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Association between private and public places and practice of physical activity in adults

Associação entre locais públicos e privados e prática de atividade física em adultos

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Abstract – There are some studies that showed the relationship between built environment with practice of physical activity during leisure-time and active transportation in the adult population. However, this relationship may be influence by type and intensity of physical activity. The aim of this study was to verify association between public and private places for engaging in different types of physical activity in adults of Rio Claro City, Brazil. Cross sectional study with representative sample of 1588 adults with a mean age of 45.7±17.0 years completed the IPAQ-long form. Geographic Information System data were employed to assess the built environment. The time to different physical activity types were divided in actives (≥10 min/week) and inactive (<10 min/week). Poisson Multilevel Regression Analysis was performed in the Stata version 12.0. After adjusting for confounders, walking during leisure-time was positively associated with São Paulo's Social Vulnerability Index (SSVI) categories of 1 (PR=2.77) through 5 (PR=1.94) and negatively associated with population density higher than 68 km/m2 (PR=0.70). Vigorous intensity physical activity was negatively associated with distance greater than 596 meters of private places to practice physical activity (PR=0.50). Total leisure time physical activity was positively associated with SSVI 1 (PR=2.48) and 5 (RP=1.89). Moderate intensity physical activity was not associated with built environment factors. There were differents associations between the built environment factors with leisure time PA except to moderate intensity physical activity.

Key words: Adults; Environment; Epidemiology; Physical activity.

Resumo – *Há diversos estudos que verificaram a relação entre ambiente construído e a prática de atividade física no lazer e no transporte ativo na população adulta. Entretanto, essa relação parece ser influenciada pelo tipo e intensidade da atividade física. Objetivou-se verificar a associação entre locais públicos e privados para a prática de atividade física com diferentes tipos de atividade física em adultos da cidade de Rio Claro-SP/Brasil. Estudo transversal com amostra representativa de 1.588 adultos (45,7±17,0 anos) que responderam o IPAQ versão longa. Dados do sistema de informação geográfica foram utilizados para avaliar o ambiente construído. O tempo dos diferentes tipos de atividade física foi dividido em ativo (≥10 min/sem) e inativo (<10 min/sem). Foi realizada a regressão multinivel de Poisson no Stata versão 12.0. Depois de ajustado pelas variáveis de confusão, a caminhada no lazer foi associada positivamente com o Indice de Vulnerabilidade Social de São Paulo (IPVS) da categoria 1 (RP=2,77) à 5 (RP=1,94) e, negativamente, associado com densidade populacional maior que 68 km/m2 (RP=0,70). Atividade física vigorosa de lazer foi associada negativamente com distâncias maiores que 596 metros de locais privados para atividade física (RP=0,50). Atividade física total foi possitivamente associado com o IPVS 1 (RP=2,48) e 5 (RP=1,89) e, atividade física moderada não foi associada com nenhuma variável do ambiente construído. Houve associações distintas entre o ambiente construído e os tipos de atividades físicas, exceto para atividades de intensidade moderada.*

Palavras-chave: *Adultos; Ambiente; Atividade física; Epidemiologia.*

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INTRODUCTION

Many cross sectional studies have shown the relationship between availability (number of the facilities) and accessibility (distance to facilities) of physical activity (PA) facilities with practice of physical activity during leisure-time and active transportation in the adult population[1,2]. Studies have shown that the presence of places for PA are positively associated with higher levels of walking during leisure-time[3,4], increased use of facilities[5] and higher frequency of exercise[6].

McComarck et al.[5] demonstrated that for each additional private and public place to practice PA in the neighborhood there was an increase of 51% and 12% in the use of these places, respectively. Additionally, people who used these places showed more prevalence of moderate and vigorous intensity PA than people who did not use these places[4]. Further, the Halonen et al.[7] study showed that an increase distance to a facility was associated with decrease in MET hour in adults. However, studies that evaluate availability and accessibility through objective instruments have been shown less consistent reporting[8] and weak associations[9]. Futhermore, the association between built environment and PA may be different for each PA domain (leisure, transport, occupation and home) and type[1].

