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FATORES DO AMBIENTE ASSOCIADOS COM ATIVIDADE FÍSICA DE DESLOCAMENTO E LAZER EM ADOLESCENTES DE PORTO ALEGRE-RS

Porto Alegre
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Orientador: Prof. Adroaldo Cezar Araujo Gaya.

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“...Não é sobre chegar no topo do mundo e saber que venceu

É sobre escalar e sentir que o caminho te fortaleceu...”

(Ana Vilela)

RESUMO

O objetivo geral foi identificar as possíveis associações entre a atividade física (AF) de deslocamento e lazer com os fatores do ambiente em adolescentes brasileiros. Nesse sentido, os objetivos específicos são: (1)analisar a associação entre o deslocamento ativo para escola (DAE) com medidas percebidas e objetivas de fatores ambientais do bairro, bem como avaliar a influência do nível socioeconômico (NSE); (2)verificar se a densidade residencial, conectividade entre as ruas e índice de walkability são mediadores da associação entre os fatores ambientais percebidos e o DAE; (3)verificar as associações entre a caminhada de lazer (CL) com medidas percebidas e objetivas de fatores ambientais do bairro estratificados por sexo e NSE; e (4)verificar se a percepção de segurança atua como mediadora na associação entre a distância de casa até o parque mais próximo e o uso dos parques para AF. Estudo de corte transversal desenvolvido com 1130 adolescentes (47,3% meninos) na cidade de Porto Alegre-Brasil. AF foi avaliada através de questionário. Os fatores do ambiente foram mensurados pelo "Neighborhood Environment Walkability Scale for Younth" (NEWS-Y) e Sistema de Informação Geográfica pela rede de ruas nos buffers de 0,5km e 1,0km em torno do endereço residencial dos estudantes. As análises foram realizadas por regressão linear generalizada. O primeiro artigo indicou que DAE foi associado com o uso misto do solo, instalações de recreação no bairro, existência de parques/praças (buffer de 0,5km), existência de ciclovias e densidade residencial (buffers de 0,5km e 1,0km). A existência de ciclovias foi associada com DAE em todos NSE para ambos buffers. O uso misto do solo e instalações de recreação no bairro foram associados com DAE apenas no NSE médio. Ainda, foi encontrada associação entre o uso misto do solo com DAE no buffer de 0,5km no NSE baixo e alto. Já o segundo artigo demonstrou que a densidade residencial é um mediador da associação entre instalações de recreação no bairro, acesso e estética com DAE. O índice de walkability é um mediador da relação entre o uso misto do solo, instalações de recreação no bairro e acesso com DAE. Com relação a AF no lazer, o terceiro artigo evidenciou as mesmas associações tanto nos buffers de 0,5km quanto nos de 1,0km. Para as meninas do NSE baixo, o acesso e menor distância para parques/praças foram positivamente associados com CL. Densidade residencial e walkability foram associados com CL em meninas de NSE médio. Com relação aos meninos, foi encontrado uma associação inversa entre segurança do crime com CL no NSE baixo. Instalações de recreação no bairro foi associada com CL no NSE médio. Uso misto do solo, instalações de recreação no bairro e locais para caminhar foram associados com CL no NSE alto. O último artigo apontou que a percepção de segurança nas ruas é um mediador explicando 16% da associação entre uso do parque e distância de casa até o parque. A principal conclusão é que esses resultados podem auxiliar em estratégias de políticas públicas afim de incentivar a prática de AF e promoção da saúde.

Palavras-Chave: ambiente construído; percepção do ambiente; atividade física de transporte; caminhada no lazer; saúde pública; jovens.

ABSTRACT

The general aim was to identify the possible associations between commuting and leisure physical activity (PA) with environment factors in Brazilian adolescents. In this sense, the specific aims are: (1) to analyze the association between active commuting to/from school (ACS) with perceived and objective measures of neighborhood environmental factors, as well as to evaluate the influence of socioeconomic status (SES); (2) to verify whether residential density, connectivity between streets and walkability index are mediators on the association between perceived environmental factors and ACS; (3) to verify the associations between leisure walking with perceived and objective measures of neighborhood environmental factors stratified by gender and SES; and (4) to examine whether adolescents' road safety perception (RSP) acts as a mediator on the association between the distance from home to the nearest park and the use of the parks for PA. A cross-sectional study developed with 1130 adolescents (47.3% boys) in the city of Porto Alegre, Brazil. PA was assessed through a questionnaire. Environmental factors were measured by the Neighborhood Environment Walkability Scale for Youth (NEWS-Y) and Geographic Information System by the streets network in the 0.5km and 1.0km buffers around the residential address of the students. Analyzes were performed by generalized linear regression. The first manuscript indicated that ACS was associated with land use mix, neighborhood recreation facilities, existence of parks/squares (0.5km buffer), existence of bicycle paths and residential density (0.5km and 1.0km buffers). The existence of bicycle paths was associated with ACS in all SES for both buffers. Land use mix and neighborhood recreation facilities were associated with ACS only in the middle NSE. Also, an association was found between the land use mix with ACS in 0.5 km buffer in low and high SES. The second manuscript showed that residential density is a mediator of the association between neighborhood recreation facilities, access and aesthetics with ACS. The walkability index is a mediator of the relationship between land use mix, neighborhood recreation facilities and access with ACS. Regarding leisure PA, the third manuscript showed the same associations in both 0.5km and 1.0km buffers. For girls from the low SES, access and shorter distance to parks/squares were positively associated with leisure walking. Residential density and walkability were associated with leisure walking in middle SES girls. Regarding boys, an inverse association was found between crime safety with leisure walking in low SES. Neighborhood recreation facilities was associated with leisure walking in middle SES. Land use mix, neighborhood recreation facilities and places for walking were associated with leisure walking in high SES. The last manuscript pointed out that the road safety perception is a mediator explaining 16% of the association between use of the parks and distance from home to the park. The main conclusion indicated that these results could be considered in public managers strategies in order to encourage PA practice and health promotion.

Keywords: built environment; environmental perception; physical activity of transport; leisure walking; public health; young.

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ACS – Active commuting to/from school

AF – Atividade física

CAPES – Coordenação de Aperfeiçoamento de Pessoal de Nível Superior

CL – Caminhada de lazer

DAE – Deslocamento ativo para escola

GIS – Geographic Information Systems

IE – Indirect effect

IPAQ – International Physical Activity Questionnaire

IPEA – Instituto de Pesquisa Econômica Aplicada

IPEN – International Physical Activity and Environment Network

MVPA – Moderate to vigorous physical activity

NEWS-Y – Neighborhood Environment Walkability Scale for Youth

NSE – Nível socioeconômico

PA – Physical activity

PROESP – Projeto Esporte Brasil

RSP – Road safety perception

SES – Socioeconomic status

SPSS – Statistical Package for the Social Sciences

UFRGS – Universidade Federal do Rio Grande do Sul

SUMÁRIO

INTRODUÇÃO

A prevalência de fatores de risco cardiometabólicos, como obesidade, diabetes tipo 2 e hipertensão, vêm aumentando em crianças e adolescentes ao longo dos anos (MACPHERSON et al., 2016). Esses fatores estão associados a baixos níveis de atividade física nessa população (TARP et al., 2018). Nesse sentido, a prática de atividade física é reconhecida por proporcionar benefícios para a saúde. Um estudo desenvolvido em 17 países, incluindo o Brasil, mostrou que a atividade física foi inversamente associada ao risco de mortalidade e doença cardiovascular em indivíduos de baixa, média e alta renda (LEAR et al., 2017). Não obstante, é elevado o número de crianças e adolescentes que não cumprem com os níveis mínimos de atividade física para uma boa saúde (HALLAL et al., 2012).

Por outro lado, os espaços públicos configuram-se como locais que favorecem a prática de atividade física (SALLIS et al., 2006). Então, é plausível considerar a relevância de estudos que estabeleçam associações entre o ambiente construído com os níveis de atividade física dispendidos em atividades de deslocamento e lazer em adolescentes dos grandes centros urbanos (BAUMAN et al., 2012; SALLIS et al., 2006).

O ambiente pode ser analisado por várias características, tais como o acesso aos locais, qualidade dos espaços, a estética, a segurança, entre outras. Tais características podem ser mensuradas de forma objetiva: através da observação sistemática do ambiente e baseadas em dados geoprocessados; e de forma subjetiva: através da percepção do indivíduo sobre o ambiente construído (HINO; REIS; FLORINDO, 2010).

Embora haja estudos que abordam as características do ambiente associados a atividade física de deslocamento e lazer, a maioria deles envolvendo jovens são oriundos de países desenvolvidos (DUNCAN et al., 2016b; FUEYO et al., 2016; KÄRMENIEMI et al., 2018; OYEYEMI et al., 2014; PEREIRA et al., 2018), no Brasil destacam-se alguns estudos relevantes (LIMA et al., 2013; MENDONÇA et al., 2018; REIS et al., 2009; SILVA et al., 2018, 2017; HINO, 2018). Não obstante, é pertinente conjecturar que as relações entre os fatores do ambiente urbano e a atividade física em adolescentes ainda não são bem compreendidas e, como tal, merecem atenção de pesquisadores das áreas de políticas públicas no âmbito da saúde, educação, esporte, lazer e urbanismo.

Neste contexto a presente tese, na forma de uma coletânea de artigo, tem por objetivo geral:

- Identificar as possíveis associações entre a atividade física de deslocamento e lazer com os fatores do ambiente em adolescentes brasileiros.

As associações entre atividade física de deslocamento e lazer com fatores ambientais foram identificadas a partir dos seguintes objetivos específicos:

- Analisar a associação entre o deslocamento ativo para escola com medidas percebidas e objetivas de fatores ambientais do bairro, bem como avaliar a influência do nível socioeconômico;
- Verificar se a densidade residencial, a conectividade entre as ruas e o índice de walkability são mediadores da associação entre os fatores ambientais percebidos e o deslocamento ativo para escola;
- Verificar as associações entre a caminhada de lazer com medidas percebidas e objetivas de fatores ambientais do bairro estratificados por sexo e nível socioeconômico;
- Verificar se a percepção de segurança atua como mediadora na associação entre a distância de casa até o parque mais próximo e o uso dos parques para atividade física.

Justifica-se a relevância do presente estudo por dois principais motivos: (1) a convicção de que seus resultados possam sugerir indicadores que sirvam como suporte para os gestores públicos e os responsáveis pelo planejamento urbano no desenvolvimento de futuras intervenções comunitárias, estratégias de políticas públicas e o investimento de recursos; (2) a expectativa de proporcionar a possibilidade da configuração de um ambiente mais saudável, seguro e de fácil acesso para as pessoas, bem como incentivar a prática de atividade física e consequentemente, melhorar a qualidade de vida e saúde dos adolescentes.

Finalmente, é importante salientar que este é um dos primeiros estudos científicos que abordam os fatores do ambiente mensurados de forma percebida e objetiva associados com domínios específicos de atividade física envolvendo uma amostra representativa de adolescentes de Porto Alegre/RS.

Esta tese, é constituída por seis partes interrelacionadas:

- I Parte- Revisão de literatura: cuja finalidade é demarcar o referencial teórico que sustenta o objetivo geral da tese;
- II Parte- Artigo 1: estudo que analisa as associações entre os fatores ambientais com o deslocamento ativo para a escola, assim como a influência do nível socioeconômico. O trabalho encontra-se publicado na edição especial “Transportation and Health in Latin America” no “Journal of Transport & Health”.

- III Parte- Artigo 2: retrata quais variáveis do ambiente construído influenciam na relação da percepção do ambiente com o deslocamento ativo para a escola;
- IV Parte- Artigo 3: aborda as características do ambiente associadas a atividade física no lazer, estratificados por sexo e nível socioeconômico.
- V Parte- Artigo 4: apresenta o artigo publicado no periódico “Public Health” acerca do quanto a percepção de segurança influencia na menor distância da casa até o parque e o uso do parque no lazer;
- VI Parte- Considerações finais, sugestões para futuros estudos e referências: sugerem conjecturas conclusivas do estudo através de uma síntese dos resultados dos quatro artigos. Adicionalmente, será abordado sugestões para futuros estudos, e por fim, a lista dos autores referenciados ao longo da tese.

I PARTE

REVISÃO DE LITERATURA

REVISÃO DE LITERATURA

Ao considerar que aproximadamente metade da população mundial (3,4 bilhões de pessoas) vive em áreas urbanas e que esse número pode dobrar até 2050 (ONU, 2019), pesquisas têm evidenciado os impactos do planejamento urbano sobre a saúde da população (GILES-CORTI et al., 2016; SALLIS et al., 2016a, 2016b; STEVENSON et al., 2016). Rydin et al., (2012) afirmaram que há uma complexidade envolvida na melhoria da saúde através de políticas e planejamentos urbanos. Então, os autores procuraram apresentar algumas estratégias para esse planejamento: 1) explorar e testar alguns projetos utilizando recursos das comunidades e organizações locais para efetivamente atingir o objetivo; 2) a ênfase no aprendizado dos projetos sugere a necessidade de uma avaliação, a qual deve basear-se no diálogo e discussão entre os interessados, assim como apoiar-se em diferentes fontes do conhecimento; e por fim, 3) intervenções através das políticas públicas e a criação de fóruns para debater aspectos éticos e morais das diferentes abordagens à saúde e ambientes urbanos.

Nesse sentido, uma série da Lancet intitulada “Desenho urbano, transporte e saúde” (*Urban design, transport, and health*) evidenciou que os planejamentos urbano e de transporte podem ser uma estratégia de promoção da saúde em países de alta e baixa renda. O primeiro estudo com o intuito de reduzir o uso de veículos motorizados e incentivar o deslocamento ativo, ressalta algumas intervenções como a criação de rede com movimentações favoráveis para os pedestres e ciclistas, bairros com mais densidade residencial, reduzir a distância até o transporte público e ofertar opções para o deslocamento ativo, por exemplo, criar bairros atrativos e seguros, com transporte público acessível e conveniente, entre outras (GILES-CORTI et al., 2016). Essas intervenções possibilitariam a criação de cidades mais saudáveis e sustentáveis, reduzindo os fatores de risco ambientais, sociais e comportamentais que afetam nas escolhas do estilo de vida.

Já o segundo estudo da série demonstrou que o aumento da densidade e a diversidade do uso do solo e a redução da distância até o transporte público (afim de incentivar a caminhada, ciclismo e transporte público) em seis cidades, promoveu ganhos em saúde em termos de diabetes, doenças respiratórias e doenças cardiovasculares (STEVENSON et al., 2016). Esses resultados destacaram que mudanças no ambiente urbano com apoio das políticas públicas influenciaram positivamente na saúde geral da população.

Por fim, o terceiro artigo recomenda como uma estratégia promissora que as cidades busquem aplicar projetos urbanos, através de uma abordagem sistematizada, com a finalidade de incentivar as alterações do modo do deslocamento refletindo na melhora da saúde

(SALLIS et al., 2016a). Em outras palavras, essa ação pretende melhorar a sustentabilidade por meio de transporte ativo, assim como a promoção da saúde, direcionando a uma nova mobilidade urbana.

Cabe salientar que essas ações com o objetivo de incentivar a prática de atividade física, melhorar a mobilidade urbana e a promoção da saúde, têm como base o modelo ecológico. Esse modelo é reconhecido como uma importante abordagem para elucidar o comportamento da atividade física, considerando a influência de diferentes fatores (individual, social, ambiental e político) e a interação entre eles (SALLIS et al., 2006). Ainda, uma revisão sistemática indicou que variáveis demográficas, biológicas, ambientais, sociais e culturais estão associadas com a atividade física de pessoas que vivem em países de baixa e média renda (BAUMAN et al., 2012). Então, o foco não está apenas no indivíduo, mas na interação dinâmica entre as pessoas e o ambiente em que vivem, aprendem (escolas), trabalham e brincam (SALLIS et al., 2006).

A partir disso, os lugares onde as pessoas são e/ou podem ser fisicamente ativas são importantes na perspectiva de saúde pública e esses ambientes físicos podem ser definidos como ambiente construído, natural e social (SALLIS, 2009a). O ambiente construído caracteriza-se por estruturas e espaços construídos e modificados pelo homem como edifícios, casas, escolas, parques, praças, sistemas de transporte, entre outros (BROWNSON et al., 2009; GILES-CORTI, 2006; SALLIS, 2009a). O ambiente natural considera espaços abertos, assim como aspectos da natureza, que englobam características como o clima, vegetação e topografia. Já o ambiente social inclui interações entre indivíduos, famílias, grandes ou pequenos grupos, comunidades, culturas, entre outros (SALLIS, 2009a).

O ambiente construído pode ser analisado de acordo com várias características, que foram consideradas no presente estudo, tais como: o acesso aos locais, segurança, instalações de recreação no bairro, conectividade entre as ruas, estética, lugares para caminhar, entre outros. Além disso, essas características podem ser mensuradas: 1) de forma objetiva: através da observação sistemática do ambiente e baseadas em dados geoprocessados; e 2) de forma subjetiva: baseadas na percepção do indivíduo sobre o ambiente construído (HINO; REIS; FLORINDO, 2010). As medidas objetivas são consideradas mais precisas para descrever um grande número de variáveis do ambiente construído (BROWNSON et al., 2009; DING et al., 2011; HINO; REIS; FLORINDO, 2010), embora se reconheça a importância das avaliações com base na percepção dos participantes sobre os lugares onde vivem. Por conseguinte, análises objetivas e subjetivas podem oferecer informações diferentes, todavia, complementares (HINCKSON et al., 2017). Por exemplo, as pessoas podem ter um bom

acesso a praças e parques para atividade física, mas percebem estes locais como inseguros para a prática. Por outro lado, pode se ter uma percepção positiva de determinado local, entretanto este é localizado a uma grande distância de casa ou o espaço não oferta alguma infraestrutura específica.

É possível identificar na literatura estudos envolvendo adolescentes que objetivaram verificar a associação entre a atividade física global com os fatores do ambiente independente, ou seja, mensurados objetivamente ou subjetivamente (MANTA et al., 2018; DIAS et al., 2018; FARIAS JUNIOR et al., 2014; ORESKOVIC et al., 2015) e também com a utilização de ambos (BARR-ANDERSON et al., 2014; HINCKSON et al., 2017; JANSSEN, 2014). Um artigo de revisão envolvendo as características do ambiente e atividade física geral indicou que instalações como parques e recursos que facilitam a caminhada apresentaram efeito positivo na atividade física dos adolescentes (MCGRATH; HOPKINS; HINCKSON, 2015). Dados recentes de crianças e adolescentes brasileiros demonstraram que a percepção positiva e/ou barreiras no acesso às estruturas, parques, presença de calçadas e ciclovias, proximidade com a residência, segurança referente ao crime e trânsito, quantidade de espaços e/ou estruturas no entorno da residência, são alguns dos fatores associados com a atividade física geral (MANTA et al., 2018). Esse estudo de revisão indicou ainda que as medidas utilizadas para avaliar o ambiente são distintas, o que dificultou a comparabilidade dos dados e que até então, não foram identificados no Brasil estudos envolvendo jovens que forneçam informações sobre as medidas do ambiente utilizadas de maneira combinada (percebida e objetiva).

Embora evidências nessa área estejam crescendo, a heterogeneidade das formas de avaliação do ambiente entre os estudos representa um desafio. Um estudo de revisão analisou o uso de diferentes medidas de atividade física e características do ambiente e os resultados indicaram que diferentes medidas influenciaram as associações entre ambiente e atividade física de crianças e adolescentes (DING et al., 2011). Essas associações foram mais estáveis quando as características ambientais foram determinadas de forma objetiva e a atividade física relatada. Contudo, não foi encontrado correlato consistente em nenhuma variável ambiental (DING et al., 2011). Nesse sentido, os modelos conceituais que orientam pesquisas em ambientes construídos e atividade física propõe que diferentes domínios da atividade física, por exemplo, lazer, transporte ou deslocamento, são influenciados por distintos fatores do ambiente (SALLIS et al., 2006). Então, nos últimos anos os estudos envolvendo fatores ambientais são mais específicos de acordo com os domínios da atividade física,

principalmente com as atividades realizadas no deslocamento e no lazer (KÄRMENIEMI et al., 2018; MENDONÇA et al., 2018; SILVA et al., 2017).

No contexto da relação entre os fatores ambientais e atividade física de deslocamento, a maioria dos estudos envolvendo jovens são oriundos de países desenvolvidos (KÄRMENIEMI et al., 2018; WONG; FAULKNER; BULIUNG, 2011). Revisões sistemáticas indicaram que somente a distância foi consistentemente associada com o deslocamento ativo de crianças e adolescentes (WONG; FAULKNER; BULIUNG, 2011). Recentemente Kärmeniemi et al., (2018) mostraram que maior acessibilidade e novas infraestruturas para caminhada, ciclismo e transporte público foram associadas com a atividade física de deslocamento. Entretanto, todos os estudos incluídos nessas revisões foram realizados em países de alta renda, como Estados Unidos, Canadá, Austrália e Nova Zelândia.

No Brasil, Hino (2018) apresentou um estudo de revisão sobre as características do ambiente associadas a prática de atividade geral, atividades no deslocamento e atividades no lazer de acordo com a população de crianças e adolescentes, adultos e idosos. A síntese dessas informações, específicas para a população do presente estudo, e atividade física no deslocamento, foram pouco consistentes. Mesmo que não encontrada associações intermediárias ou fortes, os fatores do ambiente como segurança relacionada ao crime e acesso à locais/estruturas para atividade física foram relatados. Adicionalmente, a influência do nível socioeconômico é uma questão importante ao considerar que o Brasil é um país com alta desigualdade de renda. Silva et al., (2018) demonstraram que o nível socioeconômico é um moderador na associação entre a percepção de segurança nas ruas e no crime com o deslocamento ativo para escola de adolescentes. Além disso, no nível socioeconômico intermediário foi encontrada associação entre a iluminação pública e presença de ciclovia com a atividade física de deslocamento (SILVA et al., 2017). Em vista disso, além de explorar quais são as variáveis e se influenciam os fatores do ambiente (percebido e objetivo) associados com o deslocamento ativo, abordar os aspectos referentes ao nível socioeconômico é importante.

Com relação a associação entre os fatores do ambiente com a atividade física de lazer, existem estudos em diferentes partes do mundo. Países desenvolvidos como Austrália, Estados Unidos, Canadá, Alemanha, Holanda e Portugal indicaram que fatores do ambiente como: intersecções de ruas (CARVER et al., 2010), rede de ciclismo e caminhada (BAAR et al., 2014), acesso a instalações para prática de atividade física (BARR-ANDERSON et al., 2014; DUNCAN et al., 2016b), percepção de segurança e criminalidade no bairro (JANSSEN, 2014), menor distâncias a instalações (PEREIRA et al., 2018) e percepções de disponibilidade

de praças (PRINS et al., 2009) foram associados com a atividade física fora da escola ou no lazer. Adicionalmente, adolescentes americanos com um parque a uma curta distância de casa e aqueles com um parque considerado seguro nas proximidades foram mais propensos a serem fisicamente ativos durante uma visita ao parque (BABEY et al., 2015). No mesmo país, Oreskovic et al., (2015) mostraram que os adolescentes eram mais propensos a se envolverem em atividade física quando utilizavam ambientes construídos ao ar livre. Para as adolescentes belgas que vivem em bairros de baixo nível socioeconômico, foi encontrada uma associação positiva entre o índice de walkability e atividade física (DE MEESTER et al., 2012).

Já nos países subdesenvolvidos, foi encontrada associação entre a densidade residencial e a disponibilidade de infraestruturas com a atividade física no lazer para os meninos nigerianos (OYEYEMI et al., 2014). Para os adolescentes de Taiwan, China, um ambiente construído diversificado incentiva a prática de atividade física no lazer. Ainda, se destaca que preocupações com a segurança são essenciais para que o adolescente se envolva nas atividades no lazer (LIN; TING, 2014). Ademais, para os adolescentes argentinos foi encontrada associação positiva entre o acesso aos espaços públicos com a atividade física de lazer (FUEYO et al., 2016).

No Brasil, dados de revisão sistemática indicaram que a conectividade de ruas apresentou forte associação com a atividade física no lazer de crianças e adolescentes (Hino 2018). No nordeste do país, adolescentes que reportaram “ver outros adolescentes engajados em atividade física” e “ver coisas interessantes durante a caminhada” realizaram mais atividades recreativas no lazer (MENDONÇA et al., 2018). Já na região sul, a atividade física realizada nos parques foi associada com a falta de espaços para ser fisicamente ativo (REIS et al., 2009). Nesse sentido, outro estudo demonstrou que morar perto da praia aumentou a prática de atividade física moderada e vigorosa no tempo livre dos adolescentes (SILVA et al., 2017). Além disso, a atividade física dos meninos foi associada inversamente com a distância de casa até academia e ginásio, e positivamente com o número de instalações recreativas no bairro (LIMA et al., 2013). Destaca-se que essas relações podem diferir de acordo com o sexo, Lopes et al., (2014) indicaram que a atividade física com duração de 20 minutos foi associada com “há lugares que eu gosto” para os meninos e “coisas interessantes” para as meninas. Além de considerar a influência do sexo, é importante abordar essas relações de acordo com o nível socioeconômico.

Nesse contexto, outro aspecto que deve ser considerado é com relação à segurança pública. O Instituto de Pesquisa Econômica Aplicada (IPEA) apresenta um atlas com dados da violência do país e os resultados indicaram altos índices de criminalidade (IPEA, 2019).

Nesse sentido, incluir aspectos sobre segurança é fundamental quando se trata dos fatores ambientais associados com a atividade física e o uso dos espaços públicos, como parques e praças. Evidências apontam que os adolescentes que aumentaram a prática de atividade física foram aqueles que perceberam o ambiente no bairro como seguro (LENHART et al., 2017; MITÁŠ et al., 2018). Não obstante, um recente estudo demonstrou que a segurança e estética são fatores secundários na relação com a atividade física (VAN HECKE et al., 2018a). Em concordância, Bracy et al., (2014) indicaram que as associações entre atividade física com a segurança no crime, ruas e/ou trânsito podem ser mais complexas do que apenas em associações diretas. Portanto, ressalta-se ainda a necessidade de estudos explorando a influência de questões de segurança na relação entre fatores do ambiente com a atividade física no contexto brasileiro.

Considerando o supracitado, as relações entre fatores do ambiente urbano e atividade física requerem ser exploradas no contexto brasileiro, especificamente na população jovem. Ademais, é pertinente evidenciar que as associações entre essas variáveis são específicas de acordo com o contexto social e econômico do país. Ainda, as cidades brasileiras possuem características ambientais diferentes, algumas são contempladas com mais praças e parques, outras praias, montanhas ou lagos. Portanto, avaliar as características ambientais de determinada cidade e verificar sua relação com a prática de atividade física, pode auxiliar em estratégias de políticas públicas e promoção de saúde. Todavia, é relevante mencionar que os fatores ambientais serão capazes de explicar somente em pequena proporção a realização da prática de atividade física global ou de acordo com o domínio do deslocamento ou lazer, já que isso é dependente de uma série de fatores e influências.

II PARTE

ARTIGO ORIGINAL – 1

Perceived and objective measures of neighborhood environment: association with active commuting to school by socioeconomic status in Brazilian adolescents

Medidas percebidas e objetivas do ambiente no bairro: associação com o deslocamento ativo para a escola de acordo com o nível socioeconômico em adolescentes Brasileiros

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ARTIGO ORIGINAL 1 (Medidas percebidas e objetivas do ambiente no bairro: associação com o deslocamento ativo para a escola de acordo com o nível socioeconômico em adolescentes brasileiros)

ABSTRACT

Introduction: Commuting to school is influenced by environmental factors that are country specific. The present study aimed to analyze the association between active commuting to/from school (ACS) with perceived and objective measures of neighborhood environmental factors, as well as to evaluate the influence of socioeconomic status (SES) in Brazilian adolescents.

