



Contents lists available at ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed

Perceived neighborhood environmental attributes associated with leisure-time and transport physical activity in Mexican adults

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ARTICLE INFO

Article history:

Received 9 June 2016

Received in revised form 15 November 2016

Accepted 24 November 2016

Available online xxxx

Keywords:

Motor activity
Environment design
Space perception
Recreation
Latin America

ABSTRACT

Environmental factors have been associated with specific physical activity domains, including leisure-time and transport physical activity, in some high income countries. Few studies have examined the environmental correlates for domain-specific physical activity in low- and middle-income countries, and results are inconsistent. We aimed to estimate the associations between perceived environment and self-reported leisure-time walking, moderate-to-vigorous leisure-time physical activity and transport physical activity among adults living in Cuernavaca, Mexico. A population-based study of adults 20 to 64 years old was conducted in Cuernavaca, Mexico in 2011 ($n = 677$). Leisure and transport physical activity was measured using the International Physical Activity Questionnaire – Long Form. Perceptions of neighborhood environment were obtained by questionnaire. Hurdle regression models estimated the association between environmental perceptions and participation and time spent in each physical activity domain. High perceived aesthetics were positively correlated with participation and time spent in leisure-time walking and moderate-to-vigorous physical activity. SES differences existed for aesthetics in relation to participation in leisure-time walking. Participation in transport physical activity was positively associated with easy access to large parks, while closer distance to large parks was a negative correlate for participation and time-spent in this physical activity domain. Results suggest that perceived environmental characteristics related with physical activity are domain specific. High perceived aesthetics were an important correlate for leisure-time activities among Mexican adults, suggesting that policy strategies aimed at improving this environmental perception may be warranted. Patterns of associations between environmental correlates and transport physical activity differed from those reported in commonly studied high income countries.

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1. Introduction

Non-communicable diseases constitute the leading causes of death globally, with nearly 80% of these deaths occurring in low- and middle-income countries (Anon., 2011a). Since physical inactivity is a major risk factor for chronic diseases, (Lee et al., 2012) effective interventions are needed to increase population levels of physical activity

(PA) (Anon., 2011a). Ecological models of PA emphasize the importance of considering multiple levels of influence when developing interventions (Sallis et al., 2008). In addition to individual and interpersonal factors, certain environmental factors may be associated with specific PA domains, such as PA for leisure or transport (Sallis et al., 2008).

Evidence suggests that the relations between neighborhood environmental attributes and PA are domain-specific (Sugiyama et al., 2012; Van Dyck et al., 2012, 2013). While availability and access to retail and service destinations, street connectivity, residential density, and sidewalk availability have been positively related with walking for transport, (Sugiyama et al., 2012; Van Dyck et al., 2012) other features, such as availability and accessibility of recreational facilities (e.g., parks) and aesthetics, have been associated with leisure-time walking (Sugiyama et al., 2012; Van Dyck et al., 2013). However, to date most of the available evidence on these relations is from some high-income

Abbreviations: PA, Physical activity; SES, Socioeconomic status; IPEN, International Physical Activity and the Environment Network; IPAQ, International Physical Activity Questionnaire; ANEWS, Abbreviated Neighborhood Environment Walkability Scale.

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<http://dx.doi.org/10.1016/j.ypmed.2016.11.014>

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Please cite this article as: Jáuregui, A., et al., Perceived neighborhood environmental attributes associated with leisure-time and transport physical activity in Mexican adults, *Prev. Med.* (2016), <http://dx.doi.org/10.1016/j.ypmed.2016.11.014>

countries from the “Global North”, such as the United States, Canada, the United Kingdom, Australia and Northern European countries.

Environmental characteristics have been measured using objective and perceived (self-reported) measures (Arango et al., 2013; Leslie et al., 2007; Salvo et al., 2014a). Perceived measures may play an important and distinct role in influencing PA, and allow for assessing relevant aspects of the built environment that are difficult to measure objectively (e.g., aesthetics and safety) (Arvidsson et al., 2012; Brownson et al., 2009). Little is known about the association between perceived environment and domain specific PA in Mexico and the Latin American region at large, and the available evidence suggests differences with findings reported from those commonly studied high income countries (Arango et al., 2013). Due to the cultural (Anon., 2011b) (Sivak and Schoettle, 2013), social, economic (Knox and McCarthy, 2012; Poumanyvong et al., 2012) and structural (Dodman, 2009) differences between commonly studied high income countries and Latin America, differences in associations between the built environment and physical activity are expected.

Previous reports from our research team show that in Mexico, objective and perceived measures of residential density, land use mix diversity, and street connectivity, are either not related, or inversely related to accelerometer-based physical activity (Jauregui et al., 2016a; Salvo et al., 2014c).

The objective of this study was to estimate the associations between perceived neighborhood environmental features and self-reported leisure-time walking, moderate-to-vigorous leisure-time PA, and transport PA among adults from Cuernavaca, Mexico.