Study performed in Brazil show that the presence of a gym (private places) was associated with a higher prevalence of people who met the PA recommendations in relation to walking, moderate and vigorous intensity of PA[10]. However, international and nationals studies that demonstrate this relationship were carried out in cities with more than 500,000 inhabitants (large city)[11-14], such as Curitiba, which has more than one million inhabitants. In Brazil, larger cities have different cultural and environment characteristics in comparison to mediun and small cities. Further, most of them Brazilian studies used subjective instruments to assess the built environment only two studies used objective instruments to assessment built environment[10,15]. McCormack et al.[16] study suggests that the perceptions of the built enviroment are not well correlated with the objective measures of the built environment (e.g presence of parks, PA facilities, amenities, walking times and distance to several different destinations). Thus, the aim of this study was to verify the association between public and private places and PA types in adults of a medium sized city -Rio Claro-SP city Brazil- using objective measures of the built environment. From the results of this study, we hope to better understand the association between built environment and practice of PA in adults of a medium sized city.

METHODOLOGICAL PROCEDURES

The study was performed in the Rio Claro city that is situated in the Southeast of São Paulo state with territorial area of 1,498 km^2, a population of 187,637[17] and a Human Development Index of 0.825. Rio Claro is a medium city according to the Brazilian Institute of Geography and Statistics[18].

Subjects

A process of random sampling stratified by census tracts was used to select adult residents in the urban area of Rio Claro-SP. The city has 200 census tracts and in the present study all odd census (100) tracts were selected. In total, 1464 households were randomly selected. Of these, only 66% (960) were eligible for the study and the others had enrolment problems. The total number of households interviewed was 800 (83%), and approximately 1700 individuals aged 20 years or older were part of the data collection, with 17% of refusals (individuals who did not respond the questionnaire; reported lack of time; were not found in five attempts by the interviewers; presented health problems).

Dependent Variables

The IPAQ- long form was used to assess the frequency (per week) and duration of more than 10 minutes per week of walking, moderate intensity PA, vigorous intensity PA and total leisure time PA performed in the last week before the interview. The total leisure time PA was calculated using the equation suggestion by Hallal et al.[19]. The walking time during leisure time, moderate and vigorous intensities of PA and total PA in leisure time were classified into < 10 min/week (inactive) and ≥ 10 min/week (active) and were analyzed separately[11-13].

Independent variables

The 1.588 participants were geocoded by their residential address in ArcGIS version 10.0. The geographic information layers were obtained in two phases. First, we purchased the Google database of Rio Claro city that contains geographic information about streets, avenues and census tracts. Second, cycle paths, banks, churchs, schools, bus stations and private and public place to practice PA were geocoded using addresses obtained through the Departament of Planning Development and Environment, National Institute of Education Studies and Research, City Department of Education and Rio Claro Sports Department and internet sites.

The built environment indicators were classified to reflect availability and acessibility. The availability was determined by the number of facilities inside a 500 meters buffer from the participant's house[10]. Acessibilty was determined as the shortest distance in meters between the participant's house to a place to practice PA, both private (places that need paid fees, eg. fitness academy, recreation center and school sport) and public (places that do not need paid fees, eg. parks, churchs, school and public centers). Population density, i.e. inhabitants per square meter of each buffer of 500 meters, and São Paulo's Social Vulnerability Index (SSVI) were matched at the census tract level only. The SSVI provides a life's and poverty municipal conditions overview, geographic poverty distribution and a tool for policy evaluation in 645 cities of the State of São Paulo. This index was developed by the SEADE Foundation.

The availability of PA places was dichotomized into presence (≥ 1) and absence (0) of places inside in each area. Acessibility to private places were

dichotomized in < 594 meters and ≥ 595 meters and to public places was < 617 meters and ≥ 618 meters based on the mean distance from locations for this city. Theses variables were dichotomized because the data were highly skewed. The population density was classified into quartiles based on the city level distribution and the SSVI was categorized from 1 (low vulnerability) to 6 (high vulnerability)[20].