Methods: This is a cross-sectional study with a random sample of 1130 adolescents (47.3% boys), aged between 14 to 20 years old, from the city of Porto Alegre-Brazil. ACS and SES were evaluated by a questionnaire and perceived environmental factors were assessed through Neighborhood Environment Walkability Scale for Youth (NEWS-Y). Objective built environmental factors were measured using Geographic Information Systems (GIS) within 0.5 km and 1.0 km road network buffers around participant's residential address. Data analysis was performed using generalized linear regression models.

Results: Association between ACS with perceived and objective measures of neighborhood environmental factors of adolescents in 0.5 km and 1.0 km buffers were: land use mix, neighborhood recreation facilities, existence of bicycle paths and residential density. Besides, existence of parks and squares was associated with ACS only in 0.5 km buffers. The existence of bicycle path either in 0.5 km and 1km buffers was associated with ACS in all SES. Land use mix and neighborhood recreation facilities were associated with ACS only in middle SES in both buffers. Also, the association between land use mix and ACS in 0.5 km buffers was found for low and high SES.

Conclusion: ACS was associated with land use mix, neighborhood recreation facilities, existence of parks, squares and bicycle paths and residential density in Brazilian adolescents. SES is an important factor to consider when studying ACS and environmental factors.

Keywords: active transport; physical activity; urban environment; built environment; youth.

RESUMO

Introdução: O deslocamento para a escola é influenciado por fatores ambientais que são específicos de cada país. O presente estudo teve como objetivo analisar a associação entre deslocamento ativo de/para escola com medidas percebidas e objetivas dos fatores ambientais do bairro, assim como avaliar a influência do nível socioeconômico em adolescentes brasileiros.

Métodos: Esse é um estudo transversal, com amostra aleatória de 1130 adolescentes (47,3% meninos), com idades entre 14 e 20 anos, da cidade de Porto Alegre-Brasil. O deslocamento de/para escola e o nível socioeconômico foram avaliados por um questionário e os fatores do ambiente percebido foram avaliados através do *Neighborhood Environment Walkability Scale for Youth* (NEWS-Y). Os fatores objetivos do ambiente construído foram mensurados usando o Sistema de Informações Geográficas pela rede de ruas nos buffers de 0,5 km e 1,0 km em torno do endereço residencial do participante. A análise dos dados foi realizada por meio de modelos de regressão linear generalizada.

Resultados: A associação entre o deslocamento ativo de/para escola com medidas percebidas e objetivas dos fatores ambientais no bairro de adolescentes nos buffers de 0,5 km e 1,0 km foram: uso misto do solo, instalações de recreação no bairro, existência de ciclovias e densidade residencial. Além disso, a existência de parques e praças foi associada com o deslocamento ativo de/para escola apenas no buffer de 0,5 km. A existência de ciclovias nos buffers de 0,5 km e 1.0 km foi associada com o deslocamento ativo de/para escola em todos os níveis socioeconômicos. O uso misto do solo e as instalações de recreação no bairro foram associados com o deslocamento ativo de/para escola apenas no nível socioeconômico médio em ambos os buffers. Ainda, foi encontrada associação entre o uso misto do solo com o deslocamento ativo de/para escola no buffer de 0,5 km no nível socioeconômico baixo e alto.

Conclusão: O deslocamento ativo de/para escola foi associado com o uso misto do solo, instalações de recreação no bairro, existência de parques, praças e ciclovias e densidade residencial em adolescentes brasileiros. O nível socioeconômico é um fator importante ao considerar o deslocamento ativo de/para escola e fatores ambientais.

Palavras-chave: transporte ativo; atividade física; ambiente urbano; ambiente construído; jovens.

INTRODUCTION

Active commuting to/from school (ACS) (i.e. walking or cycling to and from school) has the potential to contribute substantially to physical activity and health (LAROUCHE et al., 2014). Studies developed in different countries, such as Portugal (PIZARRO et al., 2016), Sweden and Estonia (CHILLÓN et al., 2010), shows that adolescents who walk or cycle to school have higher daily levels of physical activity than those who go to school by car or bus. Besides, ACS is associated with better physical fitness and a lower incidence of metabolic syndrome in girls (RAMÍREZ-VÉLEZ et al., 2017), and with better profile of high density lipoprotein cholesterol and waist circumference in school children (PIZARRO et al., 2013).

Ecological models have been recognized as an important approach to understand and explain physical activity behavior, considering they postulate that human behavior involve different scales of influence (individual, social, physical environmental and policy) and the interaction between them (SALLIS et al., 2006). Regarding the built environment, a recent systematic review showed that creating new infrastructure for walking, cycling and public transportation could induce active modes of transportation (KÄRMENIEMI et al., 2018). Also, some studies held in developed countries have found that highest rates of walkability index, street connectivity and neighborhood safety are associated with ACS in adolescents (D'HAESE et al., 2015; DUNCAN et al., 2016b; MEESTER et al., 2013). Winters et al., (2011) showed that routes away from traffic noise and pollution, routes with beautiful scenery and paths separated from traffic are the motivators for bicycling. Another environment factor that could intervene on active commuting is topographic characteristics of the city (NIXON, 2012).

In order to reduce private motor vehicle and to enhance active commuting, a Lancet series identified some interventions, highlighting the following factors: destination accessibility, employment distribution, parking policies, pedestrian- and cycling-friendly street networks, residential density, public transportation availability, mixed land use and desirability of active travel modes (GILES-CORTI et al., 2016). It is important to consider that, compact cities that involve these characteristics are benefited with health gains in terms of diabetes, respiratory disease and cardiovascular disease (STEVENSON et al., 2016).

The influence of socioeconomic status (SES) is another issue that must be taken into account regarding the relationship between ACS and environmental factors. Molina-García, Sallis and Castillo, (2014) has shown that low SES is associated with higher active commuting in Spanish students. More recently, the same author indicated that children

attending schools located in lower SES neighborhoods reported more active commuting than those attending schools in higher SES (MOLINA-GARCÍA; QUERALT, 2017). In Brazil, there are only two studies investigating this topic in adolescents, Silva et al., (2018) showed that SES is a moderator in the association between the perceived environment and ACS. Besides, it was found associations between commuting physical activity with street lighting and presence of cycle lanes only among the intermediate SES tertile (SILVA et al., 2017).

Commuting to school is a daily activity, highly influenced by environmental and cultural factors that are specific for each country and geographical area. To assess environmental characteristics related to neighborhood walkability, both perceived and observed measures can be used (HINO; REIS; FLORINDO, 2010). However, it is not clear how strong the agreement between both types of measure is. Thus, studies have been suggesting to include both objective and perceived measures of the built environment, because they give different information, although complementary (HINCKSON et al., 2017).

Indeed, the above mentioned aspects should be more explored in Brazilian adolescents considering that to the best of our knowledge, this is one of the first studies conducted with environmental characteristics objectively and subjectively measured, in addition to investigate the role of SES. We emphasize that knowing the relationship between environmental factors and ACS by SES is important in Brazil where there is not enough evidence about these aspects, especially considering that this is one of the most unequal countries in the world. Therefore, the present study aimed to analyze the association between ACS with perceived and objective measures of neighborhood environmental factors, as well as to evaluate the influence of SES in Brazilian adolescents.

METHODS

Study design

This is a cross sectional study, with a quantitative approach, developed in Porto Alegre, Brazil. The city population is approximately 1.4 million inhabitants (year 2010), a territorial area of 496,681 km² and a demographic density of 2,837.53 inhabitants/km² (IBGE, 2010). Porto Alegre is one of the most forested capitals of the country, it has approximately 630 squares, 8 public parks and 3 conservation units according to data from the Planning Environment Department.

The population was composed of approximately 34,645 high school students, from 71 public schools (IBGE, 2012). They were allocated in the following regions: 8,057 north; 6,423 south; 4,268 east; and 15,897 center.

In order to calculate the sample size, the following criteria were considered: a) estimated population of 34,645 students (N); b) proportion of subjects in the target population 50% (p); c) complementary percentage of 100 minus p value (q); d) degree of confidence of 2 standard deviations (S); and e) acceptable sampling error of 3% (e). After the adoption of these criteria and accordingly the formula presented below, it was estimated that 1,077 students should be evaluated. However, to avoid probable difficulties with the sample loss, an increase of 5% was assumed, totaling 1,130 youth. This formula was used to have a sample that represents the study population. This calculation was performed using the formula to have a representative sample of the population. The power of the test was tested through the software G*power version 3.1, for the statistical analysis used in the study, the value of the power of the test was 1.0.

$$n = S^2 \cdot p \cdot q \cdot N / e^2 (N - 1) + (S^2 \cdot p \cdot q)$$

Sample selection considered the proportion of youth enrolled in the schools by region. Thus, the sample was composed of: 263 students from 4 schools in the north region (23.26%); 518 students from 7 schools in the central region (45.88%); 140 students from 2 schools in the east region (12.32%); and 209 students from 3 schools in the south region (18.54%).

The sample selection was realized by multiple phases' procedure (GAYA et al., 2008). Initially, the schools were selected, accordingly to each region, and then, in the schools, the high school classes were selected, randomly. A number was assigned for each school and all numbers were placed in a box, mixed and randomly reelected one by one. Then, data was collected in one class belonging to first, second and third year from the high school.

The students from classes selected were invited to participate in the study, and the inclusion criteria were: a) belonging to the first, second or third year of high school; b) handing in the consent document signed by a parent or guardian; and c) signing the assent document manifesting will to participate. We emphasize that according to Sawyer et al., (2018) a definition of 10–24 years corresponds more closely to adolescent growth and popular understandings of this life phase, thus we use the term adolescents, even when some students were over 18 years of age.

Data collection was performed during eight months in 2017, this period corresponds in three different seasons (winter, fall and spring), however we verified that there was no difference in ACS between the seasons ($F=0.41$; $p=0.66$). First, the researcher went to the selected schools, explained the aims of the study and if the managers agreed to participate,

they were asked to sign an acceptance term. Then, data collection was scheduled. Questionnaires were filled out during a regular class, corresponding to approximately 45 minutes.

Measurements procedures

Mode of commuting to and from school

Students completed a questionnaire, supervised by researchers at school. To assess ACS, subjects answered the question 'How do you usually go to/go back from school?' (Normalmente como você se desloca para ir e voltar da escola?). This question about mode of commuting to and from school has been proposed as one of the most appropriate measurements for asking about mode of commuting to school (HERRADOR-COLMENERO et al., 2014). Response choices were (1) by walking, (2) by bicycle, (3) by bus, (4) by car and (5) other. Active commuting was defined as walking or cycling to school, while, passive commuting was defined as traveling to school by bus or by car. The students who answered other, should describe which transportation they used to school, so the answers were individually analyzed and defined as active or passive commuting.

Perceived environmental factors

To measure perceived neighborhood environmental factors, the version of the Neighborhood Environment Walkability Scale for Youth (NEWS-Y) (ROSENBERG et al., 2009), validated in Brazil (LIMA; RECH; REIS, 2013) was used. This questionnaire evaluates perceived environment factors that may influence youth physical activity (ROSENBERG et al., 2009). Questions were considered according to the following dimensions, proposed by the NEWS-Y scoring guidelines (SALLIS, 2009b): Land use mix-diversity (perception of distance in minutes from home to a variety of more common destinations, such as shops or school), neighborhood recreation facilities (perceived distance in minutes from the student house, walking to a variety of places for physical activity practice, such as walking/running track or large public park), access to services, street connectivity, places for walking, neighborhood aesthetics, neighborhood safety and crime safety. More information about the questions can be found elsewhere Lima, Rech and Reis, (2013), Rosenberg et al., (2009) and website James Sallis athrough the link <http://sallis.ucsd.edu/Documents/Measures_documents/NEWS_Y_adolescent.pdf>.

For land use mix (diversity) and neighborhood recreation facilities, the answers options were: 1-5min, 6-10min, 11-20min, 21-30min, more than 30 min and don't know/there

isn't. The option 'don't know' response was coded as a "more than 30 min" because if it is not known whether the facility is within walking distance, the actual walk is likely more than 31 minutes (SALLIS, 2009b). All items were reverse coded and employ mean values. Also, the NEWS-Y guidelines indicate an alternative scoring to tally the number of stores or facilities within a 5, 10, or 20-minute walk, which was considered "near from home" (SALLIS, 2009b).

All the questions from the dimensions' access to services, street connectivity, places for walking, neighborhood aesthetics, neighborhood and crime safety were measured using 4-point Likert scale (strongly disagree, partially disagree, partially agree, strongly agree). These answers were dichotomized into agree and disagree for descriptive analyses. All determinants were calculated following the NEWS-Y scoring protocol (SALLIS, 2009b) with a higher score, indicating better conditions for commuting to school.

Objective environment factors

Students addresses, reported in the questionnaire were geocoded in the Geographic System Information (GIS) through ArcMap 10.3.1 software. A shapefile of the streets, parks and squares provided by the Municipal Department of Urbanism and environment and sustainability of Porto Alegre – RS was used for the analysis.

Buffers within 0.5 km and 1 km of the participants' homes, reachable by the street network, were defined to estimate accessible neighborhood features. These buffers were used because the methodology of a large study, International Physical Activity and Environment Network (IPEN), involving different countries of the world, including Brazil, applied these buffers sizes (SALLIS et al., 2016b). Thus, the following variables were used: existence of parks and squares (existence of parks and squares in buffer); existence of bicycle path (existence of bicycle path in buffer); residential density (number of residences within each buffer); density of blocks (number of blocks within each buffer); average size of the blocks (average size of streets/blocks within each buffer); and connectivity between streets (intersection number of streets in buffer).

The walkability concept employed in the IPEN project methodology, comes from the transportation and urban planning fields and is concerned with environments that primarily encourage people to walk or bike for transportation (IPEN, 2012; SALLIS et al., 2016b). "Walkable" neighborhoods in this context are the ones where it is easy to walk or bike directly to multiple destinations (IPEN, 2012). Thus, connectivity between streets and residential density were determined and z-scores were calculated. The walkability index was

calculated as follows: walkability = (2* z-score connectivity between streets) + (z-score residential density). Considering that no data of "retail floor area ratio and land use mix" were available for the present study, the original formula of Frank et al., (2010) was adapted. Also, Koohsari et al., (2016) proposed an alternative walkability index with two variables (population density and a space syntax measure of street integration) and found a high correlation with original walkability index in walking for transport.

Socioeconomic status

Socioeconomic status was assessed through a National commonly used index which include a number of owned items at the adolescents' residences (for example, refrigerator, notebook and microwave) and the level of schooling of the parent or guardian, according to the criteria established by the Brazilian Association of Research Companies (ABEP, 2015). Then, students answered questions about the existence and quantity of items in their home and information about the level of schooling of the parent or guardian, where does the house water come from (well or spring, general distribution register or other means) and the street of his home (asphalted / paved or earth / gravel). For each answer, a score was constructed and the sum of the points was done to identify each student's economic class (ABEP, 2015). Then adolescents were classified into the following economic classes: low (1° tertile), middle (2° tertile) and high (3° tertile). Sex and age were assessed using a questionnaire.

Statistical Analysis

Descriptive data are shown as absolute and relative values (sex, socioeconomic status, commuting to school, perceived environmental factors and existence of bicycle path, parks and squares), means and standard deviations (age, scores dimensions of perceived environmental factors and built environmental factors in 0.5km and 1km buffers). To verify internal consistency from NEWS-Y dimensions' variables Cronbach Alpha (0.89) was calculated: land use mix- diversity (0.88), neighborhood recreation facilities (0.84), access to services (0.36), street connectivity (0.36), places for walking (0.30), neighborhood aesthetics (0.71), neighborhood safety (0.10) and crime safety (0.85).

Then, the associations between ACS with perceived and objective measures of neighborhood environmental factors, were investigated through generalized linear regression. The analyzes were splitted in two models: variables of the perceived environment adding objective built environment with 0.5 kilometers buffers (model 1); and perceived environment adding objective built environment with 1 kilometers buffers (model 2). Also, the analyzes

were stratified by SES for each buffer. Both analyzes were adjusted for sex, age, socioeconomic status and class. We tested additional adjustment for the environmental variables considering collinearity between them (rho ≥ 0.60). Finally, alpha values (<0.05) and confidence intervals (95%) were presented. All the analyses were performed in the software IBM SPSS version 22.0 (SPSS, Inc., Chicago, Illinois, USA).

RESULTS

The study sample comprised 1130 youth living in Porto Alegre-RS, 1010 were geocoded for built environmental analyses (Figure 1). Sample losses were caused by insufficient address information and incompatibilities in the street network, leading to some critical constraints for an integration of the space syntax within GIS.

Descriptive characteristics of the sample are presented in table 1. Five hundred and thirty-four (534) boys and 596 girls, aged 14-20 years participated in the study. Only 30.2% actively commuted to school. Furthermore, questions regarding perceived environmental factors and the scores of each dimension, as well as, questions of built environment factors, from 0.5km and 1km buffers, are described in Table 1.

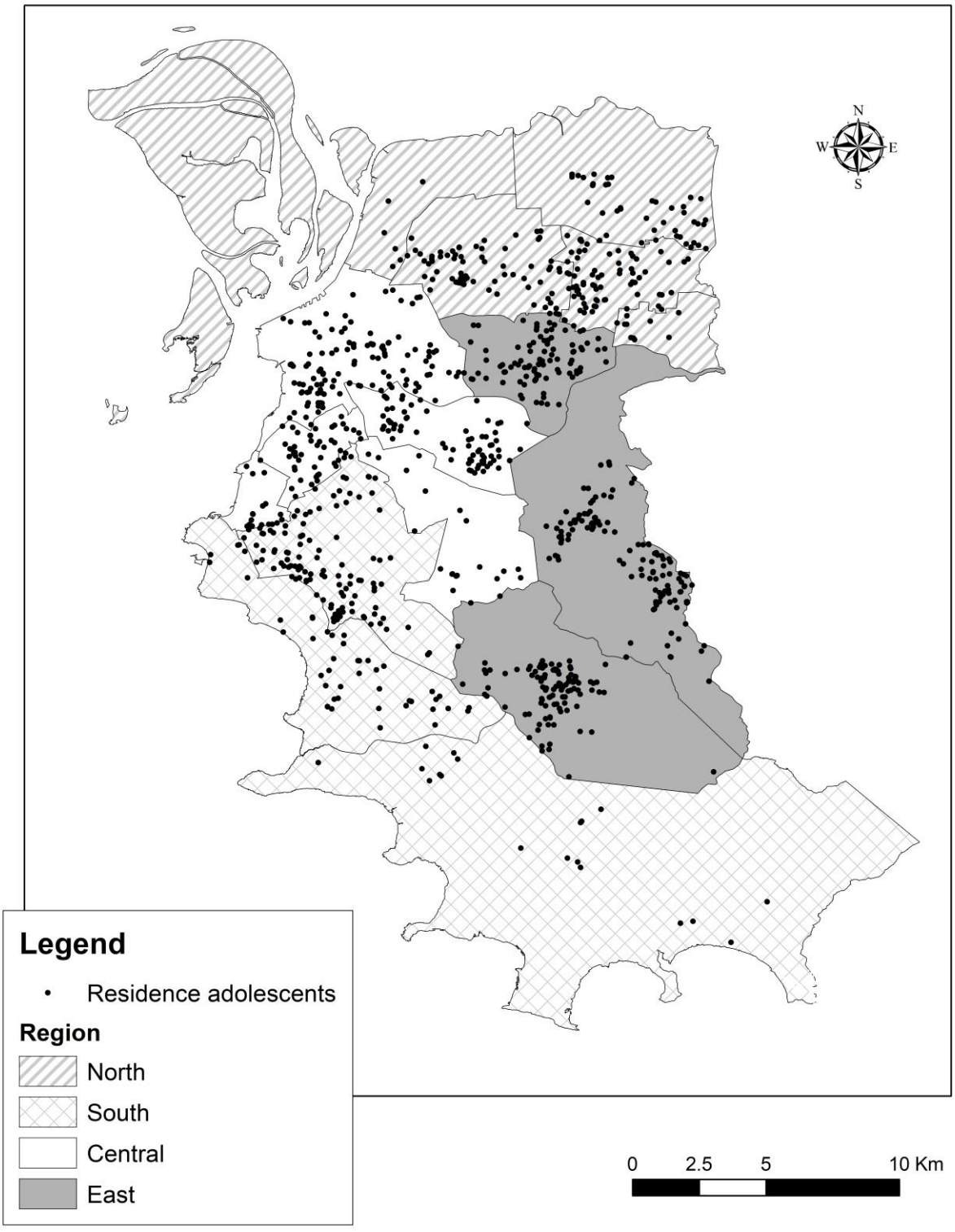

Figure 1. Georeferenced of participants of the sample in Porto Alegre-RS (n=1010)

Table 1. Sample's characteristics, descriptive and occurrence analysis

Variables	N(%)	Mean(SD)
Age (years)	-	16.49(1.05)
Sex		
Boys	534(47.3)	-
Girls	596(52.7)	-
Socioeconomic status (n= 1114)		
High	410(36.8)	-
Middle	336(30.2)	-
Low	368(33.0)	-
Physical activity (n= 1123)		
Commuting to school (active)	339(30.2)	-
Perceived Environmental Factors		
Land use mix - diversity *(proportion: near from home)* (n=1129)		
1.Convenience/corner store/ small grocery store/bodega	1034(91.5)	-
2. Supermarket	951(84.2)	-
3. Hardware store	892(78.9)	-
4. Fruit/vegetable market	844(74.7)	-
5. Laundry or dry cleaners	347(30.7)	-
6. Clothing store	525(46.5)	-
7. Post office	324(28.7)	-
8. Library	173(15.3)	-
9. Elementary school	883(78.1)	-
10. Middle or high school	610(54,0)	-
11. Book store	221(19.6)	-
12. Fast food restaurant	588(52.0)	-
13. Coffee place	446(39.5)	-
14. Bank/credit union	581(51.4)	-
15. Non-fast food restaurant	643(56.9)	-
16. Video store	442(39.1)	-
17. Pharmacy/drug store	882(78.1)	-
18. Hairdressers/barber shop	935(82.7)	-
19. Any offices/worksites	293(25.9)	-
20. Bus, subway or train stop	1049(92.8)	-
21. Score land use mix – diversity	-	3.56(0.89)
Neighborhood recreation facilities *(proportion: near from home)* (n=1129)		
1. Indoor recreation or exercise facility (public or private)	512(45.3)	-
2. Beach, lake, river, or creek	142(12.6)	-
3. Bike/hiking/walking trails, paths	336(29.7)	-
4. Basketball court	797(70.5)	-
5. Other playing fields/courts (like soccer, football, etc)	499(44.2)	-
6. Private sports clubs	336(29.7)	-
7. Boys and girls club	540(47.8)	-
8. Swimming pool	342(30.4)	-
9. Walking / running track	367(32.5)	-
10. School with recreation facilities open to the public	266(23.5)	-
11. Small public park	838(74.2)	-
12. Large public park	407(36.0)	-
13. Public playground with equipment	542(48.0)	-
14. Public open space that is not a park	448(39.6)	-
15. Score neighborhood recreation facilities	-	2.86(1.05)
Access to services *(proportion: agree)* (n=1130)		
1. Stores are within easy walking distance of my home	821(72.7)	-
2. Parking is difficult in local shopping areas	527(46.6)	-
3. There are many places to go within easy walking distance of my home	819(72.5)	-
4. From my home, it is easy to walk to a transit stop alone or with someone	1018(90.1)	-
5. The streets in my neighborhood are hilly, making my neighborhood	582(51.5)	-

difficult to walk in (alone or with someone)		
6. There are major barriers to walking in my local area that make it hard to get from place to place	246(21.8)	-
7. Score access to services	-	2.46(0.49)
Street connectivity *(proportion: agree)* (n=1130)		
1. The distance between intersections (where streets cross) in my neighborhood is usually short	662(58.6)	-
2. The streets in my neighborhood do not have many cul-de-sacs	621(55.0)	-
3. There are many different routes for getting from place to place in my neighborhood	786(69.6)	-
4. Score street connectivity	-	2.74(0.68)
Places for walking *(proportion: agree)* (n=1130)		
1. There are sidewalks on most of the streets in my neighborhood	852(75.4)	-
2. Sidewalks are separated from the road/traffic in my neighborhood by parked cars	682(60.4)	-
3. There is grass/dirt between the streets and the sidewalks in my neighborhood	579(51.2)	-
4. Score places for walking	-	2.75(0.69)
Neighborhood Aesthetics *(proportion: agree)* (n=1130)		
1. There are trees along the streets in my neighborhood	957(84.7)	-
2. There are many interesting things to look at while walking in my neighborhood	415(36.7)	-
3. There are many beautiful natural things to look at in my neighborhood (e.g., gardens, views)	404(35.8)	-
4. There are many buildings/homes in my neighborhood that are nice to look at	643(56.9)	-
5. Score neighborhood aesthetics	-	2.55(0.72)
Neighborhood safety *(proportion: agree)* (n=1129)		
1. There is so much traffic along nearby streets that it makes it difficult or unpleasant to walk in my neighborhood	485(42.9)	-
2. The speed of traffic on most nearby streets is usually slow	658(58.2)	-
3. Most drivers go faster than the posted speed limits in my neighborhood	590(52.2)	-
4. My neighborhood streets have good lighting at night	593(52.5)	-
5. Walkers and bikers on the streets in my neighborhood can be easily seen by people in their homes	696(61.6)	-
6. There are crosswalks and signals to help walkers cross busy streets in my neighborhood	595(52.7)	-
7. When walking in my neighborhood there are a lot of exhaust fumes	432(38.3)	-
8. Score neighborhood safety	-	2.38(0.46)
Crime safety *(proportion: agree)* (n=1129)		
1. There is a high crime rate in my neighborhood	802(71.0)	-
2. The crime rate in my neighborhood makes it unsafe to go on alone or with someone at night	795(70.4)	-
3. I am worried about being outside alone around my home because I am afraid of being taken or hurt by a stranger	377(33.4)	-
4. I am worried about being outside with a friend around my home because I am afraid of being taken or hurt by a stranger	510(45.1)	-
5. I am worried about being or walking alone or with friends in my neighborhood and local streets because I am afraid of being taken or hurt by a stranger	581(51.4)	-
6. I am worried about being in a local/nearby park because I am afraid of being taken or hurt by a stranger	732(64.8)	-
7. Score crime safety	-	2.59(0.81)
Objective Environmental Factors (n= 1010)		
Existence of parks and squares – 0.5 km buffers (proportion: yes)	609(60.3)	-
Existence of parks and squares –1.0 km buffers (proportion: yes)	867(85.8)	-
Existence of bicycle path – 0.5 km buffers (proportion: yes)	122(10.8)	-
Existence of bicycle path – 1.0 km buffers (proportion: yes)	242(24.0)	-
Residential density –0.5 km buffers	-	2757.03(1452.26)

Residential density –1.0 km buffers	-	7257.91(4106.12)
Connectivity between streets –Number of intersections (0.5km buffers)	-	50.77(31.39)
Connectivity between streets-Number of intersections (1.0 km buffers)	-	186.02(103.45)
Blocks density - 0.5 km buffers	-	8657.89(3570.94)
Blocks density – 1.0 km buffers	-	29198.02(12181.17)
Average size of the blocks - 0.5 km buffers (meters)	-	122.98(84.83)
Average size of the blocks – 1.0 km buffers (meters)	-	114.97(42.17)
Walkability index[a] – 0.5 km buffers	-	0.001(2.52)
Walkability index[a] – 1.0 km buffers	-	0.001(2.57)

[a]Walkability index: Standardized variables (transformed into Z-scores).