2. Materials and methods

2.1. Study design and setting

This study was part of the International Physical Activity and the Environment Network (IPEN) – Mexico project (Kerr et al., 2013). IPEN is a study exploring the relationships between the built environment and physical activity among 12 culturally- and environmentally-diverse countries, including Mexico. IPEN-Mexico is a cross-sectional, population-based study that was carried out in the city of Cuernavaca, Mexico. Cuernavaca is a mid-sized (total area of 150 km², 365,000 inhabitants) city with human activity localized in the central business district (Anon., 2016). The city has many steep slopes and is carved up by a system of 46 gorges. Public transportation is highly available and provided by a system of feeder-buses stopping whenever and wherever a potential rider signals the driver to do so (Adams et al., 2014; Baik et al., 2006). IPEN-Mexico collected data in 2011, when Mexico was enduring a period of very high crime, and Cuernavaca was one of the most affected cities (Anon., 2012; Ortega, 2015) of the country. Data collection for the IPEN-Mexico study took place in 2011–2012, and analyses are ongoing.

2.2. Neighborhood selection and recruitment

A representative sample of adults was selected using Census tracts as sampling units. Census tracts were stratified in four levels of socioeconomic status (SES) and two levels of objectively measured walkability (high and low walkability, via median split) (Frank et al., 2010). Eight Census tracts per stratum were randomly selected, yielding 32 (out of 123) study Census tracts. Seven blocks were randomly selected per census tract and two to four households were selected per block (Salvo et al., 2015). Data was collected in person via two home visits. Eligible participants were aged 20 to 65 years, able to walk, and permanent residents of that household (Salvo et al., 2015). Participants signed informed consent forms before data collection. The study was approved by the institutional review boards of Emory University and the Instituto Nacional de Salud Pública of Mexico.

2.3. Physical activity

Self-reported PA was measured using the International Physical Activity Questionnaire–Long Version (IPAQ, 2005). Validation studies in Latin America suggest that the IPAQ has high reliability (Spearman's rho ~0.8) and moderate criteria validity in comparison with accelerometers (Craig et al., 2003; Hallal et al., 2010b). The Colombian (Spanish) version of IPAQ was adapted for a Mexican audience, using culturally appropriate wording and examples. Frequency (number of days in the last seven days) and duration (minutes per day) of PA in leisure and transport PA were queried (Hallal et al., 2010a). Only bouts of at least ten minutes were reported. Using this information, weekly minutes of leisure-time walking, leisure-time moderate-to-vigorous PA, and transport PA (walking and bicycling) were derived (IPAQ, 2005). The proportion of participants meeting PA recommendations (150 min per week of moderate to vigorous PA) per PA domain was calculated (WHO, 2010).

2.4. Perceived environment

Perceived neighborhood environment was measured using the Latin American version of the Abbreviated Neighborhood Environment Walkability Scale (ANEWS) (Salvo et al., 2014b). ANEWS consists of 58 items divided into ten subscales (Cerin et al., 2013): residential density, land use mix diversity, land use mix access, street connectivity, few cul-de sacs, no major physical barriers for walking, pedestrian infrastructure, aesthetics, traffic safety, and safety from crime. High test-retest reliability (intraclass correlation coefficient > 0.75) has been reported for most of these subscales (Leslie et al., 2005; Oyeyemi et al., 2013; Saelens et al., 2003). This version included characteristics of the built environment present in Latin American urban settings such as hilliness, proximity to public transportation, park safety, and easy access and proximity to small and large parks (Salvo et al., 2014b). Variables were calculated as per the ANEWS protocol (Supplementary Table) (Cerin et al., 2013). All measures were scored such that higher values were expected to be positively related to PA domains.

2.5. Covariates

Self-reported sociodemographic variables including age, sex, education level, marital status, individual-level SES (based on 25 questions on household characteristics and assets (Gutierrez et al., 2012)) and motor vehicle ownership were collected.

2.6. Data analysis

Descriptive statistics (means, proportions and 95% confidence intervals) were computed for all variables. Weekly minutes of leisure-time walking, leisure-time moderate to vigorous PA, and transport PA were log-transformed to improve the normality of the distribution for the dependent variables.

All PA variables had a distribution with a large number of zeros (between 10 and 65% of participants did not accumulate any PA within specific domains), and a continuous right-skewed non-zero part. To account for the large number of zeros we estimated hurdle models of participation and time spent in each domain. Hurdle models recognize that decisions about PA participation are made in two steps: 1) The decision to participate in a determined PA domain (e.g. leisure-time walking), and 2) The decision on the duration of such activity, given participation (Humphreys and Ruseski, 2015). This distinction allows factors that affect participation and factors that affect duration of PA to have different signs (Humphreys and Ruseski, 2015). Additionally, these models may account for correlated error terms between participation and duration equations. We specified the participation decision by using a probit model and the duration decision by using a log-normal model. To account for potential correlated errors in both equations, we introduced the inverse Mills ratio in all models. Since ratios' *p* values were >0.05

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