Covariates

Sex, age (20-39, 40-59 and ≥ 60 years of old), marital status (single, married, widowe/divorced), educational level (≥ 11, 8-10 and ≤ 7 years) and number of cars per home (0 and ≥ 1) were evaluated by questionnaire. Body Mass Index (BMI) (≤ 24.9, 25-29,9 and ≥ 30 kg/m^2) was calculated using self reported height and weight. These were entered as covariates in the analyses. These covariates were used because some studies showed the association between these variables with practice of PA in Brazil[10,12,14].

Statistical Analysis

To verify the relationship between physical activity in each type of physical activity and built environment variable was carried out the Poisson Mixed Regression Analysis and used a random effects. The individual characteristics of participants were added to the first model and in the second model the built environment variables were added. All analyses were performed through the Stata program version 12.0.

RESULTS

The total sample consisted of 1,588 participants, 57.7 % women, 40.3% of people with 20 to 39 years, 64.6 % married, 44.6% of the participants have more than 7 years of education, 64.8% have more than 1 car per home; 48.3 % with BMI ≤ 24.9. Related to the built environment the average of de population density (inhabitants/km^2) was 0.93; private places and pubic places were 0.96 and 0.52 (unit), respectively. Acessibility to private and public places were 842.3 and 634.7 meters, respectively (Table 1).

Table 1. Characteristcs of built environment. Rio Claro, Brazil (2007-2008)

Environment Variables	Unit	Average	Medium	SD	Min	Max
Population density						
Inhabitants/Km^2	Inhabitants/Km^2	0.93	0.31	2.34	0.09	22.6
Availability						
Private places	Unit	0.96	0	1.57	0	9
Public places	Unit	0.52	0	0.77	0	4
Accessibility						
Private places	Meters	842.3	595.7	747.2	4.8	3922.4
Public places	Meters	634.7	618.8	317.1	0	1862.8

SD= standard deviation Min=minimum Max= maximum

The individual level variables associated positively with walking during leisure time were: people who had more than 60 years of age had a 34% greater prevalence of walking than younger people (< 39 years old), widower or divorced had 42% more chance to do this exercise than single participants, and those over 11 years of schooling had a 54% greater likelihood of walking than people who had less than 7 years of schooling. Residents of SSVI categories of 1 (PR[95% Confidence Interval] 2.77[1.14-6.71]) and 5 (1.94[1.02-3.73]) showed higher prevalence of walking than people who lived in areas with SSVI 6. People who lived in areas with a population density higher than 0.68 km/m^2 (0.70[0.49-0.99]) showed lower prevalence of walking than people who lived in areas with less than 0.22 km/m^2 population densities. Further, the private and public variables were not associated with walking during leisure time (Table 2).

Table 2. Association of individual and built environment characteristcs with walking during leisure time. Rio Claro, Brazil (2007-2008).

Covariates	2- Loglikelihooh	Prevalence (%)	Crude PR (95% CI)	Adjusted PR (95% CI)
First Level				
Sex				
Women		57.9	Reference	Reference
Men		42.1	0.97 (0.78-1.20)	0.98 (0.79-1.22)
Age (years)				
20-39		33.2	Reference	Reference
40-59		40.5	1.25 (0.96-1.63)	1.16 (0.89-1.53)
≥60		26.0	1.64 (1.20-2.49)	1.34 (0.95-1.90)
blank		0.30		
Marital Status				
Single		14.5	Reference	Reference
Married		63.3	1.31 (0.94-1.82)	1.38 (0.90-2.11)
Widower/divo.		15.2	1.37 (0.89-2.08)	1.42 (1.01-1.98)
Education (years)				
≤ 7		51.7	Reference	Reference
8-10		17.2	1.31 (0.94-1.82)	1.28 (0.92-1.79)
≥ 11		31.1	1.74 (1.33-2.27)	1.54 (1.16-2.04)
Quantity of car per home				
0		29.0	Reference	Reference
≥ 1		68.0	1.14 (0.89-1.45)	1.06 (0.83-1.36)
blanks		3.0		
BMI (kg/m^2)				
≤ 24.9		42.6	Reference	Reference
25.0-29.9		39.4	1.20 (0.95-1.52)	1.22 (0.96-1.54)
≥ 30		16.9	1.06 (0.79-1.44)	1.08 (0.80-1.47)
blanks		1.1		
2- Loglikelihooh (individual)	855.06			
Second Level				
SSVI				
6		3.2		Reference
5		4.8		1.94 (1.02-3.73)