Table 2 shows the results of the association between perceived and objective measures of neighborhood environment factors with ACS in adolescents. The results indicated that ACS was associated with land use mix, neighborhood recreation facilities, existence of parks, squares and bicycle paths and residential density in 0.5 km buffers (model 1). Regarding 1 km buffer (model 2), it was observed that ACS was associated with land use mix, neighborhood recreation facilities, existence of bicycle paths and residential density.

Table 2. Association between perceived and objective neighborhood environment factors with active commuting to school in adolescents (n=770)

	Active commuting to school					
Perceived Environmental Factors	Model 1[a]			Model 2[a]		
	OR	CI-95%	p	OR	CI-95%	p
Land use mix – diversity	1.63	(1.32 2.03)	**<0.001**[b]	1.50	(1.21 1.88)	**<0.001**[c]
Neighborhood recreation facilities	1.36	(1.14 1.62)	**<0.001**[b]	1.38	(1.15 1.64)	**<0.001**[c]
Access to services	1.10	(0.76 1.60)	0.57	1.15	(0.80 1.67)	0.43
Street connectivity	0.98	(0.73 1.21)	0.66	0.97	(0.76 1.25)	0.86
Places for walking	0.79	(0.61 1.02)	0.07	0.89	(0.69 1.15)	0.39
Neighborhood aesthetics	1.03	(0.80 1.31)	0.80	1.02	(0.80 1.30)	0.84
Neighborhood safety	1.05	(0.71 1.56)	0.79	1.13	(0.76 1.67)	0.53
Crime safety	1.10	(0.88 1.38)	0.36	1.07	(0.85 1.34)	0.54
Objective Environment Factors	(0.5km - buffers)			(1km – buffers)		
Existence of parks and squares						
No	1			1		
Yes	1.50	(1.02 2.20)	**0.03**	1.40	(0.76 2.57)	0.26
Existence of bicycle path						
No	1			1		
Yes	2.01	(1.26 3.23)	**0.003**	2.56	(1.75 3.75)	**<0.001**
Residential density*	1.19	(1.01 1.42)	**0.04**[b]	1.31	(1.07 1.60)	**0.008**[c]
Connectivity between streets*	0.85	(0.69 1.04)	0.12[b]	0.90	(0.73 1.10)	0.31[c]
Blocks density*	1.10	(0.91 1.32)	0.30[b]	1.21	(0.98 1.49)	0.07[c]
Average size of the blocks*	0.93	(0.75 1.15)	0.53	0.82	(0.64 1.06)	0.13[c]
Walkability*	0.96	(0.89 1.04)	0.96[b]	0.98	(0.90 1.07)	0.75[c]

*Standardized variables (transformed into z-scores). [a]: adjusted for sex, age, socioeconomic status and class.

[b]Additionally adjusted for model 1[a], without the environmental variables that present high collinearity (rho ≥ 0.60). Land use mix – diversity showed high correlation with neighborhood recreation facilities (rho= 0.63). Walkability showed high correlation with residential (rho= 0.78), blocks (rho= 0.85) density and connectivity between streets (rho= 0.89). Connectivity between streets showed high correlation with blocks density (rho= 0.78) (0.5km buffers).

[c]Additionally adjusted for model 2[a], without the environmental variables that present high collinearity (rho ≥ 0.60). Land use mix – diversity showed high correlation with neighborhood recreation facilities (rho= 0.63). Walkability showed high correlation with residential (rho= 0.81), blocks (rho= 0.90) density and connectivity between streets (rho= 0.92). Residential density showed high correlation with blocks density (rho= 0.78). Connectivity between streets showed high correlation with residential (rho= 0.60), blocks (rho= 0.82) density and average size of the blocks (rho= 0.70) (1km buffers).

The association between perceived and objective neighborhood environment factors with ACS by socioeconomic status in adolescents is presented in table 3. Results showed that the existence of bicycle path in 0.5 and 1km buffers was associated with ACS in all SES. In addition, neighborhood recreation facilities were associated with ACS in middle SES in both buffers. An association between land use mix and ACS in all SES was also found for 0.5km buffer While in the 1km buffer a higher perception of land use mix increased the odds of ACS only in middle SES.

Table 3. Association between perceived and objective neighborhood environment factors with active commuting to school by socioeconomic status in adolescents

	Active commuting to school					
	Model 1[a]			Model 2[a]		
	SES (n=1114)					
Perceived Environmental Factors	**Low** (n=368) OR (CI-95%)	**Middle** (n=336) OR (CI-95%)	**High** (n=409) OR (CI-95%)	**Low** (n=368) OR (CI-95%)	**Middle** (n=336) OR (CI-95%)	**High** (n=409) OR (CI-95%)
Land use mix – diversity	**1.70 (1.03 2.80)**	**1.75 (1.19 2.57)**[b]	**1.51 (1.01 2.26)**	0.69 (0.42 1.13)	**1.73 (1.16 2.59)**[b]	1.34 (0.90 2.02)
Neighborhood recreation facilities	1.16 (0.77 1.77)	**1.47 (1.09 1.99)**[b]	1.08 (0.76 1.54)	0.78 (0.51 1.19)	**1.46 (1.07 1.98)**[b]	1.13 (0.80 1.60)
Access to services	0.63 (0.32 1.28)	1.49 (0.74 2.97)	1.21 (0.65 2.26)	1.52 (0.75 3.06)	1.68 (0.82 3.41)	1.15 (0.61 2.16)
Street connectivity	0.82 (0.53 1.29)	1.33 (0.82 2.17)	0.94 (0.63 1.40)	1.25 (0.79 1.97)	1.37 (0.84 2.23)	0.90 (0.59 1.35)
Places for walking	0.75 (0.49 1.15)	0.72 (0.44 1.15)	1.17 (0.75 1.83)	1.28 (0.85 1.93)	0.64 (0.35 1.14)	1.12 (0.70 1.78)
Neighborhood aesthetics	1.30 (0.83 2.02)	1.08 (0.68 1.73)	0.78 (0.51 1.18)	0.80 (0.50 1.27)	1.09 (0.68 1.75)	0.81 (0.52 1.24)
Neighborhood safety	1.52 (0.69 3.33)	1.15 (0.55 2.42)	0.85 (0.46 1.57)	0.66 (0.30 1.44)	1.28 (0.61 2.69)	0.76 (0.40 1.43)
Crime safety	0.92 (0.62 1.37)	1.54 (0.98 2.39)	1.01 (0.69 1.49)	1.07 (0.72 1.59)	1.49 (0.96 2.31)	1.05 (0.71 1.54)
Objective Environment Factors	(0.5km - buffers)			(1km – buffers)		
Existence of parks and squares						
No	1			1	1	1
Yes	1.38 (0.65 2.93)[b]	1.55 (0.75 3.20)	1.53 (0.79 2.97)	1.16 (0.61 4.28)	0.88 (0.29 2.65)	1.10 (0.32 3.75)
Existence of bicycle path						
No	1			1	1	1
Yes	**2.43 (1.00 5.94)**	**2.72 (1.08 6.82)**	**1.39 (1.01 2.18)**	**2.12 (1.05 4.29)**	**2.09 (1.04 4.19)**	**2.83 (1.53 5.21)**
Residential density*	1.15 (0.79 1.66)[b]	1.02 (0.71 1.45)[b]	1.22 (0.93 1.61)[b]	1.42 (0.96 2.10)[b]	0.99 (0.68 1.44)[b]	1.18 (0.85 1.62)[b]
Connectivity between streets*	1.00 (0.72 1.39)[b]	0.71 (0.48 1.03)[b]	0.87 (0.63 1.20)[b]	0.78 (0.53 1.14)[b]	0.64 (0.41 1.01)[b]	0.75 (0.49 1.14)[b]
Blocks density*	1.29 (0.93 1.80)[b]	0.91 (0.64 1.31)[b]	0.96 (0.69 1.32)[b]	0.73 (0.50 1.08)[b]	0.94 (0.61 1.44)[b]	0.95 (0.66 1.37)[b]
Average size of the blocks*	1.04 (0.80 1.35)[b]	0.97 (0.59 1.58)[b]	1.02 (0.76 1.38)[b]	1.14 (0.78 1.65)	0.71 (0.44 1.17)	0.88 (0.59 1.32)
Walkability*	1.03 (0.89 1.20)[b]	0.88 (0.77 1.01)[b]	1.00 (0.88 1.14)[b]	0.88 (0.75 1.03)[b]	0.86 (0.72 1.02)[b]	0.95 (0.82 1.09)[b]

*Standardized variables (transformed into z-scores). [a]: adjusted for sex, age, socioeconomic status and class.

[b]Additionally adjusted for model 1[a], without the environmental variables that present high collinearity (rho ≥ 0.60).

Low (0.5km buffers) - High correlation between following variables: Residential density with blocks density (rho=0.69) and walkability (rho=0.79);
Blocks density with connectivity between streets (rho=0.84), existence of park and squares (rho=0.60) and walkability (0.88). Connectivity between streets with average size of the blocks (rho=0.74) and walkability (rho=0.93).
Low (1km buffers) - High correlation between following variables: Residential density with connectivity between streets (rho= 0.72), blocks density (rho= 0.83) and walkability (rho= 0.83). Connectivity between streets with blocks density (rho= 0.88) and walkability (rho= 0.94). Blocks density with walkability (rho= 0.90).

Middle (0.5km buffers) - High correlation between following variables: Land use mix with neighborhood recreation facilities (rho= 0.64); residential density with blocks density (rho=0.66) and walkability (rho=0.78). Blocks density with connectivity between streets (rho=0.77) and walkability (0.82); connectivity between streets with average size of the blocks (rho=-0.77) and walkability (rho=0.87). Average size of the blocks with walkability (rho=-0.61)
Middle (1km buffers) - High correlation between following variables: Land use mix with neighborhood recreation facilities (rho= 0.64). Residential density with connectivity between streets (rho= 0.60), blocks density (rho= 0.76) and walkability (rho= 0.80). Connectivity between streets with blocks density (rho= 0.84) and walkability (rho=0.92). Blocks density showed high correlation with walkability (rho= 0.90).

High (0.5km buffers) - High correlation between following variables: Residential density with blocks density (rho=0.67) and walkability (rho=0.78); Blocks density with connectivity between streets (rho=0.72) and walkability (rho=0.80); connectivity between streets with average size of the blocks (rho=-0.77) and walkability (rho=0.84).
High (1km buffers) - High correlation between following variables: Residential density with blocks density (rho= 0.76) and walkability (rho= 0.76). Connectivity between streets with blocks density (rho= 0.76) and walkability (rho=0.85). Blocks density with walkability (rho= 0.84).

DISCUSSION

The results showed that when considering the perceived and objective measures of the environment, ACS was associated with perceived land use mix and neighborhood recreation facilities, as well as objectively measured existence of bicycle paths and residential density in 0.5 km and 1 km buffers around adolescents' home. Existence of parks and squares was also associated with ACS but only in 0.5 km buffers. Concerning the influence of SES, it was found an association between land use mix, neighborhood recreation facilities and existence of bicycle path with ACS in both buffers.

Regarding the perceived environmental factors, our data showed that the shortest distance from the adolescent's residence to places like bookstores, supermarkets, and other land use mix-diversity places, as well as distance to neighborhood recreation facilities, such as less distance to the square, parks, soccer fields and clubs, were associated with ACS. In this perspective, a research carried out in Belgium is in agreement with the results of the present study, showing that the land use mix is associated with more min/day ACS (MEESTER et al., 2013). Several reasons may underline this association, for example it might be that youth are so used to walk to the different places in the neighborhood, that they choose to active commute to school, in addition to safety perception neighborhood and short distance to school. On the other hand, active commuting was positively associated with "having places they like to go to" but inversely related with "places with opportunities to practice", in adolescents from the northeastern of Brazil (MENDONÇA et al., 2018), which go against to our data. However, this inverse association may be due different assessment methods that were used for active commuting.

Unexpectedly, we found no association between safety perceptions and ACS. Previous research in Brazil has found a relationship of perceiving the neighborhood as not violent with active commuting (MENDONÇA et al., 2018). Moreover, a systematic review, included mainly by studies in North America and Australia, has suggested that safety measures were associated with ACS (D'HAESE et al., 2015). In fact, different studies have shown that safety perception is as an interveniet factor for physical activity engagement (D'HAESE et al., 2015; JANSSEN, 2014; REES-PUNIA; HATHAWAY; GAY, 2018) but not in ours. However, we emphasize that each place has its specificities and people perceive safety of the neighborhood differently, which may influence this assotiations.

Considering the objectively measured built environmental factors, the results of the present study showed that existence of bicycle paths and residential density were associated with ACS in both the 0.5km and 1km buffers around adolescents' residence. On the other

hand, existence of parks and squares was only associated with ACS in the 0.5km buffer. In line with our results, reviews about this topic (GILES-CORTI et al., 2009; PONT et al., 2009; SALLIS et al., 2012) showed that built environmental factors, such as, urban density, neighborhoods with mixed-use planning, recreation facilities and walk or bike paths are associated with active commuting or walking. Smith et al., (2017) demonstrated a positive effect of provision of quality parks and playgrounds, and installation or improvements in infrastructure for active transport. Also, a recent review study found that creating new infrastructure for walking, cycling and public transportation is associated with active commuting (KÄRMENIEMI et al., 2018).

Our findings are in line with the aforementioned review studies, where existence of parks, squares and bicycle paths and residential density were associated with ACS in adolescents. However, studies are scarce regarding objective measures of built environment and its relation with ACS in Brazilian adolescents. These aspects have been explored in adult populations and results indicate that neighborhoods with greater density of employment factors, and greater proportion of residential and commercial areas were associated with walking for transport (HINO et al., 2014; YANG et al., 2017).

SES emerged as a significant variable in this research study. Our findings showed that adolescents that have bicycle path in 0.5 and 1km buffers around the residence had more odds to actively commute to school in all SES. Thus, we highlight the importance of a cycle path for ACS in all adolescents, independently of SES. There are limited references regarding this issue in adolescents. It was found in south of Brazil an association between active commuting and presence of cycle lanes, in addition to street lighting only in middle SES (SILVA et al., 2017).

In the 0,5 km buffer, adolescents with better perception of land use mix in were more likely to active commute to school in all SES levels, while in the 1km buffer this association remained significant only in middle SES. Perception of a shorter distance to neighborhood recreation facilities was also associated with ACS in both buffers, but only in middle SES. As generally studies that investigate the relationship between these variables not consider the role of SES, our findings bring new information regarding this topic. Indeed, we observed that a wide range of infrastructure around adolescent's residence, enhances the probability of ACS in all SES.

The main strengths of this study are that we provide a combined assessment of the contribution of subjective and objective measures of environment characteristics and its association with ACS. Further we also consider the influence of SES. In addition, this study

included a large sample of Brazilian adolescents, which is relevant once most studies in Brazil were developed with adults. Based on this, as practical applications, policy makers will have access to concrete data to help them decide on how to allocate resources and on what to invest. Furthermore, students will have the opportunity of using pleasant and high-quality environments that provide better conditions for active commuting, and this will contribute to their health.

This study has also some limitations that should be mentioned. The cross-sectional nature did not allow for causal inferences. Commuting to school was self-reported, and we were not able to determine the distance, frequency, duration and intensity of commuting. Another aspect that was not included was for how long has the participant being living in that address or neighborhood, which could influence their perceptions. The lack of topographic characteristics, not using larger buffers sizes and information to compose original walkability index may also be worth to mention as a limitation since it may influence the results. Future studies should consider personal and social factors to understand the behavior of active commuting.

In conclusion, ACS was associated with land use mix, neighborhood recreation facilities, existence of parks, squares and residential density in Brazilian adolescents. The presence of a bicycle paths seems of particular relevance for ACS in all SES levels in both of the buffers studied. Although some environmental characteristics were important across all SES levels others were important in a specific SES level. These factors must be taken into consideration by policy makers when considering interventions aimed to increase this healthy behavior.

III PARTE

ARTIGO ORIGINAL – 2

Residential density and walkability index are mediators in the relationship between perceived environmental factors and active commuting to school in adolescents

Densidade residencial e o índice de walkability são mediadores da relação entre fatores do ambiente percebido e deslocamento ativo para escola em adolescentes

ARTIGO ORIGINAL 2 (Densidade residencial e o índice de walkability são mediadores da relação entre fatores do ambiente percebido e deslocamento ativo para escola em adolescentes)

ABSTRACT

Objective: To verify whether residential density, connectivity between streets and walkability index are mediators on the association between perceived environmental factors and active commuting to school (ACS) in Brazilian adolescents.

Methods: Cross-sectional study with a random sample of 1130 school-aged adolescents (52.7% girls), aged between 14 to 20 years old, from the city of Porto Alegre-Brazil. Adolescent's self-reported their usual mode of commuting to and from school using a validated questionnaire and the built-environmental attributes by the Neighborhood Environment Walkability Scale for Youth (NEWS-Y). Residential density, connectivity between street and walkability index were measured by Geographic Information Systems (GIS), within 1.0 km road network buffers around participant's residential address. Linear regression models were fitted according to Baron and Kenny procedures for mediation analyses.

Results: Residential density is a mediator on the association between perceived environmental factors and ACS in adolescents, including neighborhood recreation facilities (Indirect effect [IE]=0.098; 95%CI: 0.058–0.146), access to services (IE=0.213; 95%CI=0.130–0.311) and neighborhood aesthetics (IE=0.082; 95%CI=0.041–0.134). Walkability index is a mediator on the relationship between land use mix-diversity (IE=0.048; 95%CI=0.009–0.093), neighborhood recreation facilities (IE=0.039; 95%CI=0.012–0.070) and access to services (IE=0.090; 95%CI=0.033–0.159) with ACS. The connectivity between street did not show correlation with ACS, thus it was not tested in the mediation model.

Conclusion: Residential density and walkability index are mediators on the relationship between land use mix-diversity, neighborhood recreation facilities, access to service and neighborhood aesthetics with ACS in Brazilian adolescents. The connectivity between street did not show association with the ACS, and consequently was not a mediator.

Keywords: active transport; built environmental; public health; physical activity; youth.

RESUMO

Objetivo: Verificar se a densidade residencial, conectividade entre as ruas e o índice de walkability são mediadores na associação entre fatores do ambiente percebido e deslocamento ativo para escola em adolescentes brasileiros.

Métodos: Estudo de corte transversal, com uma amostra aleatória de 1130 adolescentes em idade escolar (52,7% meninas), com idades entre 14 e 20 anos, da cidade de Porto Alegre-Brasil. Os adolescentes reportaram seu modo usual de deslocamento de/para a escola utilizando um questionário validado e os atributos do ambiente construído através do *Neighborhood Environment Walkability Scale for Youth* (NEWS-Y). Densidade residencial, conectividade entre as ruas e o índice de walkability foram mensurados usando o Sistema de Informações Geográficas pela rede de ruas no buffer de 1,0 km em torno do endereço residencial dos participantes. Modelos de regressão linear foram realizados de acordo com os procedimentos de Baron e Kenny para análises de mediação.

Resultados: Densidade residencial é um mediador da associação entre fatores do ambiente percebido e deslocamento ativo de/para escola em adolescentes, incluindo instalações de recreação no bairro (Efeito Indireto [EI]=0,098; 95%IC: 0,058–0,146), acesso a serviços (EI=0,213; 95%IC=0,130–0,311) e estética no bairro (EI=0,082; 95%IC=0,041–0,134). O índice de walkability é um mediador da relação entre o uso misto do solo-diversidade (EI=0,048; 95%IC=0,009–0,093), instalações de recreação no bairro (EI=0,039; 95%IC=0,012–0,070) e acesso a serviços (EI=0,090; 95%IC=0,033–0,159) com o deslocamento ativo de/para escola. A conectividade entre as ruas não apresentou correlação com o deslocamento ativo de/para escola, então não foi testado no modelo de mediação.

Conclusão: A densidade residencial e o índice de walkability são mediadores da relação entre uso misto do solo-diversidade, instalações de recreação no bairro, acesso a serviços e estética no bairro com o deslocamento ativo de/para escola em adolescentes brasileiros. A conectividade entre as ruas não apresentou associação com o deslocamento ativo de/para escola, e consequentemente não foi um mediador.

Palavras-chave: transporte ativo; ambiente construído; saúde pública; atividade física; jovens.

INTRODUCTION

The prevalence of cardiometabolic risk factor, such as obesity, type 2 diabetes and hypertension have been increasing in children and adolescents over the years (MACPHERSON et al., 2016). These non-communicable diseases has been associated with low levels of physical activity in this population (TARP et al., 2018). Active commuting to school (ACS) (i.e., walking or cycling to school) is a reasonable form of physical activity among adolescents being recognized as an opportunity for health promotion (CHILLÓN et al., 2010; LAROUCHE et al., 2014). Increase in daily physical activity (CHILLÓN et al., 2010; PIZARRO et al., 2016) and cardiorespiratory fitness (LUBANS et al., 2011), as well as the decrease in metabolic syndrome incidences (RAMÍREZ-VÉLEZ et al., 2017) and waist circumference (PIZARRO et al., 2013), are some of the health factors associated with ACS. Since most school children have to travel to and from school twice a day, this behavior could be integrated into their individual routine. In this sense, previous reviews studies have identified numerous interventions based on promoting ACS and its association with several health indicators in children and adolescents (CHILLÓN et al., 2011; PANG; KUBACKI; RUNDLE-THIELE, 2017; VILLA-GONZÁLEZ et al., 2018).

Particularly, the adolescents' mode of commuting is influenced by personal, social, and environmental factors (MANDIC et al., 2015; SALLIS et al., 2006). For instance, Mandic et al., (2015) showed that shorter distance to school, younger age, fewer vehicles, opportunity to chat with friends, nice scenery and parental perceptions of active transport to school safety were positively associated with ACS in adolescents. Also, studies have shown that walkability is a physical environmental factor that showed influence on physical activity and active commuting in youths (CARLSON et al., 2015; KERR et al., 2006; MOLINA-GARCÍA et al., 2019). High residential density, high street connectivity and high land use mix diversity are characterized by a high walkable neighborhood (FRANK et al., 2010). Regarding the environmental perceived factors, results indicate that traffic and crime safety (HUERTAS-DELGADO et al., 2018), land use mix diversity (DE MEESTER et al., 2013), shorter distance to school and access to destination (OYEYEMI et al., 2014) were associated with ACS in adolescents. Thus, we emphasize that creating safe neighborhoods with easy access and nice aesthetics could improve adolescent's perception, increasing ACS (DIAS et al., 2019; KÄRMENIEMI et al., 2018). In fact, it is not enough having good environments available, people need to perceive them as adequate to use it.

Recently, studies have investigated how much the physical environment influences ACS. A systematic review displayed that a higher objective accessibility and new

infrastructure for walking, cycling and public transportation were associated with increased ACS (KÄRMENIEMI et al., 2018). However, all studies included in this review were conducted in high-income economies (North America, Europe, Australia, Asia and New Zealand). Thus, it is important to emphasize that environmental characteristics associated with physical activity in high-income countries are different from low and middle-income countries (BAUMAN et al., 2012). Besides, few researches are available regarding the characteristics of the environment and physical activity of young people in low and middle-income countries (BAUMAN et al., 2012), underscoring the need for more research in Latin American countries, specifically in Brazil, where the occurrence of children and adolescents who passive commute to school varies between 43.3% and 52.0% (SILVA et al., 2011; SUZANA et al., 2019).

Considering the above-mentioned aspects, we highlight that in regions where there is not enough evidence about these aspects, especially in developing countries, exploratory analyses about the relationship between environmental factors and ACS are still important, in order to create effective policies for physical activity promotion. Likewise, studies investigating the association between ACS with environmental variables in Brazilian youth are scarce. Thus, we emphasize that our study intends to add information in order to understand whether built environmental variables influence the relationship between environment perception factors and ACS. Therefore, the present study aimed to verify whether residential density, connectivity between streets and walkability index are mediators on the association between perceived environmental factors and ACS in Brazilian adolescents.

METHODS

Study design

This is a cross-sectional study with a quantitative approach, which was developed in Porto Alegre, Brazil. The city population is approximately 1.4 million inhabitants (year 2010), a territorial area of 496,681 km² and a demographic density of 2,837.53 inhabitants/km² (IBGE, 2010). Porto Alegre is one of the most forested capitals of the country; it has approximately 630 squares, 8 public parks and 3 conservation units according to data from the Planning Environment Department. The population was composed of approximately 34,645 high school students, from 71 public schools (IBGE, 2012). They were allocated in the following regions: 8,057 north, 6,423 south, 4,268 east, and 15,897 center.

The following criteria were considered to calculate the sample size: a) estimated population of 34,645 students (N); b) proportion of 50% (p); c) complementary percentage of 100 – P (q); d) degree of confidence of 2 standard deviations (S); and e) acceptable sampling error of 3% (e). After the adoption of these criteria and accordingly the formula presented below, it was estimated that 1,077 students should be evaluated. However, to avoid probable dropouts in the sample, an increase of 5% was assumed, resulting in 1,130 school-aged adolescents. This formula [$n=S^2.p.q.N/e^2(N-1)+(S^2.p.q)$] was used to have a sample that represents the study population. This calculation was performed using the formula to have a representative sample of the population. The power of the test was tested through the software G*power version 3.1, for the statistical analysis used in the study, the value of the power of the test was 1.0.

Sample selection considered the proportion of adolescents enrolled in the schools by region. Thus, the sample was composed of 263 adolescents from 4 public schools in the north region (23.26%); 518 adolescents from 7 public schools in the central region (45.88%); 140 adolescents from 2 public schools in the east region (12.32%); and 209 adolescents from 3 public schools in the south region (18.54%).

The sample selection was realized by multiple phases procedure (GAYA et al., 2008). Initially, the schools were selected, accordingly to each region. A number was assigned for each school and all numbers were placed in a box, mixed and randomly reelected one by one. In the schools, the high school classes were selected, randomly. Data was collected in one class from each year: first, second and third.

The students from the classes selected were invited to participate in the study, and the inclusion criteria were: a) belonging to the first, second or third year of high school; b) handing in the consent document signed by a parent or guardian; and c) signing the assent document manifesting will to participate. We emphasize that according to Sawyer et al., (2018) a definition of 10–24 years corresponds more closely to adolescent growth and popular understandings of this life phase, thus we use the term adolescents, even when some students were over 18 years of age.

Data collection was performed during an eight-month period in 2017. First, the researchers provide the required information to the selected schools, explaining the aims of the study and if the managers agreed to participate, they were asked to sign an acceptance term. Then, data collection was scheduled. The adolescents took on average 30 minutes to fill out the questionnaire, that were answered during a regular class. The study was approved by

the Ethics Committee of Research with Human Beings of the Federal University of Rio Grande do Sul (nº. 1,338.597).

Measurements procedures

Mode of commuting to and from school

Adolescents self-reported their usual mode of commuting using a questionnaire supervised by a researcher (ratio 2 researchers: 30 students). Consequently, the question '*How do you usually get to and from school?*' was used. Response choices were (1) by walking, (2) by bicycle, (3) by bus, (4) by car and (5) other. Question about mode of commuting to and from school has been proposed as one of the most appropriate measurements for asking about mode of commuting to school in this population (HERRADOR-COLMENERO et al., 2014). Active commuters were defined if students commuted to and from school by walking or cycling, while passive commuters were those who commuted by bus or by car. The students who answered other were individually categorized and defined as active or passive commuting following the transportation that they used.

Perceived environmental factors

To measure self-reported environment perception factors, the version of the Neighborhood Environmental Walkability Scale for Young (NEWS-Y) (ROSENBERG et al., 2009) was used, which was previously validated in Brazil in this population (LIMA; RECH; REIS, 2013). This questionnaire evaluates environment perception factors that may influence adolescents total PA (ROSENBERG et al., 2009). Questions were considered according to the dimensions (land use mix-diversity, neighborhood recreation facilities, access to services, street connectivity, places for walking, neighborhood aesthetics, neighborhood safety and crime safety), proposed by the NEWS-Y.

