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Background

With the growth of urban populations, interest is increasing in understanding new forms of interaction between individuals and their environments, including physical activity (PA) - the focus of this study. According to the World Health Organization (WHO), environmental factors linked to urban development, such as safety, tra c, pollution, and access to parks for recreation and sports, signi cantly in uence decisions related to engaging in PA [1].

According to the WHO, insu cient PA is the fourth leading risk factor for mortality globally, with 1 in 4

Table 1 Summary of environmental scales, items and Cronbach's alpha

Scale	Items	Response Category	Cronbach's alpha
Land use mix-diversity (mean of 23 items– the higher the score, the higher the diversity)	About how long would it take to get from your home to the nearest businesses or facilities listed below if you walked to them? Items: convenience/small grocery store, supermarket, blacksmith, fruit/vegetable market, laundry/dry cleaners, clothing store, post office, library, university/school, other educational centers, book store, fast food restaurant or street food, bakery/coffee shop, bank, non-fast food restaurant, video store, pharmacy/drug store, salon/barber shop, your job or school, public transport stop, park or square, gym or fitness facility	5-point scale: 5 min (5), 6–10 min (4), 11–20 min (3), 20–30 min (2), 30 + min (1)	0.934
Land use mix-access (mean of 5 items)	Stores are within easy walking distance of my home. It is easy to walk to a transit stop (bus, train) from my home. There are many places to go within easy walking distance of my home. The streets in my neighborhood are hilly, making my neighborhood difficult to walk in (reversed). There are major barriers to walking in my local area that make it hard to get from place to place (for example, freeways, railway lines, rivers) (reversed).	4-point scale: strongly disagree (1), disagree (2), agree (3), strongly agree (4)	0.693
Street connectivity (mean of 3 items)	The streets in my neighborhood do not have many cul-de-sacs (dead-end streets). The distance between intersections in my neighborhood is usually short (100 yards or less; the length of a football field or less). There are many alternative routes for getting from place to place in my neighborhood. (I don't have to go the same way every time).	4-point scale: strongly disagree (1), disagree (2), agree (3), strongly agree (4)	0.432
Walking/cycling facilities (mean of 3 items)	There are sidewalks on most of the streets in my neighborhood. Sidewalks are separated from the road/traffic in my neighborhood by parked cars. There is a grass/dirt strip that separates the streets from the sidewalks in my neighborhood.	4-point scale: strongly disagree (1), disagree (2), agree (3), strongly agree (4)	0.614
Aesthetics (mean of 4 items)	There are trees along the streets in my neighborhood. There are many interesting things to look at while walking in my neighborhood. There are many attractive natural sights in my neighborhood (such as landscaping, views). There are attractive buildings/homes in my neighborhood.	4-point scale: strongly disagree (1), disagree (2), agree (3), strongly agree (4)	0.803
Safety from traffic (mean of 4 items)	There is so much traffic along nearby streets that it makes it difficult or unpleasant to walk in my neighborhood (reversed). The speed of traffic on most nearby streets is usually slow (50 km/h or less) Most drivers exceed the posted speed limits while driving in my neighborhood (reversed) There are crosswalks and pedestrian signals to help walkers cross busy streets in my neighborhood.	4-point scale: strongly disagree (1), disagree (2), agree (3), strongly agree (4)	0.191
Safety from crime (mean of 7 items)	My neighborhood streets are well lit at night. Walkers and bikers on the streets in my neighborhood can be easily seen by people in their homes. There is a high crime rate in my neighborhood (reversed). The crime rate in my neighborhood makes it unsafe to go on walks during the day (reversed). The crime rate in my neighborhood makes it unsafe to go on walks at night (reversed). The parks, public squares, green areas and recreation areas in my neighborhood are unsafe during the day (reversed).* The parks, public squares, green areas and recreation areas in my neighborhood are unsafe at night (reversed).*	4-point scale: strongly disagree (1), disagree (2), agree (3), strongly agree (4)	0.805

educational level, with similar distributions across the regions studied. Regarding BMI, mean values and standard deviations were presented, with a national average of 28.5 kg/m² (SD: 5.5), showing comparable trends across regions. PA data were reported as median for both transportation and leisure-time domains, with values of 264.0 min/week for transportation and 90 min/week for leisure time across the full sample.

e overall average score of land use mix − diversity (5-point scale from 1 to 5; higher scores re ect more diversity) was 2.6. e overall scores were 3.2 for land use mix − access, 2.9 for street connectivity, 3.2 for walking/cycling facilities, 2.9 for aesthetics, 2.5 for safety from tra c, and 2.8 for safety from crime (4-point scales from 1 to 4; higher scores re ect more activity friendliness) (Table 3).

A multivariate logistic regression model was used to analyze the association between neighborhood characteristics evaluated in the NEWS-A survey and total PA level (including transport and leisure time), adjusted for age, BMI, and educational level for both men and women. Additionally, the relationship between neighborhood variables and PA was explored using a linear regression model with a log10 transformation.

Table 4 presents the results of the multivariate logistic regression model for PA in the transportation domain among men and women (walking or bicycling as transportation), adjusted for age, BMI, and educational level. In this domain, for men, none of the NEWS-A categories was signi cantly associated with PA level. For women, the logistic regression model revealed that the category related to walking and/or cycling facilities was inversely associated with the likelihood of being physically active in the transportation domain (OR: 0.62, 95%CI: 0.42;0.92). Additionally, multiple linear regression analysis indicated that participants who reported higher perceived safety in tra c (β: 0.098, 95% CI: 0.005;0.192) also reported greater transportation-related PA (min/week).