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Covariates	2- Loglikelihooh	Prevalence (%)	Crude PR (95% CI)	Adjusted PR (95% CI)
4		10.7		0.93 (0.43-2.01)
3		20.4		1.36 (0.69-2.67)
2		57.9		1.68 (0.86-3.25)
1		3.0		2.77 (1.14-6.71)
Population density (inhabitants/Km^2)				
0-0.22		25.2		Reference
0.23-0.31		29.0		0.84 (0.62-1.12)
0.32-0.67		26.2		0.87 (0.65-1.18)
≥0.68		19.6		0.70 (0.49-0.99)
Private places (number)				
0		52.0		Reference
≥ 1		48.0		1.04 (0.71-1.53)
Public places (number)				
0		62.5		Reference
≥1		37.5		1.07 (0.76-1.50)
Private places (meters)				
0-595		56.0		Reference
> 596		44.0		1.14 (0.76-1.70)
Public places (meters)				
0-618		50.0		Reference
>619		50.0		0.90 (0.77-1.70)
2- Loglikelihooh (individual+ environment)	845.4			

PR: prevalence ratio; * Adjusted for sex, age group, marital status, education, quantity of car per home and BMI.

The individual level variables which were positively associated with moderate intensity PA were males (1.40[1.11-1.79]), individuals with 8 to 10 years of schooling (1.91[1.35-2.72]), and individuals with over 11 years of schooling (1.59[1.07-2.36]). Individuals over 60 years old demonstrated lower prevalence of moderate intensity PA (0.63 [0.40-0.96]) than individuals younger than 39 years of old. The private and public variables were not associated with moderate intensity PA (Table 3).

Table 3. Association between individual and built environment characteristic with moderate intensity of physical activity. Rio Claro, Brazil (2007-2008).

Covariates	2- Loglikelihooh	Prevalence (%)	Crude PR (95% CI)	Adjusted PR (95% CI)
First Level				
Sex				
Women		47.0	Reference	Reference
Men		53.0	1.40 (1.10-1.77)	1.40 (1.11-1.79)
Age (years)				
20-39		51.3	Reference	Reference
40-59		35.9	0.90 (0.68-1.19)	0.85 (0.64-1.13)
≥60		12.5	0.73 (0.49 -1.10)	0.63 (0.40-0.96)
blanks		0.3		

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Covariates	2- Loglikelihooh	Prevalence (%)	Crude PR (95% CI)	Adjusted PR (95% CI)
Marital Status				
Single		27.0	Reference	Reference
Married		63.5	0.93 (0.69-1.25)	0.98 (0.72-1.34)
Widower/divo.		9.5	0.78 (0.48-1.27)	0.82 (0.50-1.33)
Education (years)				
≤ 7		61.8	Reference	Reference
8-10		18.4	1.64 (1.11-2.43)	1.59 (1.07-2.36)
≥ 11		19.7	2.08 (1.49-2.92)	1.91 (1.35-2.72)
Quantity of car per home				
0		27.0	Reference	Reference
≥ 1		69.1	1.15 (0.88-1.52)	1.11 (0.84-1.47)
blanks		3.9		
BMI (kg/m^2)				
≤ 24.9		52.6	Reference	Reference
25.0-29.9		33.2	0.96 (0.74-1.24)	0.96 (0.74-1.25)
≥ 30		12.8	0.81 (0.57-1.16)	0.80 (0.56-1.16)
blanks		1.3		
2- Loglikelihooh (individual)	733.59			
Second Level				
SSVI				
6		4.5		Reference
5		6.3		1.43 (0.74-2.78)
4		15.5		1.17 (0.53-2.54)
3		19.1		1.32 (0.67-2.60)
2		53.3		1.12 (0.57-2.22)
1		1.3		1.00 (0.27-3.69)
Population density (inhabitants/Km^2)				
0-0.22		21.7		Reference
0.23-0.31		27.6		1.00 (0.71-1.43)
0.32-0.67		25.0		1.04 (0.73-1.49)
≥0.68		25.7		1.10 (0.76-1.60)
Private places (number)				
0		51.0		Reference
≥ 1		49.0		1.06 (0.68-1.65)
Public places (number)				
0		19.3		Reference
≥1		18.9		1.05 (0.72-1.54)
Private places (meters)				
0-595		56.3		Reference
> 596		43.7		0.92 (0.63-1.34)
Public places (meters)				
0-618		49.4		Reference
>619		50.6		0.87 (0.55-1.38)
2- Loglikelihooh (individual+ environment)	729.93			

PR: prevalence ratio; *Adjusted for sex, age group, marital status, education, quantity of car per home and BMI.