Land use mix- diversity and neighborhood recreation facilities, refer to perception of distance from home to a variety of more common destinations, such as shops or school, and perceived distance from the student house, walking to a variety of places for physical activity practice, such as walking/running track or large public park, respectively. The answers options were: 1-5min, 6-10min, 11-20min, 21-30min, more than 30 min and don't know/there isn't. All items were reverse coded and employ mean values. Questions from the dimensions: access to services, street connectivity, places for walking, neighborhood aesthetics, neighborhood and crime safety were measured using 4-point Likert scale (strongly disagree, partially disagree, partially agree, strongly agree). All dimensions were calculated following

the NEWS-Y scoring guidelines (SALLIS, 2009b), the mean value was considered for each dimension. More information about the questions can be found elsewhere Lima, Rech and Reis, (2013), Rosenberg et al., (2009) and website James Sallis athrough the link <http://sallis.ucsd.edu/Documents/Measures_documents/NEWS_Y_adolescent.pdf>.

GIS-measured environmental factors

Adolescents addresses, reported in the questionnaire were geocoded in the Geographic System Information (GIS) through ArcMap 10.3.1 software. This software was used for the analyzes the shape file of the streets, parks and squares provided by the Municipal Department of Urbanism and environment and sustainability of Porto Alegre – RS. Buffers within 1 km of the participants' homes, reachable by the street network, were defined to estimate accessible neighborhood features (SALLIS et al., 2016b).

The following variables were used: residential density, connectivity between streets and walkability index. Residential density was calculated using number of residential units to the land area within each buffer. Connectivity between streets was assessed by the number of intersections between streets in buffer. The walkability concept comes from the transportation and urban planning fields and is concerned with environments that primarily encourage people to walk or bike for transportation (IPEN, 2012; SALLIS et al., 2016b). "Walkable" neighborhoods in this context are the ones where it is easy to walk or bike directly to multiple destinations (IPEN, 2012). In this sense, connectivity between streets and residential density were determined and z-scores were calculated. The walkability index was calculated as follows: walkability = (2* z-score connectivity between streets) + (z-score residential density). Considering that no data of "retail floor area ratio and land use mix" were available for the present study, the original formula of Frank et al., (2010) was adapted. Also, Koohsari et al., (2016) proposed an alternative walkability index with two variables (population density and a space syntax measure of street integration) and found a high correlation with original walkability index in walking for transport.

Socioeconomic status

Socioeconomic status was assessed through a questionnaire, which include a number of owned items at the adolescents' residences and the level of schooling of the parent or guardian, according to the criteria established by the Brazilian Association of Research Companies (ABEP, 2015). Then, students answered questions about the existence and quantity of items in their home, such as, car, washing machine, bathroom, among others. In

addition, information about the level of schooling of the parent or guardian, where does the house water come from (well or spring, general distribution register or other means) and the street of his home (asphalted / paved or earth / gravel). For each answer, a score was constructed and the sum of the points was done to identify each student's economic class (ABEP, 2015). Then subjects were classified into the following economic classes: A1, A2, B1, B2, C1, C2, D, E. For the analyses, the classes were grouped as: high (A1+A2), middle (B1+B2) and low (C1+C2+D+E).

Statistical Analysis

Descriptive data stratified by usual mode of commuting to and from school were calculated as absolute and relative values for sex, age and socioeconomic status. Means and standard deviations were calculated for GIS-measured objective (residential density, connectivity between street and walkability index) and perceived environmental factors. These data were presented stratified by active and passive commuters to and from school. Differences between commuting to school were determined through chi-square test for dichotomies variables and independent t-test for continuous variables.

The internal consistency from NEWS-Y dimensions' variables was verified through Cronbach Alpha (0.89), indicating 0.89 as an acceptable reliability. Values for each dimension were: land use mix- diversity (0.88), neighborhood recreation facilities (0.84), access to services (0.36), street connectivity (0.36), places for walking (0.30), neighborhood aesthetics (0.71), neighborhood safety (0.10) and crime safety (0.85).

Spearman correlation was used to determine association between GIS-measured objective and perceived environmental factors and ACS. Residential density, connectivity between street and walkability index (mediating variables) should be correlated with the outcome. Perceived environmental factors that presented association with both GIS-measured objective environmental factors and active commuting to school were tested in mediation models.

To examine whether the association between perceived environmental factors and ACS was mediated by residential density, connectivity between streets and walkability index, linear regression models were fitted using bootstrapped mediation procedures included in the PROCESS macro (PREACHER; HAYES, 2008). For testing mediation hypotheses, using a resampling procedure of 10.000 bootstrap samples. Indirect effect was estimated through point estimates and confidence intervals (95%). When the confidence interval did not contain zero the point estimate was considered significant.

The following criteria were used to establish mediation: (1) the independent variable (perceived environmental factors) is significantly related to the mediators (equation a); (2) the mediator is significantly related to the dependent variable (ACS) (equation b); (3) the independent variable (perceived environmental factors) is significantly related to the dependent variable (ACS) (equation c); and (4) the association between the independent and dependent variable is attenuated when the mediator is included in the regression model (equation c'). In addition, other important criteria is that the value of equation b must be greater than the equation c' and the value of equation c' must be smaller than the equation c.

The analyses were adjusted by sex and socioeconomic status. All analyzes were carried out using the SPSS-IBM (Software, v.22.0 SPSS Inc., Chicago, IL, USA), and a value of $p<0.05$ was considered statistically significant.

RESULTS

Descriptive characteristics of the sample stratified by usual mode of commuting to and from school, i.e., active vs. passive commuters are presented in table 4. The adolescents (52.7% girls) belonging to 16 public high schools mean aged 16.49 (SD=1.05) years old. The results indicated significant statistical difference between active and passive commuters by sex ($x^2=13.97$; $p<0.001$). Most adolescents were classified in medium socioeconomic status. Residential density, walkability index and perceived environmental factors, such as land use mix, neighborhood recreation facilities, access to services and neighborhood aesthetics presented statistical difference between active and passive commuters.

Table 4. Sample's characteristics, descriptive and occurrence analysis according to usual mode of commuting to school in adolescents.

	All	**Active commuters to school** n=339 (30.2)	**Passive commuters to school** n=784 (69.8)	p
	n (%)	n (%)	n (%)	
Sex				**<0.001**
Girls	596 (52.7)	150 (44.2)	442 (56.4)	
Boys	534 (47.3)	189 (55.8)	342 (43.6)	
Age (years)				-
14-15	208 (18.4)	55 (16.2)	151 (19.2)	
16-17	753 (66.6)	223 (65.8)	522 (66.6)	
18-19-20	169 (14.9)	57 (16.8)	111 (14.1)	

Socioeconomic status				-
High	202 (18.1)	56 (16.6)	144 (18.7)	
Middle	625 (56.2)	192 (57.0)	431 (55.9)	
Low	286 (25.7)	89 (26.4)	196 (25.4)	
Objective (GIS)	Mean (SD)	Mean (SD)	Mean (SD)	
Residential density	7257.91 (4106.12)	8501.54 (4384.96)	6689.83 (3843.68)	**<0.001**
Connectivity between street	186.02 (103.45)	193.18 (100.85)	181.95 (103.25)	0.10
Walkability index*	0.001 (2.57)	0.44 (2.33)	-0.21 (2.63)	**<0.001**
Perceived environmental factors				
Land use mix - diversity	3.56 (0.89)	3.86 (0.90)	3.43 (0.85)	**<0.001**
Neighborhood recreation facilities	2.86 (1.05)	3.20 (1.10)	2.72 (0.99)	**<0.001**
Access to services	2.96 (0.49)	3.05 (0.46)	2.91 (0.49)	**<0.001**
Street connectivity	2.74 (0.68)	2.78 (0.69)	2.72 (0.68)	0.19
Places for walking	2.75 (0.69)	2.77 (0.65)	2.74 (0.71)	0.47
Neighborhood aesthetics	2.55 (0.72)	2.63 (0.73)	2.52 (0.72)	**0.01**
Neighborhood safety	2.38 (0.46)	2.36 (0.45)	2.39 (0.46)	0.31
Crime safety	2.59 (0.81)	2.60 (0.78)	2.58 (0.82)	0.77

*Standardized variables (transformed into z-scores).

Table 5 present correlations between GIS-measured objective and perceived environmental factors and ACS. It is observed that connectivity between street was not associated with ACS. Thus, this variable cannot be tested as a mediator. Residential density and walkability index presented positive correlation with ACS. Perceived environmental factors presented correlation between both residential density and ACS with land use mix-diversity, neighborhood recreation facilities, access to services and neighborhood aesthetics. For both walkability index and ACS, was found correlation with the same perceived environmental factors except neighborhood aesthetics.

Table 5. Spearman correlation between active commuting to school, GIS-measured objective and perceived environmental factors in adolescents

Perceived environmental factors	Active commuters to school	Residential density	Connectivity between street	Walkability index
Land use mix – diversity	**0.211****	**0.406****	**0.131****	**0.260****
Neighborhood recreation facilities	**0.198****	**0.285****	**0.149****	**0.217****
Access to services	**0.118****	**0.260****	**0.136****	**0.192****
Street connectivity	0.035	**0.219****	**0.113****	**0.173****
Places for walking	0.025	**0.178****	**0.176****	**0.179****
Neighborhood aesthetics	**0.075***	**0.159****	0.053	0.014
Neighborhood safety	-0.032	**-0.139****	**-0.065***	**-0.099***
Crime safety	-0.004	0.006	0.126	**0.087***
Objective (GIS)				
Walkability index	**0.125****	**0.814****	**0.926****	-
Connectivity between street	0.050	**0.607****	**-**	-
Residential density	**0.186****	**-**	**-**	-

*p<0.05; **p<0.001

The mediator role of residential density in the association between land use mix-diversity (A), neighborhood recreation facilities (B), access to services (C) and neighborhood aesthetics (D) with ACS is presented in Figure 2. In model A, one of the criteria for mediation was not reached (β values of equation b>equation c'). Therefore, residential density did not mediate the relationship between land use mix-diversity with ACS.

In model B, the first regression equation indicated a positive association between higher residential density and neighborhood recreation facilities (p<0.001). Results of the second equation showed that the neighborhood recreation facilities was positively associated with ACS (p<0.001). In the third equation, it was found a positive relationship between residential density and ACS (p<0.001). Finally, in the fourth equation, when residential density and neighborhood recreation facilities were included simultaneously in the model, residential density was positively associated with ACS (p<0.001). Thus, the relationship between neighborhood recreation facilities and ACS was attenuated when residential density was included in the model, indicating that residential density is a mediator of this relationship (Indirect effect [IE]=0.098; 95%CI: 0.058–0.146).

The analysis of the mediator role of residential density in the association between access to services and ACS (IE=0.213; 95%CI=0.130–0.311) also showed that residential

density is a mediator of these association (Figure 2C). Similarly, residential density is a mediator in the association between neighborhood aesthetics (IE=0.082; 95%CI=0.041–0.134) with ACS (Figure 2D).

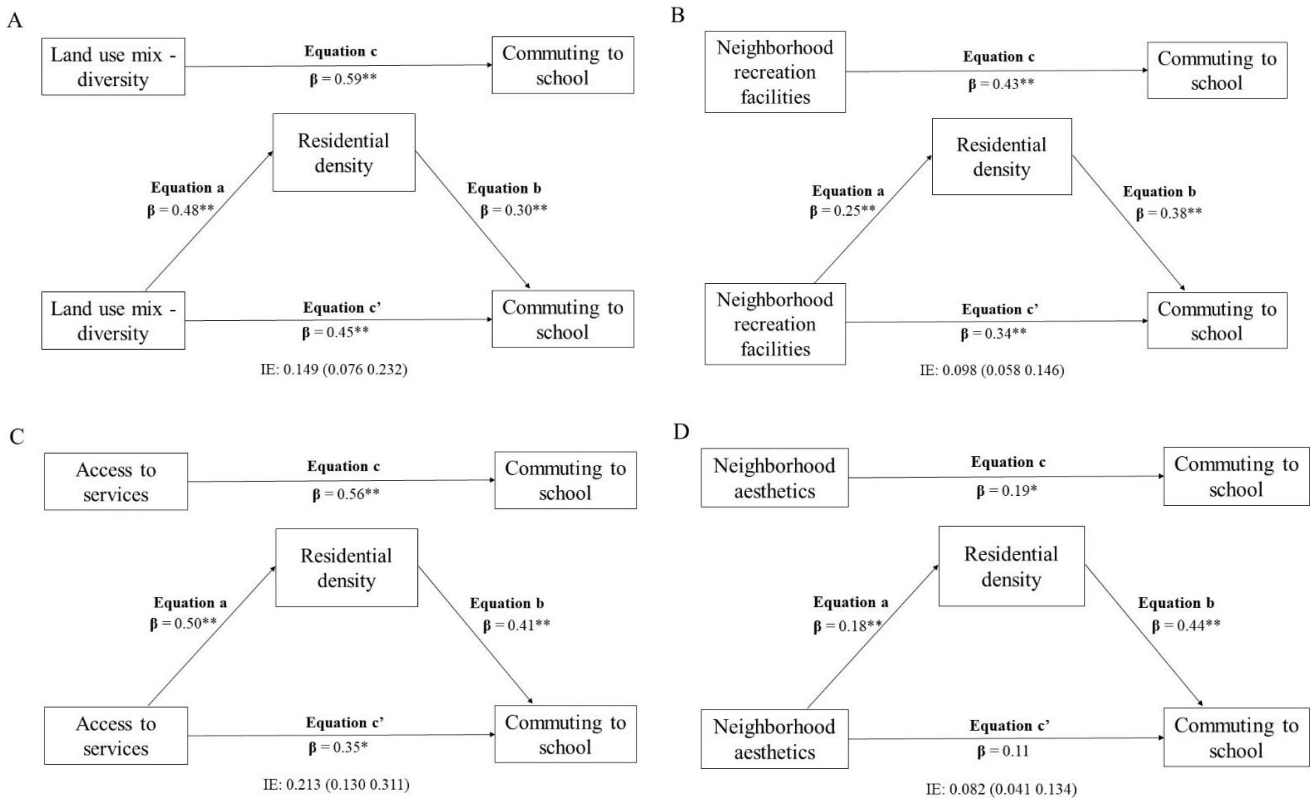

Figure 2. Residential density mediation model of the relationship between land use mix-diversity (A), neighborhood recreation facilities (B), access to services (C) and neighborhood aesthetics (D) with active commuting to school in adolescents. IE=indirect effect; *p<0.001; **p=<0.05. The analyses were adjusted for sex and socioeconomic status.

Figure 3 shows the model used to test the mediation role of walkability index in the association between land use mix-diversity (A), neighborhood recreation facilities (B), and access to services (C) with ACS. In model A, the first regression equation indicated that the association between better walkability index and land use mix-diversity was positive (p<0.001). Results of the second equation showed that the land use mix-diversity was positively associated with ACS (p<0.001). In the third equation, the relationship between walkability index and ACS was positive (p<0.001). Finally, in the fourth equation, when walkability index and land use mix-diversity were included simultaneously in the model, walkability index was positively associated with ACS (p<0.001). Additionally, the relationship between land use mix-diversity and ACS was attenuated when walkability index

was included in the model, indicating that walkability index is a mediator of this relationship (IE=0.048; 95%CI: 0.009–0.093).

The analysis of the mediator role of walkability index in the association between neighborhood recreation facilities (IE=0.039; 95%CI=0.012–0.070) and ACS (Figure 3B), also showed that walkability index is a mediator of these association since the above-mentioned criteria for the mediation analysis were observed. Similarly, walkability index is a mediator in the association between access to service (IE=0.090; 95%CI=0.033 0.159) with ACS (Figure 3C).

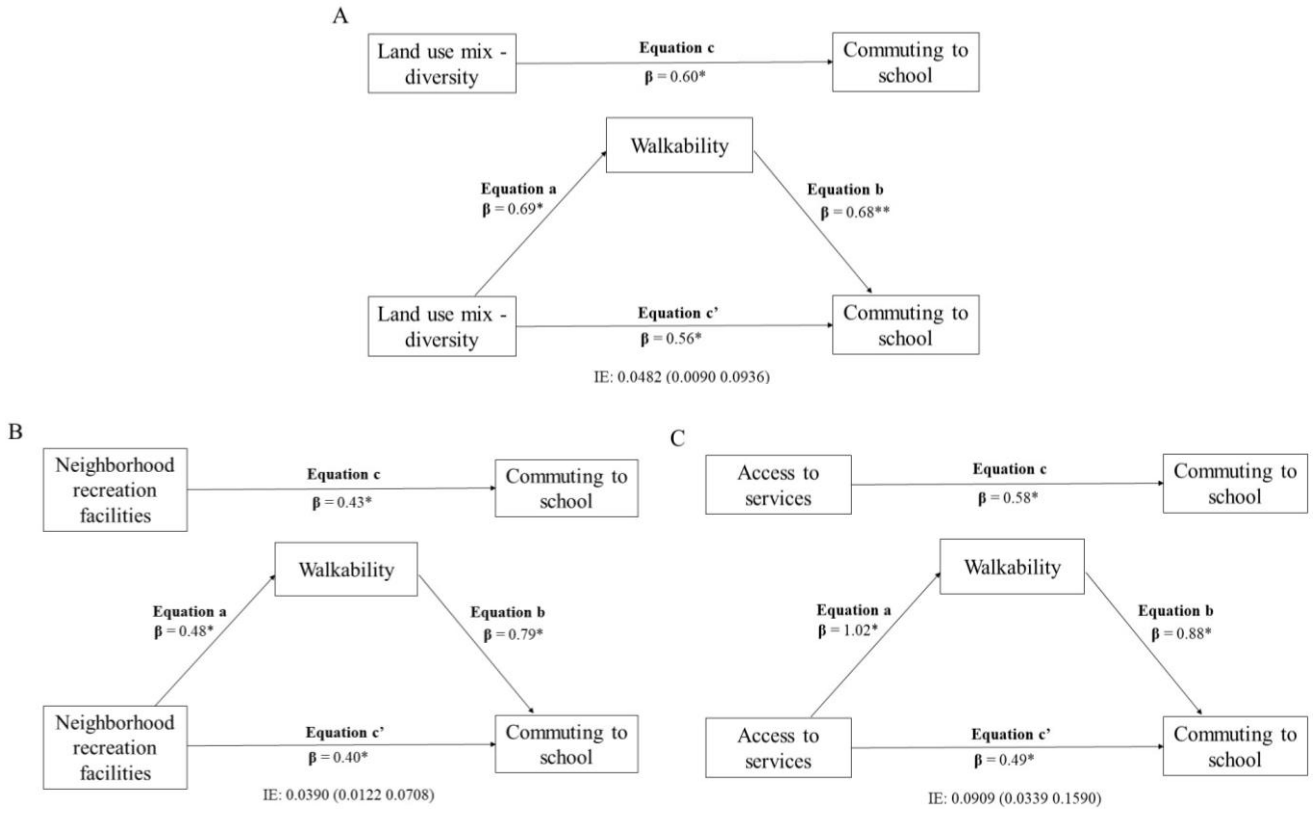

Figure 3. Walkability index mediation model of the relationship between land use mix-diversity (A), neighborhood recreation facilities (B), and access to services (C) with active commuting to school in adolescents. IE=indirect effect; *p<0.001; **p=<0.05. The analyses were adjusted for sex and socioeconomic status.

DISCUSSION

The main findings of the present study indicate that residential density, walkability index and perceived environmental factors (land use mix-diversity, neighborhood recreation facilities, access to services and neighborhood aesthetics) displayed an association with ACS. Moreover, results showed that walkability index acts as mediator on the association between land use mix-diversity, neighborhood recreation facilities and access to services with ACS in adolescents, as well as residential density is mediator between neighborhood recreation facilities, access to services and neighborhood aesthetics with ACS.

In the present study, adolescents perceived a shorter distance from the residence to several places, such as, supermarkets, library, among others (land use mix-diversity), as well as those who reported short distance to places for physical activity practice, as sport clubs, parks, etc. (neighborhood recreation facilities), better access and aesthetics of the neighborhood were those who actively commute to school. In agreement with our results, previous studies with adolescents from Belgium, Nigeria and New Zealand displayed that land use mix diversity (DE MEESTER et al., 2013), access to services (OYEYEMI et al., 2014) and nice scenery in neighborhood (MANDIC et al., 2015) were associated with ACS. Duncan et al., (2016a) showed that a distance of approximately 2 km was associated with the best results of physical activity related to active transport (9% to 15% increase on weekdays) in children and adolescents from New Zealand. However, distance to and from school, is a high specific variable which differs in each context, even within the same country. For instance, in a study conducted in Spanish adolescents, the threshold distance for walking to school was 1,350 m for adolescents (RODRÍGUEZ-LÓPEZ et al., 2017), so it is interesting to know what is the real distance of the route from home to school, and what is the distance that the adolescent is able to complete.

Studies developed with Colombian and Chilean children and adolescents indicated that ACS is associated with cultural and geographic factors, however it was not taken into account environmental factors (HERRADOR-COLMENERO; RAMI, 2019; RAMÍREZ-VÉLEZ et al., 2016). Thus, studies in low-income countries are scarce mainly concerning the relationship between the specific context of commuting to school with environmental factors in adolescents. In the northeast of Brazil, the aspect "having places they like to go to" was reported by adolescents and positively associated with active commuting (MENDONÇA et al., 2018). In this sense, a possible explanation for our results (land use mix-diversity and neighborhood recreational facilities associated with ACS) may be due to youth are used to

walk to different places in the neighborhood, and this could be the reason why they actively commute to school.

GIS-measured environmental characteristics associated with ACS have increased in recent years (KERR et al., 2006; MOLINA-GARCÍA et al., 2019; WONG; FAULKNER; BULIUNG, 2011). Walkability index, characterized by high residential density, connectivity between streets, retail floor area ratio and land use mix (FRANK et al., 2010), has been recommended in order to identify built environment characteristics that in combination can influence physical activity practice. Our results showed that residential density and walkability index is related with ACS. Some studies have shown that the residential density is positively associated with the active commuting in adolescents (CARLSON et al., 2015; DE MEESTER et al., 2013; MOLINA-GARCÍA et al., 2019). Similarly, the same population presented a relationship between walkability index and walking and cycling (CARLSON et al., 2015). In addition, in American children and adolescents, neighborhoods were selected according to walkability and income and the results showed that in high income neighborhoods more children actively commuted in high-walkable neighborhood, than in low-walkable (KERR et al., 2006). A study with Brazilian adults showed the same trend, where the walkability index was associated with walking for transport and leisure-time moderate-to-vigorous physical activity (REIS et al., 2013). On the other hand, data are scarce concerning young population and specifically in low-income countries.

Taking this relationship into consideration, our study intends to go further in order to understand which variables could intervene in the association between perceived environmental factors and ACS. Thus, our results indicated that residential density and walkability index has the role of mediate the relationship of some perceived environmental factors with ACS in adolescents. That is, having higher residential density and higher walkability index in the neighborhood influence adolescents who perceive a smaller distance to several places, as well as places for physical activity practice, better access and more aesthetics in the neighborhood for ACS. However, when the mediator variables were included in the models, the magnitude of the association were low, ranging among 0.03 until 0.21 (indirect effect). This is justified considering that there are many factors that could intervene in the relationship between environment attributes and physical activity behavior.

Considering the aforementioned, our findings could be relevant for professional's and stakeholders from the public health area. We emphasize that public and health managers, as well as transport agents and urban planning, can develop strategies to promote active commuting of the Brazilian population. Characteristics of urban design such as well-

connected streets, high-density residential locations, perception of various locations near adolescent residence and easy access to services can encourage students to ACS and consequently increase physical activity levels, reflecting on health promotion. Therefore, developing strategies to promote more active cities through resources of built environment, as well as other structures, such as walking and running trails and bicycle paths to encourage active commuting can have positive impacts on health of the entire population.

Despite this, some limitations should be mentioned. The transversal design of the study does not allow to determine cause and effect and the impossibility of obtaining the retail floor area ratio and land use mix variables, to compose walkability index. The strengths of the present study include a large sample of Brazilian adolescents. In addition, the use of environmental variables measured objectively and subjectively to understand how much this reflects in ACS. Finally, as far as we know, this is the first study using mediation analysis to understand the role of residential density and walkability index in the association of the perceived environment with ACS of Brazilian adolescents. Future studies should try to look for causal inferences and take into account the following factors: understanding the impact of improvements in the infrastructure of built environment, as well as resources and incentives in the neighborhood or school, can influence parents and adolescents to perceive the environment in a positive way and thus increase the prevalence of ACS. Another important issue is to know the reasons that lead adolescents to actively commute to school. Addressing environmental, social, individual, and political factors, can also help elucidate these relationships.

In conclusion, residential density and walkability index are mediators on the relationship between perceived environmental factors and ACS in Brazilian adolescents. The connectivity between street did not show correlation with the ACS, thus it was not tested in the mediation model. Our findings also emphasize that self-reported environmental data, such as land use mix-diversity, neighborhood recreation facilities, access to services and neighborhood aesthetics seems to be important factors for ACS in Brazilian adolescents, considering the residential density and walkability index.

IV PARTE

ARTIGO ORIGINAL – 3

Neighborhood environmental factors association with leisure walking according to socioeconomic status and gender in Brazilian adolescents

Fatores ambientais do bairro associados com caminhada no lazer de acordo com o nível socioeconômico e o sexo em adolescentes brasileiros

ARTIGO ORIGINAL 3 (Fatores ambientais do bairro associados com caminhada no lazer de acordo com o nível socioeconômico e o sexo em adolescentes brasileiros)

ABSTRACT

Objective: To verify the associations between leisure walking with perceived and objective measures of neighborhood environmental factors stratified by gender and socioeconomic status (SES) in Brazilian adolescents.

Methods: Cross-sectional study with a random sample of 1130 high school students (47.3% boys; age: 14 to 20 years old) from Porto Alegre, Brazil. Leisure walking and SES were self-reported by the adolescents. Perceived environmental factors were assessed through Neighborhood Environment Walkability Scale for Youth (NEWS-Y). Objective measures of the built environment were evaluated using Geographic Information Systems, road network buffers were calculated around adolescent's residential address, using 0.5 km and 1.0 km buffers. Generalized linear regression models were used.

Results: For girls from low SES, access to services (OR=2.22; 95%CI=1.01;4.92 for 0.5km buffers and OR=2.17; 95%CI=1.01;4.83 for 1.0km buffers) and lower distance for parks and squares (OR=2.80; CI=1.04;7.55 for 0.5km and OR=2.73; CI=1.01;7.32 for 1.0km) were positively associated with leisure walking. Residential density (OR=1.57; CI=1.08;2.28 for 0.5km and OR=1.54; CI=1.05;2.25 for 1.0km) and walkability index (OR=1.17; CI=1.02;1.35 for 0.5km and OR=1.20; CI=1.04;1.39 for 1.0km) were associated with leisure walking in girls of middle SES. Regarding boys, it was found an inverse association between crime safety with leisure walking in low SES (OR=0.59; CI=0.37;0.95 for 0.5km and OR=0.63; CI=0.36;0.98 for 1.0km). Neighborhood recreation facilities was positively associated with leisure walking in middle SES (OR=1.55; CI=1.06;2.29 for 0.5km and OR=1.60; CI=1.09;2.35 for 1.0km). Land use mix (OR=1.81; CI=1.09;3.02 for 0.5km and OR=1.81; CI=1.11;2.94 for 1.0km), neighborhood recreation facilities (OR=2.32; CI=1.26;3.93 for 0.5km and OR=2.28; CI=1.35;3.86 for 1.0km) and places for walking (OR=2.07; CI=1.03;4.19 for 0.5km and OR=2.22; CI=1.10;4.46 for 1.0km) were positively associated with leisure walking in high SES.