Table 5 presents the 544>>BDC BT 9.8 93.700805664 Tm [(in tra

Table 4 Regression models for transport-related physical activity

	Logistic Regression[1] Any transport-related PA (0 = < 600 MET/min/week, 1 ≥ 600/MET/min/week)		**Linear Regression[2] Non-zero reported transport-related PA LOG10 (min/week)**		
Independent variables	**OR (95%CI)**	*p*	**β (95%CI)**	**SE**	*p*
MEN					
Land use mix-diversity (score 1–5) [3]	1.16 (0.78–1.72)	0.46	-0.016 (-0.124-0.092)	0.03	0.772
Land use mix-access (score 1–4) [3]	0.81 (0.47–1.37)	0.43	0.021 (-0.128-0.171)	0.05	0.781
Street connectivity [4]	0.97 (0.67–1.37)	0.84	-0.051 (-0.152-0.050)	0.02	0.324
Walking/cycling facilities (score 1–4) [3]	1.17 (0.80–1.72)	0.41	0.089 (-0.018-0.195)	0.05	0.101
Aesthetics (score 1–4) [3]	1.11 (0.81–1.51)	0.53	0.079 (-0.010-0.167)	0.01	0.082
Safety from tra□c [4]	1.49 (0.97–2.30)	0.07	0.088 (-0.033-0.209)	0.02	0.153
Safety from crime (score 1–4) [3]	0.91 (0.62–1.34)	0.64	0.011 (-0.096-0.119)	0.03	0.837
WOMEN					
Land use mix-diversity (score 1–5) [3]	1.32 (0.89–1.96)	0.16	-0.007 (-0.093-0.079)	0.04	0.875
Land use mix-access (score 1–4) [3]	0.82 (0.49–1.38)	0.46	-0.016 (-0.128-0.097)	0.01	0.786
Street connectivity [4]	0.79 (0.56–1.12)	0.18	-0.025 (-0.100-0.051)	0.02	0.517
Walking/cycling facilities (score 1–4) [3]	**0.62 (0.42–0.92)**	**0.02**	-0.085 (-0.170-0.001)	0.03	0.051
Aesthetics (score 1–4) [3]	0.89 (0.66–1.20)	0.43	0.015 (-0.082-0.052)	0.01	0.657
Safety from tra□c [4]	1.27 (0.82–1.98)	0.29	**0.098 (0.005–0.192)**	**0.04**	**0.040**
Safety from crime (score 1–4) [3]	0.70 (0.47–1.04)	0.07	-0.012 (-0.100-0.075)	0.02	0.782

OR: odds ratio; β: regression coe□cient; CI: con□dence interval; SE: standard error

[1] Logistic regression model with transport-related physical activity for men (0=<600 MET/min/week, 1≥600/MET/min/week) as dependent variable, adjusted by age, BMI and education level

[2] Linear regression model with transport-related physical activity time (LOG10 (min/week)) as dependent variable in participants with transport-related physical activity ≥10 min/week, adjusted by age, BMI and education level

[3]

physically active in the logistic model. Conversely, in the linear regression model, a higher perception score of tra c was associated with increased reported PA (min/week) during leisure time (β: 0.160, 95% CI: 0.012;0.309).

Discussion

In general, this study demonstrated how di erent perceived neighborhood characteristics are associated with PA across various domains and how these associations di er by gender. Both variables were measured using self-report questionnaires, which, while translated and validated in Spanish, are still susceptible to information biases typical of such instruments [28–30]. Although recent validation of the IPAQ-Short Form Questionnaire has been published [23], it would be bene cial to have further validation for local Spanish in the adult population [19]. e same applies to the NEWS-A, which has been validated for older adults, as there may be challenges in understanding each item that could lead to information bias.

One of the most well-known studies using this methodology is the International Physical Activity Network (IPEN), which encompasses 17 cities across 12 countries, including three Latin American cities: Bogotá, Curitiba, and Cuernavaca. is study reported a positive association between various neighborhood characteristics - such as land use diversity, access to land use, street connectivity, and aesthetics - and transportation-related PA [31].

Although the questionnaire used was the IPAQ-LF, which measures four domains of PA in daily life, only transportation-related PA and leisure time PA were considered in the ELANS study. ese two domains were chosen because they exhibit the highest reliability and have a more signi cant impact on public health [17].

Previous studies have reported inconsistent associations between the environment and transportation-related PA [26], research has indicated that women tend to exhibit a greater preference for risk avoidance compared to men when it comes to using active transportation, particularly when their safety is at stake [32]. ose who had a more favorable perception of their neighborhood's walking or cycling facilities were less likely to engage in PA. is suggests that access to infrastructure alone is insu cient; the willingness to utilize these facilities presents a challenge that requires further investigation [32, 33]. Interestingly, women who reported a better perception of safety in tra c were positively associated with engaging in transportation-related PA, whether walking or cycling.

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Data availability
Data is provided within the manuscript or supplementary information □les.

Declarations

Ethics approval and consent to participate
The ELANS protocol was approved by the Western Institutional Review Board (#20140605) and registered on ClinicalTrials.gov (#NCT022266). Additionally, the Research Ethics Committee at Ponti□cia Universidad Católica de Chile approved the ELANS Protocol applied in Chile (ELANS-Chile), and the Ethics Committee of the Faculty of Social Sciences at Ponti□cia Universidad Católica de Chile approved the ELANS-Chile project (#14–179). The research has been performed in accordance with the Declaration of Helsinki.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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