Only men (1.96[1.36-2.82]) and those with over 11 years of schooling (1.72[1.00-2.96]) were positively associated with vigorous intensity PA. Individuals between the age of 40 and 59 (0.55[0.34-0.86]) and ≥ 60 years old (0.29[0.13-0.60]) showed less prevalence of vigorous intensity PA than individuals who were less than 39 years old. People who lived at a distance greater than 596 meters of private places to practice of PA (0.50[0.27-0.92]) showed lower prevalence of vigorous intensity PA than people who lived nearer to the private places to practice PA (Table 4).

Table 4. Association between individual and built environment characteristic with vigorous intensity of physical activity. Rio Claro, Brazil (2007-2008).

Covariates	2- Loglikelihooh	Prevalence (%)	Crude PR (95%CI)	Adjusted PR (95%CI)
First Level				
Sex				
Women		37.4	Reference	Reference
Men		62.6	1.90 (1.33-2.74)	1.96 (1.36-2.82)
Age (years)				
20-39		64.0	Reference	Reference
40-59		28.1	0.61 (0.39-0.95)	0.55 (0.34-0.86)
≥60		7.9	0.38 (0.19-0.78)	0.29 (0.13-0.60)
Marital Status				
Single		38.9	Reference	Reference
Married		54.0	0.71 (0.46-1.09)	0.77 (0.50-1.18)
Widower/divo.		7.1	0.71 (0.33-1.51)	0.73 (0.34-1.57)
Education (years)				
≤ 7		74.1	Reference	Reference
8-10		10.8	0.88 (0.44-1.78)	0.88 (0.44-1.79)
≥ 11		15.1	2.00 (1.17-3.40)	1.72 (1.00-2.96)
Quantity of car per home				
0		21.6	Reference	Reference
≥ 1		77.0	1.54 (1.00-2.39)	1.39 (0.89-2.17)
blanks		1.4		
BMI (kg/m^2)				
≤ 24.9		55.4	Reference	Reference
25.0-29.9		33.1	0.99 (0.67-1.45)	0.99 (0.67-1.45)
≥ 30		10.8	0.72 (0.40-1.28)	0.72 (0.40-1.27)
blanks		0.7		
2- Loglikelih (individ)	415.63			
Second Level				
SSVI				
6		1.4		Reference
5		3.6		3.43 (0.76-15.44)
4		13.7		1.66 (0.30-9.27)
3		20.1		2.77 (0.60-12.85)

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Covariates	2- Loglikelihooh	Prevalence (%)	Crude PR (95%CI)	Adjusted PR (95%CI)
2		59.7		2.47 (0.53-11.38)
1		1.4		3.10 (0.38-25.54)
Population density (inhabitants/Km^2)				
0-0.22		25.9		Reference
0.23-0.31		26.6		0.61 (0.36-1.02)
0.32-0.67		23.7		069 (0.40-1.18)
≥0.68		23.7		0.71 (0.40-1.25)
Private places (number)				
0		48.9		Reference
≥ 1		51.1		0.72 (0.42-1.26)
Public places (number)				
0		70.5		Reference
≥1		29.5		1.53 (0.87-2.70)
Private places (meters)				
0-595		63.3		Reference
> 596		36.7		0.50 (0.27-0.92)
Public places (meters)				
0-618		43.2		Reference
>619		56.8		0.85 (0.40-1.43)
2- Loglikelihooh (individ+ environment)	405.90			

PR: prevalence ratio; *Adjusted for sex, age group, marital status, education, quantity of car per home and BMI.