Conclusion: There is an association between environmental factors (objectively and subjectively measured) with leisure walking in boys and girls of different SES.

Keywords: physical activity; leisure-time walking, public open spaces, built environment, youth, Brazil.

RESUMO

Objetivo: Verificar as associações entre a caminhada no lazer com medidas percebidas e objetivas dos fatores ambientais no bairro, estratificados pelo nível socioeconômico e sexo em adolescentes brasileiros.

Métodos: Estudo transversal com amostra aleatória de 1130 estudantes do ensino médio (47,3% meninos; idade: 14 a 20 anos) de Porto Alegre, Brasil. A caminhada no lazer e o nível socioeconômico foram reportadas pelos adolescentes. Os fatores do ambiente percebido foram avaliados através do *Neighborhood Environment Walkability Scale for Youth* (NEWS-Y). As medidas objetivas do ambiente construído foram determinadas utilizando o Sistema de Informações Geográficas, a rede de ruas no buffer foi calculada em torno do endereço residencial dos participantes, utilizando os buffers de 0,5 km e 1,0 km. Regressão linear generalizada foi utilizada.

Resultados: Para as meninas do nível socioeconômico baixo, o acesso a serviços (OR=2,22; 95%IC=1,01;4,92 para 0,5 km buffers e OR=2,17; 95%IC=1,01;4,83 para 1,0 km buffers) e menor distância para parques e praças (OR=2,80; IC=1,04;7,55 para 0,5 km e OR=2,73; IC=1,01;7,32 para 1,0 km) foram positivamente associados com a caminhada no lazer. Densidade residencial (OR=1,57; IC=1,08;2,28 para 0.5 km e OR=1,54; IC=1,05;2,25 para 1,0 km) e índice de walkability (OR=1,17; IC=1,02;1,35 para 0.5 km e OR=1,20; IC=1,04;1,39 para 1,0 km) foram associados com a caminhada de lazer em meninas de nível socioeconômico médio. Com relação aos meninos, foi encontrado uma associação inversa entre a segurança do crime com a caminhada no lazer no nível socioeconômico baixo (OR=0,59; IC=0,37;0,95 para 0,5 km e OR=0,63; IC=0,36;0,98 para 1,0 km). Instalações de recreação no bairro foi positivamente associada com a caminha no lazer no nível socioeconômico médio (OR=1,55; IC=1,06;2,29 para 0,5 km e OR=1,60; IC=1,09;2,35 para 1,0 km). Uso misto do solo (OR=1,81; IC=1,09;3,02 para 0,5 km e OR=1,81; IC=1,11;2,94 para 1,0 km), instalações de recreação no bairro (OR=2,32; IC=1,26;3,93 para 0,5 km e OR=2,28; IC=1,35;3,86 para 1,0 km) e locais para caminhar (OR=2,07; IC=1,03;4,19 para 0,5 km e OR=2,22; IC=1,10;4,46 para 1,0 km) foram positivamente associados com a caminhada no lazer no nível socioeconômico alto. Conclusão: Foi encontrada associação entre os fatores ambientais (mensurados de forma subjetiva e objetiva) com a caminhada no lazer em meninos e meninas de diferentes níveis socioeconômicos.

Palavras-chave: atividade física; tempo de caminhada no lazer; espaços públicos abertos; ambiente construído; jovens; Brasil.

INTRODUCTION

Physical activity is recognized for its benefits in all health domains, a study developed in 17 countries, including Brazil showed that higher physical activity levels were associated with a lower risk of mortality and cardiovascular disease in individuals from low-income, middle-income, and high-income countries (LEAR et al., 2017). In addition, participation in physical activity, specifically physical activity during leisure time was associated with lower risk of incident coronary heart disease among young women (CHOMISTEK et al., 2017). However, the prevalence of leisure-time physical inactivity (not accumulating at least 60 min/day) was 54.3% in Brazilians adolescents, as well as more than a quarter of adolescents (26.5%) reported not be engaged in physical activity during leisure time (CUREAU et al., 2016).

A systematic review by Bauman et al., (2012) showed that physical activity in low and middle-income countries is associated with several factors, such as demographic, biological, psychosocial, environmental, social and cultural variables. In recent years, there has been increased research on the association between environmental correlates and physical activity. With regard to the young population and the specific domain of leisure physical activity, characteristics of the environment as distance to local facilities and home environmental were negatively associated in Portuguese adolescents (PEREIRA et al., 2018). In Nigeria, residential density and availability/quality of infrastructures were positively associated with leisure-time moderate to vigorous physical activity (MVPA) in adolescents (OYEYEMI et al., 2014). For students in Argentina, it was found an association between access to public spaces and leisure physical activity.

Likewise, in Brazil some evidences are available from Curitiba (HINO et al., 2011; RECH et al., 2014), São Paulo (FLORINDO et al., 2017), Belo Horizonte (GOMES et al., 2016) and Recife (HALLAL et al., 2010b) but they were conducted in adults, while in youngsters few studies were identified. Adolescents from northeastern Brazil reported that “seeing other adolescents engaged in physical activities" and "seeing interesting things while walking" were associated with recreational activities (MENDONÇA et al., 2018). In the south of the country, it was found that living near the beach increased leisure-time MVPA for adolescents (SILVA et al., 2017). Lima et al., (2013) identified that distance from home and number of recreational facilities in the neighborhood were associated with physical activity among adolescents and that these relationships differs between boys and girls.

Thus, literature about this topic in Brazilian youth are still scarce. Therefore, our study intends to add new information to the field including both objective and perceived measures

of the environment for each gender and by different socioeconomic status (SES). Also, we are exploring data from a city that has no evidence about those aspects. In addition, it is important to highlight that in developing countries, information about the built environment by SES can contribute to the development of public policies, to increase physical activity and, consequently a healthier population. Therefore, the aim of the present study was to verify the associations between leisure walking with perceived and objective measures of neighborhood environmental factors stratified by SES and gender in Brazilian adolescents.

METHODS

Characteristics of the Study and Ethical Aspects

This is a cross sectional study, with a quantitative approach, developed in Porto Alegre, Brazil. The city population is approximately 1.4 million inhabitants (year 2010), a territorial area of 496,681 km² and a demographic density of 2,837.53 inhabitants/km² (IBGE, 2010). The study was approved by the Ethics Committee of Research with Human Beings of the Federal University of Rio Grande do Sul (nº. 1,338.597).

Participant recruitment

The population study was composed of approximately 34,645 high school students, from 71 public schools (IBGE, 2012). They were allocated in the following regions: 8,057 north, 6,423 south, 4,268 east, and 15,897 center.

In order to calculate the sample size, the following criteria were considered: a) estimated population of 34,645 students (N); b) proportion of 50% (p); c) complementary percentage of 100 – p (q); d) degree of confidence of 2 standard deviations (S); and e) acceptable sampling error of 3% (e). After the adoption of these criteria and accordingly the formula "$n=S^2.p.q.N/e^2(N - 1)+(S^2.p.q)$", it was estimated that 1,077 students should be evaluated. However, to avoid probable difficulties with the sample loss, an increase of 5% was assumed, totaling 1,130 adolescents. This calculation was performed using the formula to have a representative sample of the population. The power of the test was tested through the software G*power version 3.1, for the statistical analysis used in the study, the value of the power of the test was 1.0.

Sample selection considered the proportion of youth enrolled in the schools by region. Thus, the sample was composed of: 263 students from 4 schools in the north region (23.26%); 518 students from 7 schools in the central region (45.88%); 140 students from 2 schools in the east region (12.32%); and 209 students from 3 schools in the south region (18.54%).

Sample selection was performed by multiple phases' procedure (GAYA et al., 2008). First, schools were selected, accordingly to each region, and then, in the schools, the high school classes were randomly selected. A number was assigned for each school and all numbers were placed in a box, mixed and randomly reelected one by one. Then, data was collected in one class belonging to first, second and third year from the high school. All students from each classes selected were invited to participate in the study. Inclusion criteria were: a) belonging to the first, second or third year of high school; b) handing in the consent document signed by a parent or guardian; and c) signing the assent document manifesting will to participate. We highlight that according to Sawyer et al., (2018) a definition of 10–24 years corresponds more closely to adolescent growth and popular understandings of this life phase, thus we use the term adolescents, even when some students were over 18 years of age.

Data collection

Data collection was performed during an eight-month period in 2017. First, the researcher went to the selected schools, explained the aims of the study and if the principals agreed to participate, they were asked to sign an acceptance term. Also, the adolescents signed the assent form and parents the consent form. Then, data collection was scheduled. Questionnaires were filled out during a regular class, corresponding to approximately 45 minutes and data confidentiality was kept.

Measures

Leisure physical activity

Self-reported leisure physical activity was assessed by their respective sections of the long form of the International Physical Activity Questionnaire (IPAQ) (CRAIG et al., 2003). This instrument was adapted literally and culturally in several countries (CRAIG et al., 2003), including Brazil and has been applied in epidemiological studies in Latin American countries (HALLAL et al., 2010a). To assess leisure walking, subjects answered the question 'How many days per week do you usually walk in your free time?'. Response choices were from zero until seven. We have created one binary outcome: participation in leisure-time walking (or not).

Perceived environmental

To measure perceived neighborhood environmental factors, the version of the Neighborhood Environment Walkability Scale for Youth (NEWS-Y) (ROSENBERG et al.,

2009), validated in Brazil (LIMA; RECH; REIS, 2013) was used. This questionnaire evaluates perceived environmental factors that may influence youth physical activity (ROSENBERG et al., 2009). Questions were considered according to the following dimensions, proposed by the NEWS-Y scoring guidelines (SALLIS, 2009b): Land use mix-diversity (perception of distance from home to a variety of more common destinations, such as shops or school), neighborhood recreation facilities (perceived distance from the student house, walking to a variety of places for physical activity practice, such as walking/running track or large public park), access to services, street connectivity, places for walking, neighborhood aesthetics, neighborhood safety and crime safety. More information about the questions can be found elsewhere Lima, Rech and Reis, (2013), Rosenberg et al., (2009) and website James Sallis athrough the link <http://sallis.ucsd.edu/Documents/Measures_documents/NEWS_Y_adolescent.pdf>.

For land use mix (diversity) and neighborhood recreation facilities, the answers options were: 1-5min, 6-10min, 11-20min, 21-30min, more than 30 min and don't know/there isn't. The option 'don't know' was coded as "more than 30 min" because if it is not known whether the facility is within walking distance, the actual walk is likely more than 31 minutes (SALLIS, 2009b). All items were reverse coded and employ mean values. Also, the NEWS-Y guidelines indicate an alternative scoring to tally the number of stores or facilities within a 5, 10, or 20-minute walk, which was considered "near from home" (SALLIS, 2009b).

All the questions from the dimensions access to services, street connectivity, places for walking, neighborhood aesthetics, neighborhood and crime safety were measured using 4-point Likert scale (strongly disagree, partially disagree, partially agree, strongly agree). All determinants were calculated following the NEWS-Y scoring guidelines (SALLIS, 2009b) with a higher score, indicating better conditions for physical activity.

Objective environment factors

The adolescents' address was reported in the questionnaire. From the adolescent's addresses, we perform the georeferencing process and represent them in the Geographic System Information (GIS) environment through ArcMap 10.3.1 software. The shapefile of the streets provided by the Municipal Department of Urbanism, and the shapefile of the parks and squares provided by the Municipal Department of Urbanism and environment and sustainability of Porto Alegre – RS were used for the analyzes.

The distances between houses and parks or squares of the city were defined through the tool "Network Analyst/Closest Facility". The distance was calculated in meters and

categorized in tertiles of “close”, “medium” and “far”. Besides, buffers within 0.5 km and 1.0 km of the participants’ homes, reachable by the street network, were defined to estimate accessible neighborhood features. Thus, the following variables were used: existence of parks and squares (existence of parks and squares in buffer); existence of bicycle path (existence of bicycle path in buffer); residential density (number of residences within each buffer); density of blocks (number of blocks within each buffer); average size of the blocks (average size of streets/blocks within each buffer); Connectivity between streets (intersection number of streets in buffer) and; walkability index (sum 2* z-score connectivity between streets + z-score residential density).

Socioeconomic status

SES was assessed through the number of owned items at the adolescents’ residences and the level of schooling of the parent or guardian. By means of the criteria established by the Brazilian Association of Research Companies (ABEP, 2015). For each answer, a score was constructed and the sum of the points was done to identify each student's economic class (ABEP, 2015). Then adolescents were classified into the following economic classes: low (1° tertile), middle (2° tertile) and high (3° tertile).

Data analyses

Descriptive data are shown as absolute and relative values, means and standard deviations stratified by gender and SES. Geographical data of the squares, parks, bicycle paths and students’ homes are presented in the figure.

The internal consistency from NEWS-Y dimensions variables was verified through Cronbach Alpha (0.89), indicating 0.89 as an acceptable reliability. Values for each dimension were: land use mix- diversity (0.88), neighborhood recreation facilities (0.84), access to services (0.36), street connectivity (0.36), places for walking (0.30), neighborhood aesthetics (0.71), neighborhood safety (0.10) and crime safety (0.85).

Generalized linear regressions were used to test the association between perceived and objective measures of neighborhood environmental factors with leisure walking. Thus, the analyzes were splitted by gender and SES in two models: variables of the perceived environment adding objective built environment with 0.5 kilometers buffers (model 1); and perceived environment adding objective built environment with 1.0 kilometers buffers (model 2). All analyzes were adjusted for age and region and we tested additional adjustment for the environmental variables considering collinearity between them (rho≥0.60). The variables that

present high collinearity were descripted in legend of the tables. All analyses were carried out using the IBM SPSS 22 (SPSS, Inc., Chicago, Illinois, USA), alpha <0.05 was adopted and confidence intervals (95%) were presented.

RESULTS

The study sample comprised 1130 adolescents from Porto Alegre-RS, however the data referring to SES was of 1113 students. The sample loss occurred because the adolescents did not respond adequately to the questionnaire.

Descriptive characteristics of the sample, as well as data concerning perceived and objective measures of neighborhood environmental factors by sex and SES are presented in table 6. We observed that the prevalence of adolescents that engage in leisure walking was higher for boys and girls from high SES.

The geocoding of residential addresses for built environmental analyses (objective measures) was undertaken for 1010 adolescents. Sample losses were due to lack of address information and incompatibilities in the street network. Figure 4 present the environmental characteristics, such as existence of bicycle path, parks and squares, as well as georeferencing of residence students. It is possible to verify that the distribution of park and squares is not equally distributed around the city, and few bicycle path were observed.

Table 6. Descriptive characteristics of the sample stratified by gender and socioeconomic status in Brazilian adolescents

	Girls			Boys		
Variables	**Low** (n=189) **n (%)**	**SES** (n=587) **Middle** (n=201) **n (%)**	**High** (n=197) **n (%)**	**Low** (n=175) **n (%)**	**SES** (n=526) **Middle** (n=180) **n (%)**	**High** (n=171) **n (%)**
Age						
14-15	32 (16.9)	35 (17.4)	46 (23.4)	23 (13.1)	25 (13.9)	44 (25.7)
16-17	129 (68.3)	136 (67.7)	137 (69.5)	117 (66.9)	118 (65.6)	105 (61.4)
18-19-20	28 (14.8)	30 (14.9)	14 (7.1)	35 (20.0)	37 (20.6)	22 (12.9)
Region						
Central	88 (46.6)	100 (49.8)	103 (52.3)	58 (33.1)	70 (38.9)	92 (53.8)
North	33 (17.5)	48 (23.9)	48 (24.4)	42 (24.0)	48 (26.7)	28 (16.4)
South	36 (19.0)	33 (16.4)	32 (16.2)	38 (21.7)	39 (21.7)	39 (22.8)
East	32 (16.9)	20 (10.0)	14 (7.1)	37 (21.1)	23 (12.8)	12 (7.0)
Leisure PA						
Leisure Walking (proportion: yes)	97 (51.3)	94 (46.8)	107 (54.3)	103 (58.9)	102 (56.7)	111 (64.9)
Objective (GIS)						
Existence of parks and squares (0.5km)	81 (48.2)	109 (59.9)	109 (61.6)	98 (62.0)	103 (63.6)	103 (67.8)
Existence of parks and squares (1.0km)	132 (78.6)	160 (87.9)	156 (88.1)	134 (84.8)	136 (84.0)	141 (92.8)
Existence of bicycle path (0.5km)	12 (7.1)	16 (8.8)	27 (15.3)	26 (16.5)	24 (14.8)	15 (9.9)
Existence of bicycle path (1.0km)	30 (17.9)	44 (24.2)	50 (28.2)	43 (27.2)	37 (22.8)	35 (23.0)
	Mean (SD)	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**
Perceived Environment						
Land use mix – diversity	3.16 (0.85)	3.54 (0.89)	3.73 (0.84)	3.45 (0.81)	3.66 (0.81)	3.83 (0.94)
Neighborhood recreation facilities	2.25 (0.87)	2.73 (1.05)	2.97 (0.96)	2.82 (0.99)	3.03 (1.04)	3.49 (1.00)
Access to services	2.81 (0.51)	2.97 (0.51)	3.01 (0.48)	2.98 (0.48)	2.93 (0.47)	3.05 (0.45)
Street connectivity	2.68 (0.68)	2.69 (0.70)	2.79 (0.67)	2.75 (0.68)	2.76 (0.67)	2.81 (0.66)
Places for walking	2.54 (0.80)	2.79 (0.69)	2.77 (0.66	2.81 (0.74)	2.75 (0.59)	2.87 (0.61)
Neighborhood aesthetics	2.30 (0.73)	2.50 (0.69)	2.70 (0.67)	2.55 (0.73)	2.56 (0.71)	2.76 (0.69)

Neighborhood safety	2.56 (0.48)	2.44 (0.44)	2.37 (0.47)	2.28 (0.42)	2.32 (0.41)	2.29 (0.47)
Crime safety	2.86 (0.82)	2.76 (0.80)	2.59 (0.76)	2.38 (0.79)	2.46 (0.73)	2.36 (0.78)
Objective (GIS)						
Lower distance for parks and squares	818.90 (1089.89)	558.43 (611.24)	611.98 (999.72)	649.18 (1055.49)	696.78 (1246.78)	453.92 (457.31)
Lower distance for bicycle path	3026.72 (2094.62)	2507.85 (1757.05)	2285.94 (1913.92)	2607.55 (1986.55)	2628.14 (2015.07)	2359.63 (1621.13)
Objective Environment Factors (0.5 km-buffers)						
Residential density	2550.35 (1254.49)	2855.59 (1456.52)	2811.36 (1540.46)	2728.11 (1461.43)	2583.06 (1373.02)	3003.98 (1578.16)
Connectivity between streets	53.61 (33.53)	51.94 (31.46)	47.20 (27.46)	50.83 (33.42)	49.84 (33.10)	50.11 (27.92)
Blocks density	7973.63 (3469.49)	8765.06 (3516.94)	8780.96 (3409.79)	8627.06 (3893.09)	8515.05 (3774.66)	9231.46 (3279.48)
Average size of the blocks	120.15 (123.73)	121.61 (63.89)	134.17 (123.79)	118.99 (54.31)	118.76 (44.33)	122.75 (44.81)
Walkability index*	0.02 (2.69)	0.15 (2.54)	-0.19 (2.25)	-0.05 (2.64)	-0.17 (2.63)	0.15 (2.29)
Objective Environment Factors (1.0 km-buffers)						
Residential density	6179.16 (3488.29)	7464.60 (4053.18)	7862.40 (4562.06)	6989.69 (4136.42)	6970.60 (3727.70)	8086.56 (4368.71)
Connectivity between streets	180.61 (104.48)	193.36 (104.54)	178.90 (94.90)	185.15 (107.83)	187.33 (111.07)	186.56 (92.36)
Blocks density	25397.55 (11714.66)	29766.52 (11850.19)	30480.68 (12090.82)	28926.19 (13294.79)	29464.51 (12476.15)	30918.12 (10734.35)
Average size of the blocks	107.47 (40.74)	112.55 (44.83)	121.65 (43.56)	112.99 (39.70)	116.68 (39.55)	118.53 (39.69)
Walkability index*	-0.35 (2.62)	0.20 (2.58)	-0.01 (2.45)	-0.06 (2.68)	-0.07 (2.69)	0.22 (2.31)

*Standardized variables (transformed into z-scores).

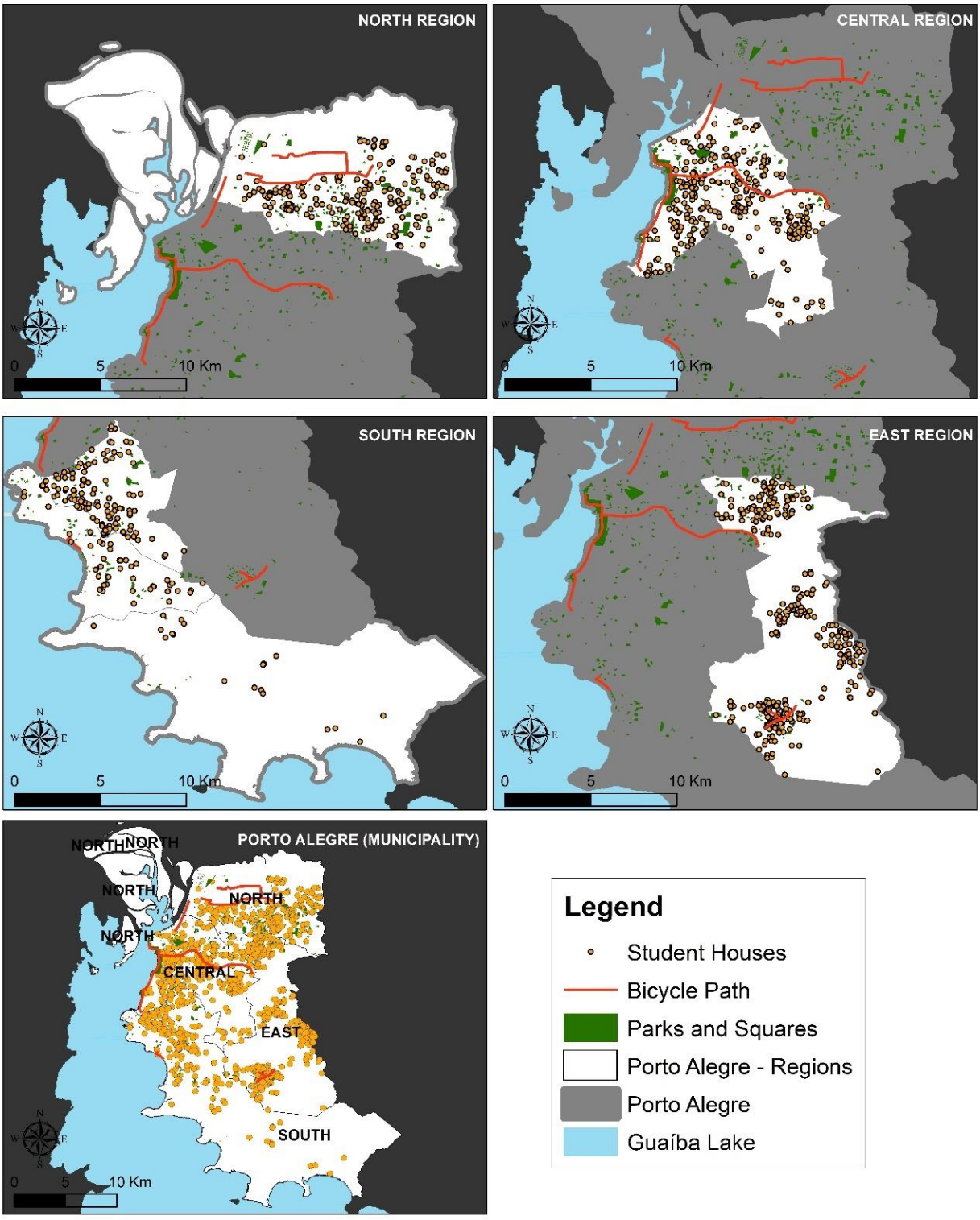

Figure 4. Georeferencing of residence students, parks, squares and bicycle path in Porto Alegre-RS (n=1010)

Table 7 and 8 shows the results of perceived and observed neighborhood environmental factors and leisure walking by gender and SES. The same results were found for girls in 0.5 and 1.0 km buffers (table 7. model 1 and 2). The analyzes for low SES girls adolescents indicated that access to services and lower distance for parks and squares were positively associated with walking leisure. The objective measures, such as residential density and walkability index were associated with walking leisure in middle SES. For girls of high SES, no associations were found.

Regarding boys, only perceived environmental factors were associated with leisure walking in both models (table 8). For boys from low SES, it was found an inverse association between crime safety with leisure walking. Neighborhood recreation facilities was positively associated with leisure walking in middle SES. Land use mix, neighborhood recreation facilities and places for walking were positively association with leisure walking in high SES.

Table 7. Association between perceived and objective neighborhood environmental factors with leisure walking by socioeconomic status in girls adolescents

	Leisure walking					
	Model 1[a]			Model 2[a]		
	SES (n=587)			**SES** (n=587)		
Perceived Environment	**Low** (n=189) OR (CI-95%)	**Middle** (n=201) OR (CI-95%)	**High** (n=197) OR (CI-95%)	**Low** (n=189) OR (CI-95%)	**Middle** (n=201) OR (CI-95%)	**High** (n=197) OR (CI-95%)
Land use mix – diversity	0.79 (0.48 133)	1.20 (0.81 1.76)[b]	1.18 (0.73 1.90)	0.79 (0.47 1.32)	1.07 (0.70 1.63)[b]	1.17 (0.71 1.93)
Neighborhood recreation facilities	0.76 (0.46 1.25)	1.33 (0.95 1.86)[b]	1.19 (0.79 1.79)	0.81 (0.50 1.32)	1.14 (0.81 1.60)[b]	1.09 (0.73 1.62)
Access to services	**2.22 (1.01 4.92)**	1.12 (0.58 2.16)	0.92 (0.42 2.02)	**2.17 (1.01 4.83)**	0.99 (0.50 1.97)	0.93 (0.42 2.05)
Street connectivity	0.72 (0.43 1.21)	1.13 (0.68 1.87)	1.27 (0.74 2.16)	0.69 (0.40 1.17)	1.02 (0.62 1.67)	1.41 (0.83 2.40)
Places for walking	0.74 (0.46 1.18)	0.80 (0.45 1.42)	1.03 (0.60 1.74)	0.80 (0.50 1.26)	0.87 (0.50 1.53)	1.01 (0.59 1.71)
Neighborhood aesthetics	1.09 (0.65 1.81)	1.30 (0.78 2.17)	1.51 (0.87 2.63)	1.12 (0.68 1.85)	1.20 (0.73 1.98)	1.38 (0.80 2.39)
Neighborhood safety	0.81 (0.35 1.84)	1.14 (0.53 2.45)	0.65 (0.29 1.46)	0.89 (0.39 1.99)	1.19 (0.56 2.55)	0.68 (0.30 1.540
Crime safety	0.93 (0.61 1.41)	0.83 (0.54 1.28)	0.75 (0.47 1.20)	0.91 (0.59 1.38)	0.82 (0.54 1.27)	0.71 (0.44 1.15)
Objective (GIS)						
Lower distance for parks and squares						
1 tertile (close)	**2.80 (1.04 7.55)**[b]	0.56 (0.22 1.39)[b]	0.42 (0.15 1.16)[b]	**2.73 (1.01 7.32)**	0.47 (0.18 1.19)	0.55 (0.20 1.48)
2 tertile (medium)	2.35 (0.93 5.94)[b]	0.67 (0.30 1.52)[b]	0.44 (0.17 1.17)[b]	2.36 (0.91 6.14)	0.54 (0.23 1 1.27)	0.56 (0.21 1.47)
3 tertile (far)	1	1	1	1	1	1
Lower distance for bicycle path						
1 tertile (close)	1.88 (0.72 4.88)	2.09 (0.86 5.04)	0.51 (0.19 1.32)[b]	1.91 (0.68 5.36)[b]	2.14 (0.86 5.31)[b]	0.57 (0.21 1.50)[b]
2 tertile (medium)	1.37 (0.63 2.95)	1.93 (0.85 4.35)	0.48 (0.20 1.17)[b]	1.42 (0.58 3.42)[b]	1.75 (0.78 3.96)[b]	0.52 (0.21 1.30)[b]
3 tertile (far)	1	1	1	1	1	1
Objective Environment Factors		(0.5km - buffers)			(1km – buffers)	
Existence of parks and squares						
No	1	1	1	1	1	1
Yes	1.63 (0.75 3.53)[b]	0.74 (0.36 1.52)[b]	0.73 (0.34 1.58)[b]	1.04 (0.45 2.43)[b]	1.54 (0.49 4.80)	0.30 (0.07 1.17)

Existence of bicycle path						
No	1	1	1	1	1	1
Yes	2.16 (0.47 9.93)	1.80 (0.52 6.16)	0.77 (0.31 1.91)[b]	1.70 (0.68 4.26)[b]	0.99 (0.44 2.20)[b]	0.79 (0.37 1.69)[b]
Residential density*	0.99 (0.62 1.57)[b]	**1.57 (1.08 2.28)**[b]	1.21 (0.83 1.75)[b]	0.88 (0.51 1.51)[b]	**1.54 (1.05 2.25)**[b]	1.25 (0.84 1.84)[b]
Connectivity between streets*	0.92 (0.65 1.30)[b]	1.25 (0.89 1.76)[b]	1.01 (0.67 1.51)[b]	1.02 (0.72 1.43)[b]	1.14 (0.80 1.61)[b]	1.90 (0.64 1.45)[b]
Blocks density*	1.11 (0.77 1.61)[b]	1.16 (0.79 1.71)[b]	1.11 (0.74 1.58)[b]	1.00 (0.68 1.47)[b]	1.35 (0.92 1.98)[b]	1.13 (0.72 1.77)[b]
Average size of the blocks*	1.08 (0.83 1.42)[b]	0.90 (0.57 1.43)[b]	0.86 (0.58 1.29)[b]	1.12 (0.76 1.67)[b]	0.78 (0.51 1.19)[b]	0.77 (0.52 1.15)[b]
Walkability index*	0.93 (0.81 1.08)[b]	**1.17 (1.02 1.35)**[b]	1.09 (0.92 1.30)[b]	0.94 (0.80 1.09)[b]	**1.20 (1.04 1.39)**[b]	1.06 (0.89 1.26)[b]

*Standardized variables (transformed into z-scores). [a]Adjusted for age and region. [b]Additionally adjusted for model 1[a], without the environmental variables that present high collinearity (rho ≥ 0.60).

