.480
Insufficiently active	17	8.0	Reference			Reference		
Active	53	13.9	1.73	0.96-3.13	0.067	1.43	0.89-2.30	0.133

PR: prevalence ratio; 95%CI: 95% confidence interval.

* The analyses were adjusted for all other variables.

Note: values in bold indicate significant association: p < 0.05.

in navigating and maintaining bicycles than do men [19]. These aspects may partially explain why the young (aged between 18 and 39.9) reported more bicycling compared to other age groups, which is corroborated by the literature [13,18]. These findings may be related to lower physical fitness in the elderly, which may be explained by a decreasing confidence in bicycling with advancing age [34]. The results also show that physically active individuals had a higher rate of bicycling during leisure time [12,35]. Similar results were observed in this study in bicycling for transportation, which was more prevalent among men, and these results are supported by similar studies in Brazil [11,31] and other countries [8,9,19]. In part, these results may be explained by women's perceived vulnerability to criminals and violence [19].

Additionally, middle-aged adults (aged 30 to 39.9 years) reported a higher frequency of bicycling for transportation, which is corroborated by other studies [7,9,12,13]. One hypothesis is that middle-aged adults are more economically active, and bicycles are an efficient and inexpensive way of arriving at work [14,19]; however, the lack of information about travel destination prevents the testing of this hypothesis. The proportion of cyclists was higher among those with lower socioeconomic status, which is consistent with the literature [7,12,13,21] and supports the hypotheses presented above. The inverse association between bicycling and the perception of quality of life was unexpected. This result may be due to the positive relationship between income and cycling, which could indicate that low socioeconomic status individuals may be dissatisfied with their general living conditions, regardless of the use of the bicycle. Comparisons with the literature were limited because there is a paucity of work on this subject in low- and middle-income countries. Finally, the ownership of a bicycle was associated with bicycling for both transportation and leisure time, which is similar to results observed in other studies [9,18,35]. These findings, which are consistent with the literature, reinforce the importance of access to bicycles as a key step in encouraging their use. Furthermore, the association between bicycling for leisure and meeting physical activity guidelines suggests that bike use could represent an important contribution for adequate levels of physical activity. This is also an important contribution of this paper since most studies on bicycling have mainly analyzed bicycling for transportation.

The study has some limitations. The cross-sectional design does not allow for cause and effect to be established. The selection of census tracts in accordance with the levels of walkability and socioeconomic status of the neighborhood may not represent all sectors of Curitiba city. However, the selection of groups with high and low potential environmental and distinct socioeconomic status can minimize this bias. Furthermore, the prevalence of bicycling in the current study was similar to other surveys conducted in Curitiba [10,11]. Because only physical activity was included in this study other health behaviors should be included in future studies. The success rate of 66.4% was somewhat low, however it was even higher than the rates observed in similar studies [36,37]. Additionally, the city of Curitiba has structures for bicycling, such as bike paths connecting public parks, which may contribute to a higher use [38]. Thus, comparison with other cities in Brazil should be made with caution. Environmental factors were not available to be included in the analysis, although they represent important factors for bicycling. Because the survey used self-reported measures of bicycling, the prevalence may have been overestimated. Finally, no information was collected about the commuting distance (e.g. distance and destination), which may be an important confounding factor in the analysis; however, this factor was considered in a different study that showed similar results [22]. Therefore, it is concluded that Curitiba has less bicycling than European cities but rates similar to those of locations in North and Latin America.

The prevalence and factors associated with bicycling were specific to the type of use. It is recommended that programs to encourage bicycling focus on strategies to guarantee access to this modality, such as decreasing the price of bicycles and equipment and focusing more on women and older adults. Recently several tools have been identified to help implement changes to the Brazilian context for making it more conducive for physical activity [39]. The findings from this study highlight the need for such changes in order to promote bicycling in the community. At the individual level, it will be useful to identify the motivational factor and barriers to bicycling in the subgroups identified in this study to tailor interventions more effectively.

Resumen

El ciclismo es una forma importante de actividad física, que puede promover beneficios para la salud. El objetivo fue examinar la asociación entre los aspectos personales y de comportamiento en el uso de la bicicleta en el transporte y tiempo libre en adultos. Encuesta de hogares que implica 677 adultos en Curitiba, Paraná, Brasil. La prevalencia de uso de bicicleta fue de un 11,2% para el transporte y 16,7% para el ocio. La frecuencia de uso de bicicleta en el tiempo libre fue mayor entre los hombres (PR = 2,08; p < 0,001), individuos con un promedio de edad de 39,9 años, entre los propietarios de bicicletas (PR = 8,76; p < 0,001) y entre los físicamente activos. El uso de la bicicleta en el transporte fue más frecuente entre los hombres (PR = 3,63; p < 0,001), con edades entre 30 y 39,9, nivel socioeconómico bajo, con los propietarios de bicicletas (PR = 10,2; p < 0,001) y los que tienen una percepción negativa de calidad de vida. La prevalencia de la bicicleta es baja en Curitiba, teniendo en cuenta su potencial como un medio de actividad física. Los factores personales y conductuales se asocian con cada forma de ciclismo.

Ciclismo; Atividades Recreativas; Locomoción; Actividad Motora

Contributors

M. Kienteka participated in the data analysis and interpretation, drafting the article and transcription of results and final approval of the version to be published. R. S. Reis contributed in the design of the study, critical review of the manuscript, drawing up results and conclusion. C. R. Rech helped to draft the manuscript and to draw up the results and conclusion.

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