For total leisure time PA the individual level variables positively associated were: men (1.27[1.07-1.51]), people who had from 8 to 10 years of schooling (1.38[1.05-1.80]) and over 11 years of schooling (1.69[1.34-2.13]). For built environment variables, people who lived in areas with SSVI 1 (2.48[1.18-5.23]) and 5 (1.89[1.20-3.19]) showed higher prevalence of leisure time PA than people who lived in areas with SSVI 6. However, the private and public variables were not associated with total leisure time PA (Table 5).

Table 5. Association between individual and built environment with total leisure time physical activity. Rio Claro, Brazil (2007-2008).

Covariates	2- Loglikelihooh	Prevalence (%)	Crude PR (95% CI)	Adjusted PR (95% CI)
First Level				
Sex				
Women		50.4	Reference	Reference
Men		49.6	1.25 (1.06-1.48)	1.27 (1.07-1.51)
Age (years)				
20-39		42.6	Reference	Reference
40-59		37.1	1.02 (0.83-1.25)	0.96 (0.78-1.18)
≥60		20.1	1.18 (0.92-1.53)	0.98 (0.74-1.30)
blanks		0.2		

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Covariates	2- Loglikelihooh	Prevalence (%)	Crude PR (95% CI)	Adjusted PR (95% CI)
Marital Status				
Single		22.0	Reference	Reference
Married		64.5	1.01 (0.80-1.27)	1.05 (0.84-1.34)
Widower/divo.		13.5	1.01 (0.74-1.40)	1.05 (0.76-1.46)
Education (years)				
≤ 7		57.1	Reference	Reference
8-10		17.3	1.40 (1.07-1.84)	1.38 (1.05-1.80)
≥ 11		25.6	1.86 (1.49-2.32)	1.69 (1.34-2.13)
Quantity of car per home				
0		28.5	Reference	Reference
≥ 1		68.2	1.13 (0.94-1.37)	1.07 (0.88-1.30)
blanks		3.3		
BMI (kg/m^2)				
≤ 24.9		47.4	Reference	Reference
25.0-29.9		36.3	1.07 (0.89-1.29)	1.08 (0.90-1.30)
≥ 30		15.3	0.97 (0.76-1.23)	0.96 (0.76-1.23)
blanks		1.0		
2-Loglikelihooh (individual)	1101.95			
Second Level				
SSVI				
6		3.3		Reference
5		6.0		1.89 (1.20-3.19)
4		13.8		1.29 (0.71-2.35)
3		19.1		1.65 (0.97-2.81)
2		55.4		1.53 (0.90-2.61)
1		2.3		2.48 (1.18-5.23)
Population density (inhabitants/Km^2)				
0-0.22		24.0		Reference
0.23-0.31		28.2		0.88 (0.70-1.13)
0.32-0.67		25.3		0.91 (0.72-1.17)
≥0.68		22.5		0.87 (0.69-1.13)
Private places (number)				
0		51.4		Reference
≥ 1		48.6		0.95 (0.71-1.12)
Public places (number)				
0		61.9		Reference
≥1		38.1		1.06 (0.81-1.38)
Private places (meters)				
0-595		57.1		Reference
> 596		42.9		0.88 (0.65-1.21)
Public places (meters)				
0-618		50.1		Reference
>619		49.9		0.89 (0.69-1.16)
2-Loglikelihooh (individual+ environment)	1092.97			

PR: prevalence ratio; *Adjusted for sex, age group, marital status, education, quantity of car per home and BMI.

DISCUSSION

The results of this study showed that built environment variables were associated with PA, however this association was different for each type of PA. The SSVI is an index that helps to identify census tracts that have populational segments that are more vulnerable to poverty evaluated by socioeconomic status and familial life cycle. The economic status of a census tract is very important because it has been associated with mortality[21], general health[22] and cardiovascular diseases[23]. In the presente study, it was verified that people who live in places with SSVI 1 and 5 showed higher total leisure time PA and SSVI 1 showed higher prevalence of walking during leisure time when compared with people who lives in SSVI 6 areas. People from SSVI 1 and 5 living in families with head of household elderly and without children while people from SSVI 6 living in families with head of household young with children[20]. Thus, these people can do more physical activity during leisure time when compared with people who have a children[24]. Also, people who live in SSVI 6 have lower neighborhood socioeconomic level. Boone-Heinonen et al.[25] performed a longitudinal study to verify the association between neighborhood socioeconomic level with PA. They used data from 5115 adults who participated in the Coronary Artery Risk Development in Young Adults (CARDIA) study. After adjusting for sex, individual economic level, educational level, number of children and marital status it was found that low economic neighborhoods showed less practice of leisure time PA in the USA. In the Gerber et al.[26] study they showed that patients with myocardial infarction who live in areas with low socioeconomic level engaged in less leisure time PA.