Low (0.5km buffers) - High correlation between following variables: Residential density with blocks density (rho=0.72), with connectivity between streets (rho=0.66) and walkability (rho=0.81); Blocks density with connectivity between streets (rho=0.86), lower distance for park and squares (rho=-0.61), existence of park and square (rho=0.60) and walkability (0.89). Connectivity between streets with average size of the blocks (rho=-0.80) and walkability (rho=0.95). Average size of the blocks with walkability (rho=-0.73). Existence of park and square with lower distance for park and square (rho=-0.84).

Low (1km buffers) - High correlation between following variables: Residential density with connectivity between streets (rho= 0.77), blocks density (rho= 0.85), existence of park and square (rho=0.60) and walkability (rho= 0.87). Connectivity between streets with blocks density (rho= 0.90), average size of the blocks (rho=-0.69), existence of park and square (rho=0.61) and walkability (rho= 0.96). Blocks density with walkability (rho= 0.93) and existence of park and square (rho=0.63). Walkability with average size of the blocks (rho=-0.61) and existence of park and square (rho=0.62). Lower distance for bicycle path with existence of bicycle path (rho=-0.64).

Middle (0.5km buffers) - High correlation between following variables: Land use mix with neighborhood recreation facilities (rho= 0.61); residential density with blocks density (rho=0.62) and walkability (rho=0.76). Blocks density with connectivity between streets (rho=0.75) and walkability (0.82); connectivity between streets with average size of the blocks (rho=-0.79) and walkability (rho=0.87). Average size of the blocks with walkability (rho=-0.62). Existence of park and square with lower distance for park and square (rho=-0.82).

Middle (1km buffers) - High correlation between following variables: Land use mix with neighborhood recreation facilities (rho= 0.61). Residential density with connectivity between streets (rho= 0.76) and walkability (rho= 0.78). Connectivity between streets with blocks density (rho= 0.81), average size of the blocks (rho=-0.72) and walkability (rho=0.93). Blocks density with walkability (rho= 0.89). Existence of bicycle path with lower distance for bicycle path (rho=-0.70).

High (0.5km buffers) - High correlation between following variables: Residential density with blocks density (rho=0.66) and walkability (rho=0.76); Blocks density with connectivity between streets (rho=0.72) and walkability (rho=0.82); connectivity between streets with average size of the blocks (rho=-0.75) and walkability (rho=0.85). Existence of park and square with lower distance for park and square (rho=-0.79). Existence of bicycle path with lower distance for bicycle path (rho=-0.62).

High (1km buffers) - High correlation between following variables: Residential density with blocks density (rho= 0.75) and walkability (rho= 0.80). Connectivity between streets with blocks density (rho= 0.78), average size of the blocks (rho=-0.69) and walkability (rho=0.86). Blocks density with walkability (rho= 0.87). Existence of bicycle path with lower distance for bicycle path (rho=-0.68).

Table 8. Association between perceived and objective neighborhood environment factors with leisure walking by socioeconomic status in boys adolescents

	Leisure walking					
	Model 1[a]			Model 2[a]		
	SES (n=526)			**SES** (n=526)		
Perceived Environment	**Low** (n=175) OR (CI-95%)	**Middle** (n=180) OR (CI-95%)	**High** (n=171) OR (CI-95%)	**Low** (n=175) OR (CI-95%)	**Middle** (n=180) OR (CI-95%)	**High** (n=171) OR (CI-95%)
Land use mix – diversity	0.84 (0.47 1.51)	1.30 (0.81 2.07)[b]	**1.81 (1.09 3.02)**[b]	0.84 (0.47 1.51)	1.40 (0.91 2.18)[b]	**1.81 (1.11 2.94)**[b]
Neighborhood recreation facilities	1.45 (0.89 2.36)	**1.55 (1.06 2.29)**[b]	**2.32 (1.26 3.93)**[b]	1.38 (0.85 2.23)	**1.60 (1.09 2.35)**[b]	**2.28 (1.35 3.86)**[b]
Access to services	0.59 (0.24 1.45)	1.40 (0.64 3.02)	1.06 (0.75 1.51)	0.57 (0.23 1.40)	1.27 (0.57 2.79)	1.09 (0.77 1.55)
Street connectivity	1.01 (0.60 1.71)	0.84 (0.50 1.43)	0.57 (0.30 1.08)	1.04 (0.61 1.78)	0.94 (0.55 1.63)	0.56 (0.30 1.04)
Places for walking	0.94 (0.56 1.57)	1.07 (0.57 2.00)	**2.07 (1.03 4.19)**	1.01 (0.60 1.69)	0.99 (0.53 1.86)	**2.22 (1.10 4.46)**
Neighborhood aesthetics	1.15 (0.68 1.96)	1.01 (0.60 1.70)	1.54 (0.85 2.78)	1.05 (0.62 1.77)	0.89 (0.52 1.53)	1.47 (0.82 2.63)
Neighborhood safety	1.59 (0.58 4.38)	1.31 (0.56 3.06)	1.15 (0.46 2.90)	1.44 (0.53 3.91)	1.36 (0.58 3.17)	1.34 (0.53 3.38)
Crime safety	**0.59 (0.37 0.95)**	0.92 (0.58 1.48)	0.93 (0.55 1.56)	**0.63 (0.36 0.98)**	0.89 (0.55 1.45)	0.87 (0.53 1.42)
Objective (GIS)						
Lower distance for parks and squares						
1 tertile (close)	0.42 (0.15 1.14)[b]	0.33 (0.11 1.01)[b]	0.40 (0.15 1.04)[b]	0.37 (0.13 1.01)	0.35 (0.11 1.02)	0.51 (0.18 1.46)
2 tertile (medium)	0.47 (0.18 1.23)[b]	0.67 (0.27 1.66)[b]	0.74 (0.26 2.09)[b]	0.40 (0.14 1.11)	0.67 (0.23 1.67)	0.91 (0.31 2.66)
3 tertile (far)	1	1	1	1	1	1
Lower distance for bicycle path						
1 tertile (close)	0.86 (0.33 2.24)	1.13 (0.36 3.51)	0.51 (0.14 1.80)	0.89 (0.33 2.41)[b]	1.61 (0.53 4.87)[b]	0.50 (0.15 1.66)[b]
2 tertile (medium)	1.93 (0.75 4.98)	0.78 (0.32 1.87)	0.35 (0.10 1.21)	1.83 (0.71 4.74)[b]	0.77 (0.30 1.93)[b]	0.43 (0.12 1.48)[b]
3 tertile (far)	1	1	1	1	1	1
Objective Environment Factors		(0.5km - buffers)			(1km – buffers)	
Existence of parks and squares						
No	1	1	1	1	1	1
Yes	1.46 (0.60 3.53)[b]	0.80 (0.36 1.77)[b]	0.49 (0.20 1.17)[b]	2.77 (0.74 10.30)	0.91 (0.28 2.97)	0.96 (0.20 4.50)

Existence of bicycle path						
No	1	1	1	1	1	1
Yes	0.79 (0.57 1.09)	2.70 (0.93 7.85)	0.35 (0.10 1.22)	2.30 (0.98 5.25)[b]	1.73 (0.71 4.24)[b]	0.43 (0.15 1.18)[b]
Residential density*	1.21 (0.79 1.85)[b]	0.80 (0.55 1.17)[b]	1.07 (0.70 1.64)[b]	1.31 (0.86 1.99)[b]	0.70 (0.43 1.16)[b]	1.16 (0.74 1.83)[b]
Connectivity between streets*	1.27 (0.84 1.94)[b]	1.05 (0.73 1.50)[b]	1.03 (0.61 1.74)[b]	1.01 (0.66 1.56)[b]	1.10 (0.75 1.61)[b]	0.61 (0.36 1.04)[b]
Blocks density*	1.56 (0.96 2.53)[b]	0.69 (0.47 1.02)[b]	1.31 (0.77 2.25)[b]	1.37 (0.86 2.18)[b]	0.76 (0.49 1.16)[b]	0.97 (0.56 1.68)[b]
Average size of the blocks*	0.90 (0.50 1.61)[b]	1.12 (0.56 2.25)[b]	1.23 (0.56 2.69)[b]	1.21 (0.75 1.98)[b]	0.96 (0.64 1.45)[b]	1.46 (0.87 2.43)[b]
Walkability index*	1.09 (0.93 1.28)[b]	1.02 (0.88 1.17)[b]	0.97 (0.81 1.17)[b]	1.13 (0.96 1.33)[b]	1.01 (0.88 1.17)[b]	0.87 (0.72 1.04)[b]

*Standardized variables (transformed into z-scores). [a]Adjusted for age and region. [b]Additionally adjusted for model 1[a], without the environmental variables that present high collinearity (rho $\geq$ 0.60).

Low (0.5km buffers) - High correlation between following variables: Residential density with blocks density (rho=0.66) and walkability (rho=0.79); Blocks density with connectivity between streets (rho=0.84) and walkability (rho=0.89). Connectivity between streets with average size of the blocks (rho=-0.69) and walkability (rho=0.90); Existence of park and square with lower distance for park and square (rho=-0.86).

Low (1km buffers) - High correlation between following variables: Residential density with connectivity between streets (rho= 0.63), blocks density (rho= 0.77) and walkability (rho= 0.76). Connectivity between streets with blocks density (rho= 0.87), average size of the blocks (rho=-0.65) and walkability (rho= 0.91). Blocks density with walkability (rho= 0.88). Lower distance for bicycle path with existence of bicycle path (rho=-0.74).

Middle (0.5km buffers) - High correlation between following variables: Land use mix with neighborhood recreation facilities (rho= 0.66); residential density with blocks density (rho=0.69) and walkability (rho=0.78). Blocks density with connectivity between streets (rho=0.78) and walkability (0.82); connectivity between streets with average size of the blocks (rho=-0.75) and walkability (rho=0.88). Average size of the blocks with walkability (rho=-0.60). lower distance for park and square with existence of park and square (rho=-0.84) and blocks density (rho=0.62).

Middle (1km buffers) - High correlation between following variables: Land use mix with neighborhood recreation facilities (rho= 0.66). Residential density with connectivity between streets (rho= 0.65), blocks density (rho=0.80) and walkability (rho= 0.81). Connectivity between streets with blocks density (rho= 0.86), average size of the blocks (rho=-0.76) and walkability (rho=0.90). Walkability with blocks density (rho= 0.90) and average size of the blocks (rho=-0.60). Existence of bicycle path with lower distance for bicycle path (rho=-0.68).

High (0.5km buffers) - High correlation between following variables: Land use mix with neighborhood recreation facilities (rho= 0.68); Residential density with blocks density (rho=0.67) and walkability (rho=0.78); Blocks density with connectivity between streets (rho=0.70) and walkability (rho=0.77); connectivity between streets with average size of the blocks (rho=-0.76) and walkability (rho=0.81). Existence of park and square with lower distance for park and square (rho=-0.82).

High (1km buffers) - High correlation between following variables: Land use mix with neighborhood recreation facilities (rho= 0.68); Residential density with blocks density (rho= 0.74) and walkability (rho= 0.73). Connectivity between streets with blocks density (rho= 0.73), average size of the blocks (rho=-0.75) and walkability (rho=0.83). Blocks density with walkability (rho= 0.81). Existence of bicycle path with lower distance for bicycle path (rho=-0.64).

DISCUSSÃO

The main findings of the present study show that there is an association between leisure walking with perceived and objective measures of neighbourhood environmental factors, according to gender and SES in adolescents. For girls, results indicated that access to services and lower distance to parks and squares were positively associated with leisure walking in low SES. In middle SES girls, it was found association between residential density and walkability index with leisure walking. In boys, crime safety was inversely related with leisure walking in low SES, while neighborhood recreation facilities were positively associated with walking leisure in middle SES. Land use mix, neighborhood recreation facilities and places for walking were positively associated with leisure walking in high SES boys.

Results of the present study contribute to the current knowledge showing the associations of leisure walking with both perceived and objective measures of neighborhood environment in adolescents. Further, considering the social inequalities in Brazilian population we presented our results according to SES. Also, it is important to approach the role of gender, since boy and girls may present differences in leisure physical activity, specifically leisure walking, and consequently different associations with environmental factors. Thus, our results extend to the previous findings reporting the influence of SES and gender, as well as exploring perceived and objective measures of environment. It is essential to consider that the majority of the evidence about this topic originated from developed countries, which have not stratified the results by SES, possibly because this variable is not an intervenient factor in this context.

The findings related to girls indicated that access to services and lower distance for parks and squares were positively associated with leisure walking in low SES. The same was found in Argentina (FUEYO et al., 2016) and Brazil (LIMA et al., 2013; REIS et al., 2009), however the results were adjusted for SES. Additionally, Pereira et al., (2018) presented such associations, without considering SES in the analyses which may influence the results as evidence shows that SES influences in the relationship between environmental factors with leisure physical activity. Our results have also showed association between residential density and walkability index with leisure walking in middle SES. Some studies have indicated association between walkability with physical activity in adolescents, however this associations were observed in low and high SES (DE MEESTER et al., 2012; SALLIS et al., 2018). One explanation for this discrepancy can be that these studies have considered SES of

the neighbourhood instead of personal level SES. In addition, residential density was positively related to walking in adolescents when adjusted for SES.

The lack of association between environmental factors with leisure walking in high SES it was an unexpected result. A reason for this finding is not apparent. We hypothesized that other variables, such as social support and individual factors that were not addressed in the present study may be influencing this result, like owning a car that can take children everywhere. Indeed, among girls a shorter distance to squares and parks, a favourable perception of access in the neighborhood as well as high walkability index and residential density are intervenient factors for leisure walking and these results varied according to SES.

Among boys, crime safety was inversely associated with leisure walking in low SES. We expected that this association was also found in middle and high SES, taking into account that crime rates are high in Brazil and it seems that perceived lack of safety from crime constrains physical activity behaviours (REES-PUNIA; HATHAWAY; GAY, 2018). In agreement with our result, Mitáš et al., (2018) indicated that boys who met recommendations for leisure-time walking were the ones who perceived the safest neighborhood environment. In middle SES, our results showed that neighborhood recreation facilities were associated with leisure walking, the same was observed for high SES, in addition to land use mix and places for walking. There is a lack of evidence regarding the influence of SES in the above-mentioned relationship. Even though some studies have shown the association between shorter distance to parks and number of facilities near home with physical activity in boys (KOWALESKI-JONES et al., 2016; LIMA et al., 2013). In addition, systematic reviews have shown that access and neighborhood park environment characteristics was associated with physical activity (BANCROFT et al., 2015; LEE; KUO; CHAN, 2016). Therefore, data concerning different SES indicated that perceived environmental factors, such as crime safety, land use mix, neighborhood recreation facilities and places for walking are important factors for leisure walking in boys' adolescents.

Some limitations must be considered when interpreting results. The cross-sectional design does not allow cause and effect to be determined. Additionally, some characteristics that can be associated with the outcome were not assessed, such as motivation and social support. The walkability index did not take into consideration land use mix and retail floor area ratio and this could influence the results. Finally, leisure walking was self-reported.

Strengths of this study are the large sample size and using both perceived and objective measures of the environmental factors. Additionally, according to our knowledge this was one of the first studies considering SES and gender in the association between

environmental factors with leisure walking in Brazilian adolescents. Taking these aspects into consideration, our findings can help public administrations in the development of strategies to promote physical activity, once some environment characteristics may be important tools to enhance this behaviour and consequently reflecting on health of the population. Also, our results allow the comprehension of how these relationships take place in each gender and SES, thereby contributing to the development of targeted actions for each context. Future studies should use longitudinal designs to enable analyse the association between environmental factors and leisure walking over time. Another important issue is to understand the reasons and other social factors that lead adolescents to leisure walking.

In conclusion, it was found an association between environmental factors (objectively and subjectively measured) with leisure walking in boys and girls of different SES. The influence of gender and SES must be considered when approaching environment and physical activity in Brazilian adolescents.

V PARTE

ARTIGO ORIGINAL – 4

Distance from home to the nearest park and the use of the parks for physical activity: the mediator role of road safety perception in adolescents

Distância da casa para o parque mais próximo e o uso do parque para atividade física: o papel mediador da percepção de segurança nas ruas em adolescentes

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ARTIGO ORIGINAL 4 (Distância da casa para o parque mais próximo e o uso do parque para atividade física: o papel mediador da percepção de segurança nas ruas em adolescentes)

ABSTRACT

Objective: The objective of the study is to examine whether adolescents' road safety perception (RSP) acts as a mediator on the association between the distance from home to the nearest park and the use of the parks for physical activity (PA).

Study design: This is a cross-sectional study.

Methods: The evaluation was through a random sample of 1130 adolescents (534 male), corresponding to 47.3%, 14-20 years old, from Porto Alegre, Brazil. RSP was assessed through some questions of the Neighborhood Environment Walkability Scale for Youth. Park use, socioeconomic status, age, and sex were measured using a questionnaire. Distance from home to the nearest park was evaluated through geographic information system. Data analysis was performed using Pearson correlation, and linear regression models were fitted as per the Baron and Kenny procedures for mediation analyses. All analyses were adjusted for sex and socioeconomic status.

Results: Road safety perception is independently associated with less distance from home to the nearest park (p= 0.04) and use of the parks for PA (p= 0.02). Road safety perception is a mediator and explains 16% of the association between park use and distance from home to the park (indirect effect= -40.9966; 95% confidence interval [CI]: -119.3733; -2.2455).

Conclusion: Our findings indicated that RSP is a mediator on the association between the distance from home to the nearest park and the use of the parks for PA. Future studies should take this into consideration frequency and intensity of PA and other environmental characteristics, such as crime, aesthetics, and neighborhood facilities.

Keywords: neighborhood safety; environment; public space; public health; physical activity; students.

RESUMO

Objetivo: O objetivo do estudo é examinar se a percepção de segurança nas ruas dos adolescentes atua como um mediador na associação entre a distância da casa até o parque mais próximo e o uso do parque para atividade física.

Desenho do estudo: Este é um estudo transversal.

Métodos: A avaliação foi realizada com uma amostra aleatória de 1130 adolescentes (534 meninos), correspondendo a 47,3%, com idades entre 14 e 20 anos, de Porto Alegre, Brasil. A percepção de segurança nas ruas foi avaliada através de algumas questões do *Neighborhood Environment Walkability Scale for Youth (NEWS-Y)*. Uso do parque, nível socioeconômico, idade e sexo foram avaliados usando questionário. A distância de casa até o parque mais próximo foi avaliada por meio do Sistema de Informações Geográficas. A análise dos dados foi realizada por meio da correlação de Pearson, e os modelos de regressão linear foram executados de acordo com os procedimentos de Baron e Kenny para análises de mediação. Todas as análises foram ajustadas para sexo e nível socioeconômico.

Resultados: A percepção de segurança nas ruas está independentemente associada com menor distância da casa para o parque mais próximo (p= 0,04) e uso do parque para atividade física (p= 0,02). A percepção de segurança nas ruas é um mediador e explica 16% da associação entre o uso do parque e a distância de casa até o parque (efeito indireto: -40.9966; intervalo de confiança de 95%: -119.3733; -2.2455).

Conclusão: Nossos achados indicaram que a percepção de segurança nas ruas é um mediador na associação entre a distância da casa até o parque mais próximo e o uso do parque para atividade física. Estudos futuros devem levar em consideração a frequência e a intensidade da atividade física e outras características ambientais, como crime, estética e instalações no bairro.

Palavras-chave: segurança no bairro; ambiente; espaço público; saúde pública; atividade física; estudantes.

INTRODUCTION

Physical inactivity has been related to the rising prevalence of different cardiometabolic risk factors in adolescents, such as type 2 diabetes, hypertension, and obesity (COUNTRYMAN et al., 2013). Nevertheless, data from many countries, including Brazil, indicate that 80% of adolescents do not meet the physical activity (PA) recommended levels for health (HALLAL et al., 2012). Recent data from Southern Brazil showed similar prevalence; 76.8% of adolescents were considered insufficiently active (<300 min/week) (DIAS et al., 2017). PA is a complex behavior that involves interpersonal, intrapersonal, community, social, and cultural factors. Thus, considering the relevance of environment characteristics, ecological models have helped to elucidate PA behavior among youth (SALLIS et al., 2006).

Studies have shown that the presence of trails, specific types of sports fields, neighborhood design, recreation facilities, transportation systems, street lighting, paved streets, and cycle paths/lanes seem to be some of the characteristics associated with PA among youth (BAUMAN et al., 2012; DING et al., 2011; SILVA et al., 2017). In addition, distance between squares/parks and adolescents' home increases the probability of engaging in PA (BARR-ANDERSON et al., 2014; DIAS et al., 2017). Thus, understanding the characteristics of the places that may facilitate PA should be a priority for health promotion (SALLIS et al., 2006).

Therefore, road safety perception (RSP) seems to be a relevant issue, although evidence regarding this topic and its relationship with PA is inconclusive (LENHART et al., 2017; MITÁŠ et al., 2018; VAN HECKE et al., 2018a). Mitáš et al., (2018) and Lenhart et al., (2017) showed that adolescents who perceived the neighborhood environment as safe were more likely to meet PA recommendations. On the other hand, a recent systematic review indicated that safety and aesthetics are secondary factors in the relationship with PA (VAN HECKE et al., 2018a).

The majority of studies have explored the association between RSP with different PA domains. Taking this aspect into consideration, we intend to understand how much does RSP explain the relationship between two environment variables. Indeed, Bracy et al., (2014) showed that the associations of PA with crime, traffic, and pedestrian safety may be more complex than through direct associations. Therefore, the aim of the present study was to examine whether adolescents' RSP acts as a mediator on the association between the distance from home to the nearest park and the use of the parks for PA.

METHODS

Study design and setting

This is a cross-sectional study, carried out in the city of Porto Alegre, capital of the state of Rio Grande do Sul (Southern Brazil).

Participants

The population was composed of approximately 34,645 high school students from 71 public schools (IBGE, 2012). They were allocated in the following regions: 8,057 northern, 6,423 southern, 4,268 eastern, and 15,897 central regions.

The sample selection was realized by multiple phases procedure (GAYA et al., 2008). Initially, the schools were selected, based on each region, and then, in the schools, the high school classes were selected randomly. A number was assigned for each school, and all numbers were placed in a box, mixed, and randomly reelected one by one. Data were collected in one class from each year: first, second, and third.

The students from the classes selected were invited to participate in the study, and the inclusion criteria were: (a) belonging to the first, second, or third year of high school; (b) handing in the consent document signed by a parent or guardian; and (c) signing the assent document manifesting the will to participate.

To calculate the sample size, the following criteria were considered: (1) estimated population of 34,645 students (N); (2) proportion of 50% (p); (3) complementary percentage of 100-p (q); (4) degree of confidence of 2 standard deviations (SDs); and (5) acceptable sampling error of 3% (e). After the adoption of these criteria and according to the formula presented in the following section, it was estimated that 1077 students should be evaluated. However, to avoid probable difficulties with the sample loss, an increase of 5% was assumed, totaling 1130 adolescents. This formula was used to have a sample that represents the study population. This calculation was performed using the formula to have a representative sample of the population. The power of the test was tested through the software G*power, version 3.1; for the statistical analysis used in the study, the value of the power of the test was 1.0.

$n= S^2 \cdot p \cdot q \cdot N/e2\ (N-1) + (S^2 \cdot p \cdot q)$

Sample selection considered the proportion of adolescents enrolled in the schools by region. Thus, the sample was composed of 263 adolescents from four schools in the north region (23.26%); 518 adolescents from seven schools in the central region (45.88%); 140 adolescents from two schools in the east region (12.32%); and 209 adolescents from two schools in the south region (18.54%).

Data collection

Data collection was performed during an eight-month period in 2017. First, the researcher went to the selected schools and explained the aims of the study, and if the managers agreed to participate, they were asked to sign an acceptance term. Then, data collection was scheduled. Questionnaires were filled out during a regular class, corresponding to approximately 45 min.

Study materials

To evaluate adolescent's environment perception, the Neighborhood Environment Walkability Scale for Youth (NEWS-Y), validated in Brazil was used (LIMA; RECH; REIS, 2013). NEWS-Y evaluate perceived environmental factors that may influence adolescents PA (ROSENBERG et al., 2009). This questionnaire is composed of eight sections; however, to meet the aim of the present study, only the section related to RSP was used which included the following questions: (1) 'There is so much traffic along nearby streets that it makes it difficult or unpleasant to walk (alone or with someone) in your neighborhood?'; (2) 'Is the speed of traffic in most of the nearby streets generally low (40 km/h or less)?'; (3) 'Most drivers go faster than the posted speed limits in your neighborhood?'; (4) 'Are the streets of your neighborhood well lit at night?'; (5) 'Walkers and bikers on the streets in your neighborhood can be easily seen by people in their home?'; (6) 'There are crosswalks and signals to help walkers cross busy streets in your neighborhood?'; (7) 'When walking in your neighborhood, there are a lot of exhaust fumes?'; and (8) 'Do you feel safe crossing the streets in your neighborhood?'. The answer options were as follows: 'strongly disagree', 'partially disagree', 'partially agree', and 'strongly agree'. For descriptive analyses, these answers were dichotomized into agree and disagree. The questions 1, 3, and 7 were standardized to allow the same sense of the answers, to leave all the questions in the negative toward positive. Then, all questions were transformed to standardized values (Z-score); then, the sum of Z-scores was performed to create the RSP score.

The question "Do you use any park to PA practice?' was used to assess the use of the park by adolescents. The possible answers were 'yes' or 'no'.

The adolescents' address was reported in the questionnaire. Adolescents' addresses were represented in the Geographic Information System (GIS) environment through the ArcMap 10.3.1 software. With the shapefile of the streets and parks provided by the Municipal Department of Urbanism of Porto Alegre-RS, Brazil, the distances between houses and parks of the city were defined through the tool "Network Analyst/Closest Facility". With

this procedure, it was possible to calculate the smallest distance, in meters, between the student's home and the nearest parks.

Socioeconomic status was assessed through the number of owned items at the adolescents' residence and the level of schooling of the parent or guardian by the criteria established by the Brazilian Association of Research Companies (ABEP, 2015). For the analyses, the classes were grouped as: high (A1+A2), medium (B1+B2), and low (C1+C2+D+E). Sex and age were assessed in the same questionnaire.

Statistical analysis

Descriptive data were calculated as absolute and relative values for age, socioeconomic status, park use, and RSP. Means and standard deviations were calculated for distance from home to the park and RSP z-score. The internal consistency from questions about RSP variables was verified using Cronbach Alpha, indicating 0.51 as an acceptable reliability. Differences between gender was determined using Chi-squared test for dichotomized variables and independent t-test for continuous variables. The Pearson correlation was used to determine relation between all variables.

Linear regression models were fitted to examine whether the association between park use and distance from home to the park was mediated by RSP, using the PROCESS macro for the Statistical package for Social Sciences (SPSS) version 24.0 (IBM Corp, Armonk, NY).The goal of this model was to investigate the total (c) and direct effects (a,b,c’), reflected by the unstandardized regression coefficient and significance between the independent and dependent variables in each model. The model also explored the indirect effect obtained from the product of coefficients (a x b), which indicates the change in the distance from home to the park for every unit change in the park use that is mediated by the proposed mediator (i.e., RSP). The PROCESS macro used bootstrapping methods recommended by Preacher and Hayes, (2008) for testing mediation hypotheses, using a resampling procedure of 10.000 bootstrap samples. Indirect effect was estimated through point estimates and confidence intervals (CIs) (95%). When the CI did not contain zero, the point estimate was considered significant.

The following criteria were used to establish mediation: (1) the independent variable (park use) is significantly related to the mediator (RSP); (2) the independent variable (park use) is significantly related to the dependent variable (park distance); (3) the mediator (RSP) is significantly related to the dependent variable (park distance); and (4) the association

between the independent and dependent variable is attenuated when the mediator is included in the regression model. The analyses were adjusted for gender and socioeconomic status.

RESULTS

Descriptive characteristics of the sample are presented in table 9. The study sample comprised 1130 adolescents, aged 14-20 years, from 16 public schools. Most adolescents were classified in medium socioeconomic status. Regarding park use, significant statistical difference (x^2= 32.55; p<0.001) was found between boys and girls, being that the use is more frequently among boys (45.9%).

Table 9. Characteristics of the study sample by gender

	All n(%)	**Boys n(%)**	**Girls n(%)**
Age in years			
14	07(0.6)	3(0.6)	4(0.7)
15	201(17.8)	90(16.9)	111(18.6)
16	369(32.7)	171(32.0)	198(33.2)
17	384(34.0)	174(32.6)	210(35.2)
18	136(12.0)	79(14.8)	57(9.6)
19	22(1.9)	11(2.1)	11(1.8)
20	11(1.0)	6(1.1)	5(0.8)
Socioeconomic status			
High	202(18.1)	104(19.8)	98(16.7)
Medium	625(56.2)	308(58.6)	317(54.0)
Low	286(25.7)	114(21.7)	172(29.3)
Park use*			
Yes	419(37.2)	244(45.9)	175(29.4)
No	708(62.8)	288(54.1)	420(70.6)

*difference park use and gender. Chi-square test (X^2)=32.55 p<0.001

For distance from home to the park analyses, 1110 adolescents' addresses were geocoded (Figure 5). Sample losses were caused by insufficient address information and incompatibilities in the street network. Results indicated that mean values of distance from home to the park was 4921.25m for boys and 5267.25 m for girls; there was no statistical difference (t= 0.008; p= 0.46) between both.

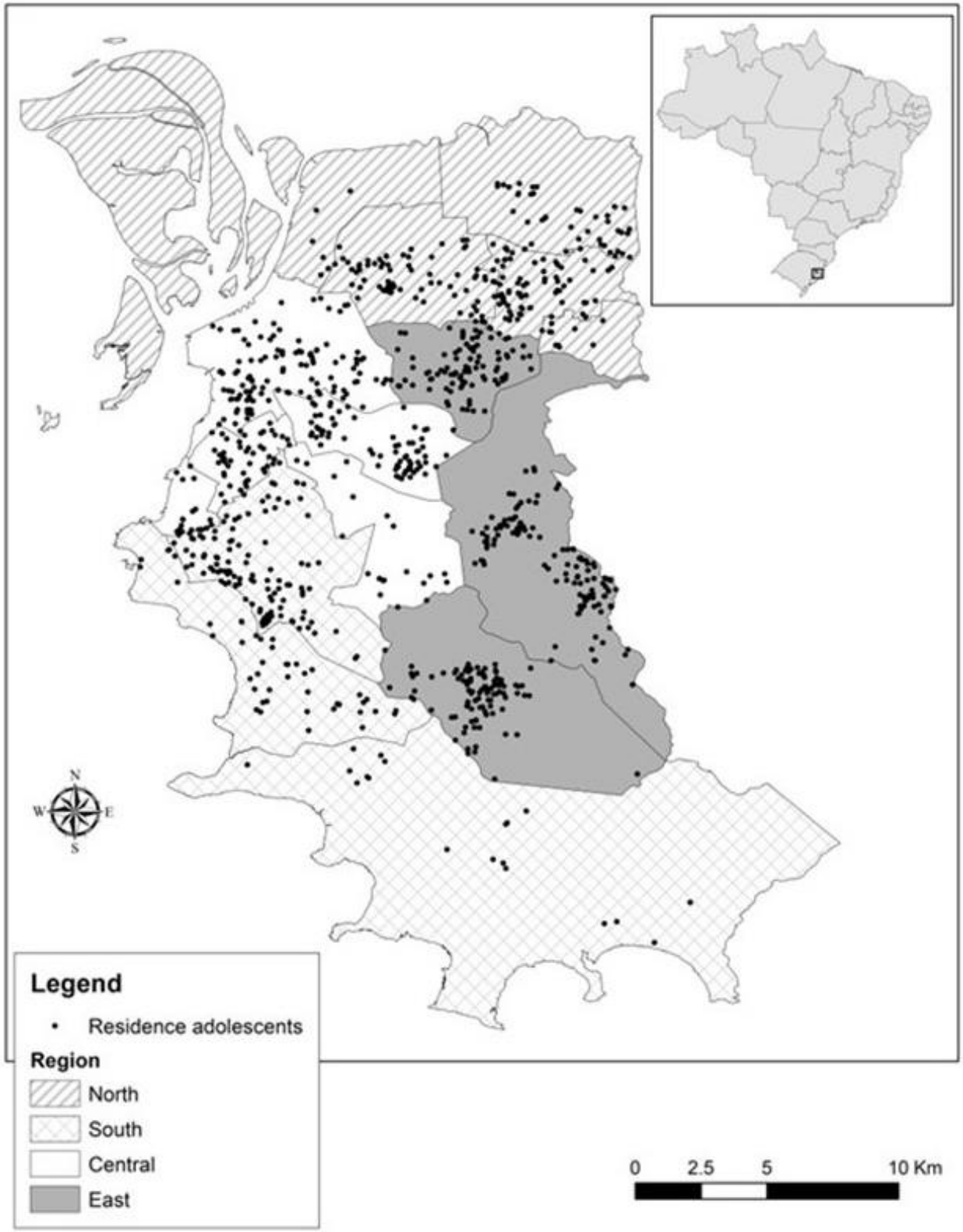

Figure 5. Georeferenced of participants of the sample (n=1010)

Descriptive characteristics of RSP are presented in table 10. There was no statistical difference between boys and girls only in questions 6 and 7. Regarding mean z-score RSP, there was difference between genders ($t= 2.53$; $p< 0.001$).

Table 10. Road safety perception of adolescents

Road Safety perception	All n(%)	Male n(%)	Female n(%)	p
1. There is so much traffic along nearby streets that it makes it difficult or unpleasant to walk (alone or with someone) in your neighborhood?				0.03*
Disagree	645(57.1)	322(60.3)	323(54.2)	
Agree	485(42.9)	212(39.7)	273(45.8)	
2. Is the speed of traffic in most of the nearby streets generally low (40 km/h or less)?				0.005*
Disagree	472(41.8)	200(37.5)	272(45.6)	
Agree	658(58.2)	334(62.5)	324(54.4)	
3. Most drivers go faster than the posted speed limits in your neighborhood?				0.01*
Disagree	540(47.8)	276(51.7)	264(44.3)	
Agree	590(52.2)	258(48.3)	334(55.7)	
4. Are the streets of your neighborhood well lit at night?				0.005*
Disagree	537(47.5)	230(43.1)	307(51.5)	
Agree	593(52.5)	304(56.9)	289(48.5)	
5. Walkers and bikers on the streets in your neighborhood can be easily seen by people in their home?				<0.001*
Disagree	434(38.4)	176(33.0)	258(43.3)	
Agree	696(61.6)	358(67.0)	338(56.7)	
6. There are crosswalks and signals to help walkers cross busy streets in your neighborhood?				0.85
Disagree	534(47.3)	251(47.0)	283(47.6)	
Agree	595(52.7)	283(53.0)	312(52.4)	
7. When walking in your neighborhood there are a lot of exhaust fume?				0.13
Disagree	679(61.7)	342(64.0)	335(59.7)	
Agree	432(38.3)	192(36.0)	240(40.3)	
8. Do you feel safe crossing the streets in your neighborhood?				<0.001*
Disagree	397(35.1)	154(28.8)	243(40.8)	
Agree	733(64.9)	380(71.2)	353(59.2)	
Road Safety Perception (Z-score all variables) [mean (SD)]	-0.0007 (0.47)	0.0937 (0.44)	-0.0854 (0.48)	<0.001**

SD= standard deviation; *p-value <0.05 according to chi-square test; **p-value according to independent t-test.

Table 11 presents the correlation between environment characteristics (RSP, distance from home to the park and the use of the parks for PA practice) and age, socioeconomic status, and gender. All environment characteristics variables showed correlation between each other.

Table 11. Pearson correlation between environment characteristics and age, socioeconomic status and gender

Characteristics	Road safety	Park use	Park distance	Gender	Socioeconomic status
Age	-0.04	-0.02	0.01	-0.05	-0.09**
Socioeconomic status	0.06*	0.08*	-0.12**	-0.04	-
Gender	-0.18**	-0.17**	0.04	-	-
Park distance	-0.08*	-0.09*	-	-	-
Park use	0.10**	-	-	-	-
Road safety	-	-	-	-	-

For road safety standardized value (Z-scores) were considered. *p<0.05 **p<0.001

Figure 6 shows the model used to test the mediation role of RSP in the relationship between park use and distance from home to the park. In the first regression equation, the relationship between better RSP and use of the parks for PA was positive (p= 0.02). Results of the second equation showed that the use of the parks was negatively associated with distance from home to the park (p= 0.008). In the third equation, the relationship between RSP and distance from home to the park was negative (p= 0.04). Finally, in the fourth equation, when RSP and use of the parks were included simultaneously in the model, better RSP was negatively associated with distance from home to the park (p= 0.005). Furthermore, the relationship between use of the parks and distance from home to the park was attenuated when RSP was included in the model, indicating that RSP is a mediator of this relationship (indirect effect= -40.9966; CI= -119.3733; -2.2455) and explains 16% of this association.

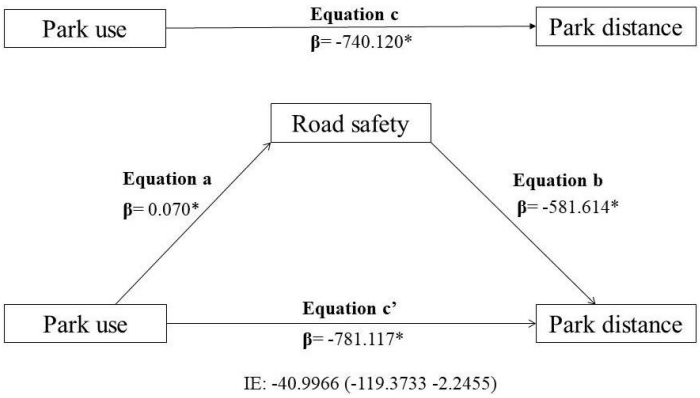

Figure 6. Road safety perception mediation model of the relationship between park use and park distance. n=998 *p<0.05 adjusted for gender and socioeconomic status

DISCUSSION

The aim of the present study was to examine whether adolescents' RSP acts as a mediator on the association between the distance from home to the nearest park and the use of the parks for PA. Our findings showed that RSP is associated with both the smallest distance to the park and the use of the parks. Besides, the mediation analysis showed that RSP explain 16% of the relationship between the distance from adolescent's home to the nearest park and their use of parks for PA.

Adolescents living at a shorter distance to parks were the ones more frequently reporting the use of the park for PA. Thus, the closer the park is, the more likely the adolescents are to use that space. In the same line, researches from the United States and the Netherlands found that perception of proximity to a park was associated with the use of that space for sports and leisure PA (BARR-ANDERSON et al., 2014; PRINS et al., 2009). Likewise, in Brazilian youngsters, perception of parks and squares proximity enhances PA practice (DIAS et al., 2017; LIMA et al., 2013). Furthermore, Silva et al., (2017) showed that living near the beach enhances 3.3 times the chance of adolescents engaging in leisure PA. In agreement with these findings, a study developed in eight countries, including Brazil, demonstrated that both direct measure and proximity perception of a park was associated with PA practice. As well as, having multiple parks nearby was the strongest positive correlate of PA (SCHIPPERIJN et al., 2017).

The use of the park is another important aspect in this context. Our findings showed that the use of public spaces, such as parks and squares, for PA was more reported among boys (45.9%). These results could be related to the fact that boys are more active than girls, and perhaps, they use open spaces for PA practice more frequently. Van Hecke et al., (2018b)

found similar results, reporting that boys and younger adolescents were more likely to use public open spaces than girls. According to these authors, urban planners should consider creating and refurbishing public open spaces, adding attractive feature for encouraging its visit by youth of all ages.

Our data showed that RSP is a mediator of the relationship between the distance from home to the nearest park and the use of the parks for PA, explaining 16% of this association. Considering that several environment factors influence PA, we highlight that RSP seems to be an important issue for Brazilian adolescents. In addition, to the best of our knowledge, there are no studies that verified the relation of RSP with variables related to environment, using mediation analysis. Given that multiple barriers to PA may exist, our research, accounting for RSP, can be useful to guide PA promotion actions among adolescents.

Evidence about safety characteristics and its relation with PA are inconclusive. As shown in a recent review, issues such as aesthetics and safety perception features seems to be less important for visiting open public spaces and PA practice (VAN HECKE et al., 2018a). In addition, Janssen and Rosu, (2015) demonstrated that the presence of roads with low traffic speed had no relation with self-reported PA, whereas, according to Aradi, Thorén and Fjørtoft, (2016), less traffic and more lighting were associated with higher levels of outdoor visitation.

Despite these findings, we emphasize that the main result of our study was expected, considering that, in Brazil, the crime rates are high and safety is a factor that worries populations in general. Indeed, Reis et al., (2009) indicated that poor lighting was negatively associated with lower involvement in PA in Brazilian adolescents. The same findings were observed in other countries. Researches from Australia and the United Sates showed positive associations of some security characteristics, such as perceived crime safety, perceived traffic safety, and presence of lighting with PA in adolescents (EDWARDS et al., 2015; ESTEBAN-CORNEJO et al., 2016). Moreover, Canadian boys and girls with the highest perceptions of safety were 1.31 and 1.45 times more likely to be physically active, respectively, than those with the lowest perceptions (NICHOL; JANSSEN; PICKETT, 2010).

Taking these aspects into consideration, our findings are useful for public health professionals. As practical implications, we highlight that public managers will have access to concrete data that strengthen the importance of these aspects, and they will be able to allocate resources to invest in these places. In addition, planning and/or transport officers public and health managers should develop strategies to promote most active cities, through parks and other structures such as walking or running trails and bicycle paths to encourage active

commuting with RSP. The availability of pleasant environments, with more quality and safety, may encourage adolescents to attend them, contributing to PA levels and consequently improving health conditions.

Future studies should take some aspects into consideration and try to look for causal inferences. Understanding the impact of improvements in the infrastructure of the parks on its use, and RSP, seems to be a promising strategy to PA promotion. Another important issue is to know the reasons that lead adolescents to attend these places, such as personal, environmental, social factors, that is, to look for information from users of the parks and qualitatively explore the reasons that lead them to use the park. Another interesting way to understand these relationships would be to sample by domicile around some parks. Thus, it would be possible to take into consideration parks with more or less equipment available for PA, within neighborhoods with higher or lower socioeconomic level. It would be also relevant to consider parks that have a private or public security system and compare with those that do not. Finally, to verify if the smallest distance from the house to the park influence the use of the park, other sociodemographic and environmental factors, such as street safety, access, and aesthetics, should be considered.

Strengths of this study include the use of an objective measure of the built environment, through GIS, to assess the distance from home to the nearest park. In addition, this study included a large sample of Brazilian adolescents. Moreover, to the best of our knowledge, this was one of the first research studies that used mediation analysis to understand the relationship of RSP with variables associated to the built environment among Brazilian adolescents. Despite the pertinence of these results, some limitations must be mentioned. The study's cross-sectional design does not allow to determine the cause and effect. The use of the park for PA was a subjective measure, not allowing to know the frequency and intensity of PA.

In conclusion, better RSP is independently associated with less distance from home to the nearest park and with the use of the parks for PA. In addition, RSP acts as a mediator, explaining 16% of the relationship between park use and the shorter distance to the park. In fact, RSP is an important factor for park use for PA when these places are near from adolescent's house.

AUTHOR STATEMENTS

Ethical approval: The study was approved by the Ethics Committee of Research with Human Beings of the Federal University of Rio Grande do Sul, under number 1,338.597.

VI PARTE

CONSIDERAÇÕES FINAIS

SUGESTÕES PARA FUTUROS ESTUDOS

REFERÊNCIAS

CONSIDERAÇÕES FINAIS

As principais conclusões da tese referente ao deslocamento ativo para escola foi que houve relação com as variáveis ambientais como, uso misto do solo, instalações de recreação no bairro (variáveis do ambiente percebido), existência de ciclovia e densidade residencial nos buffers de 0,5 e 1,0 km, além da existência de parques e praças no buffers de 0,5 km. Quando foi verificado a influência no nível socioeconômico, as principais conclusões indicaram que a existência de ciclovia apresentou associação em todos os níveis (baixo, médio e alto). Além disso, associação entre o uso misto do solo com o deslocamento ativo para escola em todos os níveis nos buffers de 0,5 km, enquanto que no buffer de 1,0 km, essa relação ocorreu apenas no nível socioeconômico médio. Ainda, a maior percepção de instalações de recreação no bairro aumentou as chances do deslocamento ativo para escola no nível socioeconômico médio. Portanto, alguns fatores do ambiente percebido e objetivo, além do nível socioeconômico são atributos importantes para que os adolescentes sejam mais ativos no deslocamento para a escola.

Ainda nesse contexto, foi observado que a densidade residencial é mediadora na relação entre as instalações de recreação no bairro, acesso e estética na vizinhança com o deslocamento ativo para escola em adolescentes. O índice de walkability é mediador na associação entre as variáveis de percepção como, uso misto do solo, instalações de recreação no bairro e acesso com o deslocamento ativo para escola. Por conseguinte, não basta ter boa percepção do ambiente se em torno do local onde o adolescente mora não houver disponibilidade de estruturas do ambiente construído, como alta densidade residencial e bons índices de walkability, afim de promover o deslocamento ativo para a escola.

Com relação a atividade física no lazer, as principais conclusões para as meninas são que houve associação positiva entre a caminhada no lazer com o acesso a serviços e a menor distância para parques e praças no nível socioeconômico baixo, enquanto que no nível socioeconômico médio foi encontrada associação com a densidade residencial e o índice de walkability. Já para os meninos, a caminhada no lazer foi inversamente associada com a percepção de segurança com relação a criminalidade no nível socioeconômico baixo, enquanto que no nível socioeconômico médio e alto foi encontrada associação positiva com as instalações de recreação no bairro. Ainda, no nível socioeconômico alto os fatores do ambiente que apresentaram associação com a caminhada no lazer foram o uso misto do solo e lugares para caminhar. Desse modo, as associações entre as medidas percebidas e objetivas

dos fatores ambientais do bairro com a caminhada de lazer dependem do sexo e nível socioeconômico.

Além disso, a percepção de segurança nas ruas é uma variável mediadora na associação entre a distância de casa até o parque mais próximo e o uso do parque para atividade física no lazer. De fato, a percepção de segurança é um importante fator para o uso do parque quando esses locais são próximos das casas dos adolescentes.

Considerando o supracitado, as conclusões da tese podem servir como suporte importante para tomada de decisões políticas e definições de estratégias públicas para tornar a cidade de Porto Alegre mais ativa, contemplando toda a população. Além disso, esses resultados podem nortear medidas relevantes no que se refere a incentivo e orientações para estratégias que visem a prática de atividade física, tais como: conexão de rotas de ciclovia e ciclofaixa, alterações do modelo das estradas, existência de quadras e campos esportivos nas praças, mais segurança nos espaços públicos, entre outras, podendo implicar em melhoras nos parâmetros de saúde da população.

SUGESTÕES PARA FUTUROS ESTUDOS

Estudos futuros devem levar alguns aspectos em consideração, tais como: inferências causais, delineamento longitudinal, assim como além dos atributos do ambiente, abordar os fatores sociais, individuais e políticos, com a finalidade de elucidar essas relações. Ainda, é relevante verificar essas conjecturas em cidades onde não existem informações a esse respeito. Cabe salientar que identificar as associações de forma indireta e perceber o quanto as variáveis ambientais explicam ou confundem a relação, por exemplo, das variáveis sociais, individuais entre outras, com os domínios da atividade física, parece ser uma forma promissora para o entendimento da prática de atividade física, que pode ser considerada um comportamento complexo.

Outra questão importante é buscar compreender as razões que levam os adolescentes a realizarem a prática de atividade física de deslocamento e no lazer, bem como, os motivos que os levam a frequentarem os espaços públicos. Nesse sentido, futuras pesquisas poderiam extrair informações dos usuários nos parques e praças e explorar qualitativamente os motivos que os levam a utilizar o espaço público.

Em outra perspectiva, compreender a relações dos fatores do ambiente com a prática de atividade física, através de uma amostra por domicílio em torno dos parques, também parece ser um caminho relevante. Assim, seria possível considerar os parques com mais ou menos equipamentos disponíveis para a prática, bairros com determinado nível socioeconômico, parques que possuem segurança pública ou privada nas redondezas, entre outras.

Por fim, compreender o impacto de melhorias na infraestrutura do ambiente construído, recursos e incentivos no bairro ou na escola, pode influenciar para que os pais e/ou adolescentes percebam o ambiente de maneira positiva, e consequentemente aumentem a prática de atividade física, seja no lazer ou no deslocamento ativo.

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APÊNCIDES

APÊNDICE A – Termo de autorização da direção da escola

APÊNDICE B – Termo de consentimento livre e esclarecido para o professor

APÊNDICE C – Termo de consentimento livre e esclarecido para os pais ou responsáveis

APÊNDICE D – Termo de assentimento para os alunos

APÊNDICE A

TERMO DE AUTORIZAÇÃO

Caro Sr(a) Diretor(a)

Pelo presente documento convidamos sua escola a participar de um projeto de pesquisa intitulado, *fatores do ambiente associados com atividade física de deslocamento e lazer em adolescentes de Porto Alegre-RS.* Nosso principal objetivo é identificar as possíveis associações entre a atividade física de lazer e de deslocamento com as características do ambiente construído e percebido em escolares de Porto Alegre-RS. Assim, solicitamos vossa autorização para aplicar nos alunos um questionário com perguntas referentes a atividade física, variáveis ambientais (percepção do aluno sobre o ambiente no bairro) e variáveis individuais (sexo, idade, endereço, escolaridade do pai ou responsável e utensílios domésticos).

Todos os procedimentos serão realizados nas dependências da escola sob a responsabilidade do Prof. Dr. Adroaldo Gaya coordenador do projeto e professor titular da Escola de Educação Física da UFRGS. O pesquisador responsável se mantém a inteira disposição para esclarecimentos sobre todas as atividades propostas, além do mais a direção da escola poderá a qualquer momento retirar sua autorização para a realização do estudo.

Ressaltamos que será mantido em sigilo a identidade da escola e de todos os participantes da pesquisa e os dados coletados servirão exclusivamente para fins de pesquisa científica. Todos os relatórios serão entregues a direção da escola e os resultados do questionário estará disponível à direção, ao professor de educação física e aos pais ou responsáveis dos alunos.

Este estudo faz parte da pesquisa intitulada “Aptidão cardiorrespiratória, composição corporal e atividade física de adolescentes: Associação com o ambiente escolar, com a estrutura pedagógica da educação física e com o ambiente urbano” aprovado pelo Comitê de Ética em Pesquisa com Seres Humanos da Universidade Federal do Rio Grande do Sul sob parecer número 1.338.597.

Agradecemos vossa colaboração e colocamo-nos a disposição para qualquer esclarecimento, em qualquer etapa da realização do projeto. Os contatos podem ser feitos pessoalmente; pelo telefone do coordenador do projeto Prof. Dr. Adroaldo Gaya (51)

81959570 ou por e-mail (acgaya@esef.ufrgs,br). Qualquer encaminhamento sobre procedimentos éticos podem ser esclarecidos pelo CEP-UFRGS pelo telefone (51) 33083629.

Prof. Dr. Adroaldo Cezar Araujo Gaya

Na condição de diretor(a) da Escola.....,
autorizo a realização da pesquisa *fatores do ambiente associados com atividade física de deslocamento e lazer em adolescentes de Porto Alegre-RS*, coordenada pelo Prof. Adroaldo Gaya e realizada pelo Programa de Pós-graduação em Ciências do Movimento Humano da UFRGS.

_____

Diretor (a) da Escola

Data___/___/_____

APÊNDICE B

Termo Consentimento Livre e Esclarecido
(professores)

Caro Sr(a) Professor(a) de Educação Física

Pelo presente documento lhe convidamos a participar voluntariamente de um projeto de pesquisa intitulado *fatores do ambiente associados com atividade física de deslocamento e lazer em adolescentes de Porto Alegre-RS*. Nosso principal objetivo é identificar as possíveis associações entre a atividade física de lazer e de deslocamento com as características do ambiente construído e percebido em escolares de Porto Alegre-RS. Assim, solicitamos vossa autorização para aplicar nos alunos um questionário com perguntas referentes a atividade física, variáveis ambientais (percepção do aluno sobre o ambiente no bairro) e variáveis individuais (sexo, idade, endereço, escolaridade do pai ou responsável e utensílios domésticos).

Caro professor, todos os procedimentos serão realizados nas dependências da escola sob a responsabilidade do Prof. Dr. Adroaldo Gaya coordenador do projeto e professor da Escola de Educação Física da UFRGS. O pesquisador responsável se mantém a sua inteira disposição para esclarecimentos sobre todas as atividades propostas, além o Sr(a) poderá a qualquer momento se retirar do projeto sem qualquer prejuízo pessoal ou institucional.