People who lived in areas with higher population density showed less prevalence of walking during leisure time. This result is the opposite from the results found in the international literature that shows that higher population density is associated with higher prevalence of PA[2]. The land use mix of rich countries is likely very different to Latin America countries. According to your data, the regions that had higher population density (≥0.68) showed higher prevalence of high vulnerability (41.04%) than compared with regions that had lower population density (≤0.31) (13.57%). In Brazil, regions with high vulnerability have high prevalence of violence[20]. According to Arango et al.[27] low perception of security is associated with low prevalence of PA during leisure-time. Thus, the high vulnerability and the low perception of security in regions with high population density may be explaining the difference between results from rich countries compared with results from Brazil.

People who lived nearer to the private places for practice of PA showed a higher prevalence of vigorous intensity PA, a similar result to the McComarck et al. studies[2,5], and Hino et al[10] studies. The Hino et al.[10] study showed that people who lived close to private places to practice PA were more likely to perform vigorous intensity PA than people who lived far from these places. Further, quality of the equipment and the aesthetic

might explain the lack of association between public places and PA[6,10]. However, the better quality of equipments of private places to PA might explain the association with vigorous exercise, because these equipments help to do this kind of exercise.

The results also did not agree with the Sallis et al.[6] study that showed that the number of private places to practice PA was more important than the distance from these places. This difference could be due to differences in the regions size. Rio Claro is a midsize city (498.008 km^2) and San Diego is a large city (964.5 km^2) and the quantity of private places in Rio Claro is lower than the large cities. In this way, the distance may be more important than availability in small city. According to Gogel[28] the perceived space become lower when increases the distance of observation. Thus, people who live in small and midsize cities may also have differences in the perception of distance when compared with people who live in large cities. In this way, people who live in midsize cities may be more influenced by acessibility than availability of places to practice PA.

In the present study, moderate intensity PA was the only type that did not show an association with built environment factors (Table 3). This result is in agreement with Oliver et al[29] that did not found any association between moderate physical activity and built environment. This lack of association can be because we evaluated only the presence of the places to practice physical activity and may be necessary assessing detail about these places (aesthetics or quality). McComarck & Shiell[2] study easy access to places for PA was positively associated with moderate PA among women. Having many shops and places within walking distance of homes was also positively associated with moderate PA among women however; reporting sidewalks on most neighborhood streets, and crime rate in the neighborhood were negatively correlated with moderate PA. This difference between the results can be explained by the use of different instruments to evaluate the built environment. In the present study and the Oliver et al.[29] study, objective instruments were used whereas in the McComarck et al.[30] study, subjective instruments were used to evaluate the built environment.

Limitations of the study include: use the objective measures without verify the perceived of the subjects about the private and public places to PA, do no use the number of inhabitants per area in each census tracts to determine the number of participants, do no use the walkability index to verifiy the relationship with walking and moderate exercise, use the SSVI as built environment charatheristc that caused a problem in the internal validation study (higher values in the interval confidence) and used cross-sectional study desing that causes limits causal inference. Further, despite our use of a validated instrument, the tool has limitation inherent of self-reported measures. However, the sample of this study included residents from diverse areas of the Rio Claro city and each residence was geocoded allowing the analysis of the environment around each participant's place of residence.

CONCLUSION

There were associations between the built environment factors with leisure time PA except to moderate intensity PA. Furthermore, people who live far from private places to practice PA showed less prevalence to practice vigorous intensity PA. Thus, public policies need to consider how the built environment influences PA to create interventions that can promote PA during each type of PA during leisure time.

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