Ressaltamos que será mantida em sigilo sua identidade, bem como a da escola e de todos os participantes da pesquisa. Os dados coletados servirão exclusivamente para fins de pesquisa científica. Todos os relatórios serão entregues a direção da escola e os resultados do questionário estará disponível à direção, ao professor de educação física e aos pais ou responsáveis dos alunos.

Este estudo faz parte da pesquisa intitulada “Aptidão cardiorrespiratória, composição corporal e atividade física de adolescentes: Associação com o ambiente escolar, com a estrutura pedagógica da educação física e com o ambiente urbano” aprovado pelo Comitê de Ética em Pesquisa com Seres Humanos da Universidade Federal do Rio Grande do Sul sob parecer número 1.338.597.

Agradecemos vossa colaboração e colocamo-nos a disposição para qualquer esclarecimento, em qualquer etapa da realização do projeto. Os contatos podem ser feitos

pessoalmente; pelo telefone do coordenador do projeto Prof. Dr. Adroaldo Gaya ((51)81959570) ou por e-mail (acgaya@esef.ufrgs,br). Qualquer encaminhamento sobre procedimentos éticos podem ser encaminhados ao CEP-UFRGS pelo telefone (51) 33083629.

Prof. Dr. Adroaldo Cezar Araujo Gaya

Como professor de educação física da Escola .....
....., estou ciente dos procedimentos da pesquisa *fatores do ambiente associados com atividade física de deslocamento e lazer em adolescentes de Porto Alegre-RS*, coordenada pelo Prof. Adroaldo Gaya e realizada pelo Programa de Pós-graduação em Ciências do Movimento Humano da UFRGS e concordo em participar.

_____

Professor de Educação Física

Data___/___/_____

APÊNDICE C

Termo Consentimento Livre e Esclarecido
(pais ou responsáveis)

Senhores pais ou responsáveis

Pelo presente documento convidamos seu filho participar voluntariamente de um projeto de pesquisa intitulado *fatores do ambiente associados com atividade física de deslocamento e lazer em adolescentes de Porto Alegre-RS.* Nosso principal objetivo é identificar as possíveis associações entre a atividade física de lazer e de deslocamento com as características do ambiente construído e percebido em escolares de Porto Alegre-RS. Assim, comunicamos que com a devida autorização da escola, seu filho responderá um questionário com perguntas referentes a atividade física, variáveis ambientais (percepção do aluno sobre o ambiente no bairro) e variáveis individuais (sexo, idade, endereço, escolaridade do pai ou responsável e utensílios domésticos).

Senhores pais, todos os procedimentos serão realizados nas dependências da escola sob a responsabilidade do Prof. Dr. Adroaldo Gaya coordenador do projeto e professor da Escola de Educação Física da UFRGS e com a devida autorização da direção da escola.

O pesquisador responsável se mantém a sua inteira disposição para esclarecimentos sobre todas as atividades propostas, além disso, o Sr(a) poderá não autorizar que seu filho participe da pesquisa sem qualquer prejuízo pessoal ou institucional para o senhor(a) ou seu filho. Também esclarecemos que mesmo obtendo seu consentimento seu filho terá plena liberdade de participar ou não da pesquisa.

Ressaltamos que será mantido em sigilo a identidades dos participantes da pesquisa. Os dados coletados servirão exclusivamente para fins de pesquisa científica. Todos os relatórios serão entregues a direção da escola e os resultados do questionário estará disponível à direção, ao professor de educação física e aos pais ou responsáveis dos alunos.

Este estudo faz parte da pesquisa intitulada “Aptidão cardiorrespiratória, composição corporal e atividade física de adolescentes: Associação com o ambiente escolar, com a estrutura pedagógica da educação física e com o ambiente urbano” aprovado pelo Comitê de Ética em Pesquisa com Seres Humanos da Universidade Federal do Rio Grande do Sul sob parecer número 1.338.597.

Agradecemos sua colaboração e estamos à disposição para qualquer esclarecimento, em qualquer etapa da realização do projeto. Os contatos podem ser feitos pessoalmente, pelo telefone do coordenador do projeto Prof. Dr. Adroaldo Gaya ((51)81959570) ou por e-mail (acgaya@esef.ufrgs,br). Qualquer encaminhamento sobre procedimentos éticos podem ser encaminhados ao CEP-UFRGS pelo telefone (51) 33083629.

Prof. Dr. Adroaldo Cezar Araujo Gaya

Estou ciente que meu filho(a) ..... irá participar da pesquisa *fatores do ambiente associados com atividade física de deslocamento e lazer em adolescentes de Porto Alegre-RS*, coordenada pelo Prof. Adroaldo Gaya.

_____ _____

Nome do pai ou responsável Assinatura do pai ou responsável

Data___/___/_____

APÊNDICE D

TERMO DE ASSENTIMENTO

(Aluno)

Eu, _____, fui convidado a participar voluntariamente de um projeto de pesquisa intitulado *fatores do ambiente associados com atividade física de deslocamento e lazer em adolescentes de Porto Alegre-RS*. Fui informado que o principal objetivo é identificar as possíveis associações entre a atividade física de lazer e de deslocamento com as características do ambiente construído e percebido em escolares de Porto Alegre-RS.

Minha participação será responder um questionário com perguntas referentes a atividade física, variáveis ambientais (minha percepção sobre o ambiente no bairro) e variáveis individuais (sexo, idade, endereço, escolaridade do pai ou responsável e utensílios domésticos). Após a conclusão do estudo, terei acesso aos relatórios entregues a direção da escola e os resultados do questionário estará disponível a mim, à direção, ao professor de educação física e aos pais ou responsáveis dos alunos.

A qualquer momento eu poderei recusar a participação no estudo, também poderei retirar este meu consentimento, sem que isso me traga qualquer penalidade ou prejuízo. Estou ciente que minha participação não terá qualquer despesa e que não receberei qualquer compensação financeira ao participar deste estudo. Será mantido em sigilo a identidade da escola e de todos os participantes da pesquisa e os dados coletados servirão exclusivamente para fins de pesquisa científica. Finalmente, tendo eu compreendido perfeitamente tudo o que me foi informado sobre a minha participação no estudo e estando consciente dos meus direitos, das minhas responsabilidades, dos riscos e dos benefícios que a minha participação implica, declaro que concordo em participar do estudo, sem que para isso eu tenha sido forçado ou obrigado.

_____ _____

Assinatura do aluno Assinatura do pesquisador

Data___/___/_____

ANEXOS

ANEXO A

QUESTIONÁRIO DE ATIVIDADE FÍSICA - IPAQ

Para responder essas perguntas é importante saber que:

> Atividades físicas **fortes** são as que exigem grande esforço físico e que fazem respirar muito mais rápido que o normal.
>
> Atividades físicas **médias** são as que exigem esforço físico médio e que fazem respirar um pouco mais rápido que o normal.

Todas as perguntas sobre atividade física, responda somente sobre aquelas que duram pelo menos **10 minutos seguidos.**

Agora pense apenas nas atividades que fazes no teu **TEMPO LIVRE (LAZER)**

1. Quantos dias por semana tu fazes caminhadas no teu tempo livre?
[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7

SE VOCÊ CAMINHA:
2. Nos dias em que tu fazes essas caminhadas, quanto tempo no total elas duram por dia?
__ __ horas __ __ minutos

3. Quantos dias por semana tu fazes atividades físicas **FORTES** no teu tempo livre? Por ex.: correr, fazer ginástica de academia, pedalar em ritmo rápido, praticar esportes competitivos, etc.
[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7

SE VOCÊ FAZ ATIVIDADES FÍSICAS FORTES:
4. Nos dias em que tu fazes essas atividades, quanto tempo no total elas duram por dia?
__ __ horas __ __ minutos

5. Quantos dias por semana tu fazes atividades físicas **MÉDIAS** fora as caminhadas no teu tempo livre? Por ex.: nadar ou pedalar em ritmo médio, praticar esportes por diversão, etc.
[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7

SE VOCÊ FAZ ATIVIDADES FÍSICAS MÉDIAS:
6. Nos dias em que tu fazes essas atividades, quanto tempo no total elas duram por dia?
__ __ horas __ __ minutos

AGORA PENSA COMO TU TE DESLOCAS DE UM LUGAR AO OUTRO. QUANDO ESTE DESLOCAMENTO DURA PELO MENOS 10 MINUTOS SEGUIDOS. PODE SER A IDA E VINDA DO TRABALHO OU QUANDO VAIS FAZER COMPRAS, VISITAR AMIGOS OU IR A ESCOLA.

7. Quantos dias por semana tu usas a bicicleta para ires de um lugar a outro?

[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7

SE USA BICICLETA:

8. Nesses dias, quanto tempo no total tu pedalas por dia?

__ __ horas __ __ minutos

9. Quantos dias por semana tu caminhas para ires de um lugar a outro?

[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7

SE CAMINHA:

10. Nesses dias, quanto tempo no total tu caminhas por dia?

__ __ horas __ __ minutos

ANEXO B

NEWS-Y – ADOLESCENTES

BLOCO 1: CARACTERÍSTICAS DO AMBIENTE COMUNITÁRIO

Seção 1. Lojas e outros locais públicos na vizinhança

Quanto tempo aproximadamente você levaria para caminhar da sua casa até as lojas ou locais mais próximos listados abaixo? Por favor, marque com um X o tempo que você levaria caminhando para cada um dos lugares, mesmo que geralmente não vá até eles.

Ex.: Posto de gasolina	1-5 min.	6-10 min.	11-20 min.	21-30 Min.	+31 Min.	Não sabe não tem	
Q1. Loja de conveniências/ lojas da vizinhança/ mercearia/ armazém	1☐	2☐	3☐	4☐	5☐	6☐	Q1._____
Q2. Supermercado	1☐	2☐	3☐	4☐	5☐	6☐	Q2._____
Q3. Loja de ferramentas (materiais de construção)	1☐	2☐	3☐	4☐	5☐	6☐	Q3._____
Q4. Quitanda (mercado de frutas e verduras)	1☐	2☐	3☐	4☐	5☐	6☐	Q4._____
Q5. Lavanderia	1☐	2☐	3☐	4☐	5☐	6☐	Q5._____
Q6. Loja de roupas	1☐	2☐	3☐	4☐	5☐	6☐	Q6._____
Q7. Correios	1☐	2☐	3☐	4☐	5☐	6☐	Q7._____
Q8. Biblioteca	1☐	2☐	3☐	4☐	5☐	6☐	Q8._____
Q9. Escola de Ensino Fundamental	1☐	2☐	3☐	4☐	5☐	6☐	Q9._____
Q10. Escola de Ensino Médio (segundo grau)	1☐	2☐	3☐	4☐	5☐	6☐	Q10._____
Q11. Livraria	1☐	2☐	3☐	4☐	5☐	6☐	Q11._____
Q12. Lanchonete fast food	1☐	2☐	3☐	4☐	5☐	6☐	Q12._____
Q13. Cafeteria (café)	1☐	2☐	3☐	4☐	5☐	6☐	Q13._____
Q14. Banco	1☐	2☐	3☐	4☐	5☐	6☐	Q14._____
Q15. Restaurante	1☐	2☐	3☐	4☐	5☐	6☐	Q15._____
Q16. Vídeo Locadora	1☐	2☐	3☐	4☐	5☐	6☐	Q16._____
Q17. Farmácia	1☐	2☐	3☐	4☐	5☐	6☐	Q17._____
Q18. Salão de beleza / barbeiro / cabeleireiro	1☐	2☐	3☐	4☐	5☐	6☐	Q18._____
Q19. Escritórios	1☐	2☐	3☐	4☐	5☐	6☐	Q19._____
Q20. Ponto de ônibus, metrô ou trem	1☐	2☐	3☐	4☐	5☐	6☐	Q20._____
Q21. Local coberto e fechado para recreação ou prática de exercício (público ou privado)	1☐	2☐	3☐	4☐	5☐	6☐	Q21._____
Q22. Praia, lago, rio ou córrego	1☐	2☐	3☐	4☐	5☐	6☐	Q22._____
Q23. Trilha de ciclismo e/ou caminhada	1☐	2☐	3☐	4☐	5☐	6☐	Q23._____
Q24. Quadras de futebol e/ou campo de futebol	1☐	2☐	3☐	4☐	5☐	6☐	Q24._____
Q25. Quadras poliesportivas e/ou campos esportivos (basquete, vôlei, tênis, pista de skate, etc.)	1☐	2☐	3☐	4☐	5☐	6☐	Q25._____

Q26. Clubes esportivos privados	1☐	2☐	3☐	4☐	5☐	6☐	Q26._____
Q27. Local para prática esportiva fora da escola	1☐	2☐	3☐	4☐	5☐	6☐	Q27._____
Q28. Piscina	1☐	2☐	3☐	4☐	5☐	6☐	Q28._____
Q29. Pista de caminhada e/ou corrida	1☐	2☐	3☐	4☐	5☐	6☐	Q29._____
Q30. Escola com estrutura para recreação aberta ao público	1☐	2☐	3☐	4☐	5☐	6☐	Q30._____
Q31. Praça	1☐	2☐	3☐	4☐	5☐	6☐	Q31._____
Q32. Parque	1☐	2☐	3☐	4☐	5☐	6☐	Q32._____
Q33. Parquinho	1☐	2☐	3☐	4☐	5☐	6☐	Q33._____
Q34. Espaços públicos abertos que não sejam parques (grama ou areia e/ou terra)	1☐	2☐	3☐	4☐	5☐	6☐	Q34._____

Agora vamos falar sobre **outros aspectos** da sua vizinhança...Gostaríamos de saber o que você **acha** ou **sente** sobre a sua vizinhança e os locais **perto de sua residência.**

Seção 2. Tipos de residências em sua vizinhança

Pense sobre os tipos de residências na sua vizinhança. Por favor, marque com um X uma resposta para cada uma das perguntas abaixo. Considere sua vizinhança como a área em que você possa chegar caminhando entre de 10-15 minutos a partir de sua residência.

Q35. Na sua vizinhança, **quantas residências** são independentes, onde **mora apenas uma família**? 1[ ] Nenhuma 2[ ] Poucas 3[ ] Algumas 4[ ] Muitas 5[ ] Todas	Q35. _____
Q36. Na sua vizinhança, **quantas residências** são geminadas que **compartilham a mesma parede**? 1[ ] Nenhuma 2[ ] Poucas 3[ ] Algumas 4[ ] Muitas 5[ ] Todas	Q36. _____
Q37. Na sua vizinhança, **quantas são residências** em que **moram mais de uma família**? (que incluem mais de uma casa no mesmo terreno) 1[ ] Nenhuma 2[ ] Poucas 3[ ] Algumas 4[ ] Muitas 5[ ] Todas	Q37. _____
Q38. Na sua vizinhança, **quantas residências** são compostas por **prédios com apartamentos ou condomínios**? 1[ ] Nenhuma 2[ ] Poucas 3[ ] Algumas 4[ ] Muitas 5[ ] Todas	Q38. _____
Q39. Os **terrenos** da sua vizinhança são compostos por prédios baixos, com até **3 andares**? 1[ ] Nenhum 2[ ] Poucos 3[ ] Alguns 4[ ] A maioria 5[ ] Todos	Q39. _____
Q40. Os **terrenos** da sua vizinhança são compostos por prédios médios, de **4-6 andares**? 1[ ] Nenhum 2[ ] Poucos 3[ ] Alguns 4[ ] A maioria 5[ ] Todos	Q40. _____
Q41. Os **terrenos** da sua vizinhança são compostos por prédios altos, de **7-12 andares**? 1[ ] Nenhum 2[ ] Poucos 3[ ] Alguns 4[ ] A maioria 5[ ] Todos	Q41. _____
Q42. Os **terrenos** da sua vizinhança são compostos por prédios muito altos, **acima de 13 andares**? 1[ ] Nenhum 2[ ] Poucos 3[ ] Alguns 4[ ] A maioria 5[ ] Todos	Q42. _____

Seção 3. Acesso a serviços	
Por favor, marque com um X na resposta que melhor se aplica a você e sua vizinhança. Considere sua vizinhança como a área em torno de sua casa, num raio de 10-15 minutos de caminhada em qualquer direção.	
Q43. As lojas estão próximas da sua residência para ir caminhando? (até 15 minutos) [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q43. _____
Q44. É difícil encontrar estacionamento no comércio da sua vizinhança? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q44. _____
Q45. Existem muitos lugares para ir caminhando (sozinho ou acompanhado) próximo da sua casa? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q45. _____
Q46. É fácil ir caminhando (sozinho ou acompanhado) da sua casa até o transporte público (ponto de ônibus)? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q46. _____
Q47. As ruas da sua vizinhança têm subidas e descidas tornando difícil caminhar (sozinho ou acompanhado)? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q47. _____
Q48. Existem obstáculos que dificultam ir caminhando (sozinho ou acompanhado) de um lugar ao outro (rodovias, trilhos, rios)? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q48. _____

Seção 4. Ruas em sua vizinhança	
Por favor, marque com um X na resposta que melhor se aplica a vizinhança onde você reside.	
Q49. A distância entre os cruzamentos de rua em sua vizinhança é geralmente curta (90 metros ou menos)? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q49. _____
Q50. Não existem muitas ruas sem saída na sua vizinhança? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q50. _____
Q51. Existem várias rotas diferentes para ir de um lugar a outro na sua vizinhança? (Você não precisa fazer o mesmo caminho todas às vezes) [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q51. _____

Seção 5. Lugares para caminhar	
Por favor, marque com um X na resposta que melhor se aplica a você e sua vizinhança. Considere sua vizinhança como a área em torno de sua casa, num raio de 10-15 minutos de caminhada em qualquer direção.	
Q52. Existem calçadas na maioria das ruas da sua vizinhança? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q52. _____
Q53. As calçadas na sua vizinhança são separadas da rua ou trânsito por carros estacionados? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q53. _____
Q54. Existe grama ou terra entre a rua e a calçada em sua vizinhança? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q54. _____

Seção 6. Arredores da vizinhança	
Por favor, marque com um X na resposta que melhor se aplica a você e sua vizinhança. Considere sua vizinhança como a área em torno de sua casa, num raio de 10-15 minutos de caminhada em qualquer direção.	
Q55. Existem árvores ao longo das ruas em sua vizinhança? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q55. _____

Q56. Existem várias coisas interessantes para você ver enquanto caminha pela sua vizinhança? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q56. _____
Q57. Existem muitas atrações naturais para você ver em sua vizinhança (jardins, paisagens)? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q57. _____
Q58. Existem vários prédios/casas bonitas para você ver em sua vizinhança? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q58. _____

Seção 7. Segurança na vizinhança	
Por favor, marque com um X na resposta que melhor se aplica a você e sua vizinhança. Considere sua vizinhança como a área em torno de sua casa, num raio de 10-15 minutos de caminhada em qualquer direção.	
Q59. Existe muito trânsito nas ruas próximas a sua vizinhança o que torna difícil ou desagradável caminhar (sozinho ou acompanhado)? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q59. _____
Q60. A velocidade do trânsito na maioria das ruas próximas é geralmente baixa (40 Km/h ou menos)? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q60. ____
Q61. A maioria dos motoristas dirige acima do limite de velocidade na sua vizinhança? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q61. ____
Q62. As ruas da sua vizinhança são bem iluminadas à noite? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q62. ____
Q63. Nas ruas da sua vizinhança pedestres e ciclistas podem facilmente ser vistos por pessoas em suas residências? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q63. ____
Q64. Na sua vizinhança existem faixas de pedestres e sinais de trânsito para auxiliar pedestres a atravessar ruas movimentadas? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q64. ____

Q65. Ao caminhar por sua vizinhança há muita fumaça/poluição de escapamento? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q65. ____
Q66. Você se sente seguro ao atravessar as ruas na sua vizinhança? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q66. _____

Seção 8. Criminalidade Por favor, marque com um X na resposta que melhor se aplica a você e sua vizinhança. Considere sua vizinhança como a área em torno de sua casa, num raio de 10-15 minutos de caminhada em qualquer direção.	
Q67. Existem muitos crimes na sua vizinhança? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q67. ____
Q68. A taxa de criminalidade na sua vizinhança torna inseguro caminhar sozinho ou acompanhado à noite? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q68. ____
Q69. Você se preocupa em ficar sozinho em casa (jardim, garagem, área comum do apartamento/casa) porque tem medo de ser atacado ou agredido por um estranho? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q69. ____
Q70. Você se preocupa em ficar com um amigo nos arredores de sua casa porque tem medo de ser atacado ou agredido por um estranho? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q70. ____
Q71. Você se preocupa em ficar ou caminhar sozinho ou com amigos em sua vizinhança e ruas próximas porque tem medo de ser atacado ou agredido por um estranho? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q71. ____
Q72. Você se preocupa em ficar em um parque próximo porque tem medo de ser atacado ou agredido por um estranho? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q72. ____
Q73. Você tem medo de ser atacado ou agredido por alguma pessoa que é perigosa na sua vizinhança? [1][ ] discordo totalmente [2][ ] discordo um pouco [3][ ] concordo um pouco [4][ ] concordo totalmente	Q73. ____

ANEXO C

QUESTÕES DEMOGRÁFICAS E DESLOCAMENTO PARA ESCOLA

Nome: _____

Idade: _____ **Sexo**: ( ) Masculino ( ) Feminino

Questões ABEP (2015)

1. POSSE DE ITENS	**QUANTIDADES (marque um x por linha)**				
	0 (zero)	1	2	3	4 ou mais
Quantidade de **automóveis** de passeio exclusivamente para uso particular					
Quantidade de **empregados mensalistas**, considerando apenas os que trabalham pelo menos cinco dias por semana					
Quantidade de **máquinas de lavar roupa**, excluindo tanquinho					
Quantidade de **banheiros**					
DVD, incluindo qualquer dispositivo que leia DVD e desconsiderando DVD de automóvel					
Quantidade de **geladeiras**					
Quantidade de **freezers** independentes ou parte da geladeira duplex					
Quantidade de **microcomputadores**, considerando computadores de mesa, laptops, notebooks e netbooks e desconsiderando tablets, palms ou smartphones					
Quantidade de **lavadora de louças**					
Quantidade de fornos de **micro-ondas**					
Quantidade de **motocicletas**, desconsiderando as usadas exclusivamente para uso profissional					
Quantidade de **máquinas secadoras de roupas**, considerando lava e seca					

2. A água utilizada no seu domicílio é proveniente de?
[ ] Rede geral de distribuição [ ] Poço ou nascente [ ] Outro meio

3. Considerando o trecho da rua do seu domicílio, você diria que a sua rua é:
[ ] Asfaltada/Pavimentada [ ] Terra/Cascalho

4. Qual é o grau de escolaridade do **responsável financeiro** da sua família?
[ ] Analfabeto/ fundamental I Incompleto
[ ] Fundamental I completo / Fundamental II incompleto
[ ] Fundamental completo/Médio incompleto
[ ] Médio completo/Superior incompleto
[ ] Superior completo

DIVULGAÇÃO DO ESTUDO

DIVULGAÇÃO A – Modelo de relatório entregue a cada escola avaliada

DIVULGAÇÃO B – Divulgação por E-mail

DIVULGAÇÃO A

Segue abaixo um modelo de relatório que foi entregue para a direção e professores de Educação Física das turmas avaliadas, após as avaliações na escola. Também foi ofertado uma conversa para os alunos dessas turmas e quando autorizado pela direção, os resultados preliminares foram levados para os alunos.

ESCOLA ESTADUAL XXXXX

RESULTADO PARCIAL DA PESQUISA

"Atividade física de lazer e deslocamentos de adolescentes associados à percepção do ambiente e os espaços públicos de Porto Alegre-RS"

Aluna: Arieli Fernandes Dias
Orientador: Adroaldo Gaya
Programa de Pós-Graduação em Ciências do Movimento Humano.
Grupo de Pesquisa: Projeto Esporte Brasil - (PROESP-Br)
ESEFID - UFRGS

Data das avaliações: 05.05.2017.
Número de alunos avaliados: 78

Características das turmas avaliadas

	Turma	Número de alunos	Idade entre:
1° ano	105	14	15 – 17
1° ano	106	21	14 – 18
2° ano	202	10	16 – 18
3° ano	300	19	16 – 21
3° ano	301	14	16 – 19

Atividade Física é qualquer atividade que aumente a frequência cardíaca e/ou faça respirar mais forte que o normal por algum tempo.

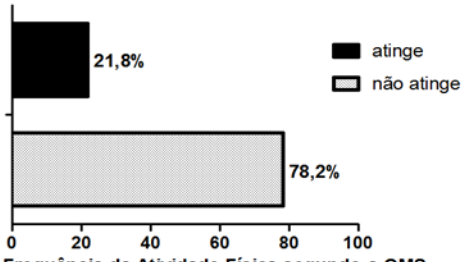
Além disso, a atividade física pode ser dividida em diferentes domínios, que são:

LAZER TRABALHO DOMÉSTICA DESLOCAMENTO

Resultados da Atividade Física

Durante uma semana..	Nenhuma n (%)	1 a 3 vezes n (%)	4 a 7 vezes n (%)
Caminhadas no tempo livre de lazer	34 (43,6)	25 (32,0)	19 (24,4)
Caminhadas como meio de deslocamento	07 (09,0)	11 (14,1)	60 (76,9)

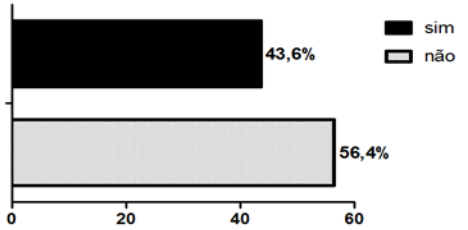
A soma desses domínios, caracterizam a Atividade Física diária. A Organização Mundial de Saúde (OMS) recomenda para crianças e adolescentes: 60 minutos de atividade física moderada a intensa por dia.



Frequência da Atividade Física segundo a OMS

ESPAÇOS PÚBLICOS

Você utiliza alguma praça, parque, ciclovia, rua ou outro espaço público para práticar algum tipo de Atividade Física?



Lugares frequentados:
Ipanema,
Avenida beira rio,
ciclovia,
praça em frente e/ou perto da minha casa,
Parque marinha do brasil,
Academia pública no bairro Guarujá,
Praça na rua dos bancários.

Motivos que o leva a não frequentar:
Insegurança,
não ter companhia,
Os locais são de ruim acesso, falta de tempo,
falta de vontade, prefiro ficar no computador,
não ter perto de casa,
tenho preguiça,
Mais perigoso que o normal.

Os resultados demonstram que 43,6% dos alunos frequentam as praças e parques para fazer Atividades Físicas. Todavia, 78,2% deles não atingem a recomendação de atividade física para saúde.

Sugestões de atitudes:
Enfatizar a importância da Atividade Física para a promoção da saúde. Aulas diferenciadas podem despertar e desafiar os alunos, que tal uma aula na praça? Ou uma caminhada pelo bairro?

Existe uma evidente preocupação com os níveis de atividade física associados à saúde dos escolares, portanto seria relevante que a escola, os professores e os gestores públicos pudessem formular ações que visem a promoção da saúde dos estudantes.

Obrigada pela participação e quaisquer dúvida e/ou esclarecimento estamos à disposição! (GRUPO PROESP-Br)

DIVULGAÇÃO B

A partir do primeiro contato com a Secretaria de Meio Ambiente (SMAM) da prefeitura de Porto Alegre, onde foram explicados os objetivos do estudo e solicitado os *shapfiles* dos mapas da cidade, ficou acordado que seria feito um retorno informando os resultados encontrados. Então, foi enviado por e-mail um relatório, através de linguagem coloquial, informando os principais achados.