

Food, care, and spatial accessibility: Research methods, evidence, and public policies in Chile

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de Concepción**



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Manchester, 19th – 21st May 2026**



Transport Justice: Three Dimensions

Why food, care, and accessibility?

Food purchasing / consumption

Access to healthy food

How transport and mobility shape food purchasing choices, diet quality, and health — with equity implications across income groups

Care and mobility

Gendered activity-travel

How care activities require a broader understanding of people's context beyond the focus on travel and the urban environment

Accessibility to railway projects

Spatial justice in transport

How to incorporate justice principles in evaluating railway projects and measure impacts on groups across the metropolitan region

Context:

Chile as a case study — high obesity, persistent socio-spatial inequalities, recently expanded transport infrastructure

Part 1

Food purchasing and consumption

Data, models, and evidence from Concepción, Chile

Rojas et al. (2023) · The Professional Geographer

Astroza, Guarda & Carrasco (2022) · J. Choice Modelling

Miranda, Carrasco & Astroza (2025) · Travel Behaviour & Society

Vecchio et al. (2023) · Sustainability

Jirón, Carrasco & Imilan (2025) · Book Chapter



Food · Methods: A Multi-Method Data Collection Strategy

Survey and Built Environment Data

- Household survey (n = ~900, Concepción)
- Variables: food purchasing frequency, store type, transport mode, diet quality (diet score, BMI)
- Social networks, attitudes, time pressure captured as latent constructs
- Built environment: distance to supermarkets, ferias libres, open-street markets

Spatial and Ethnographic Data

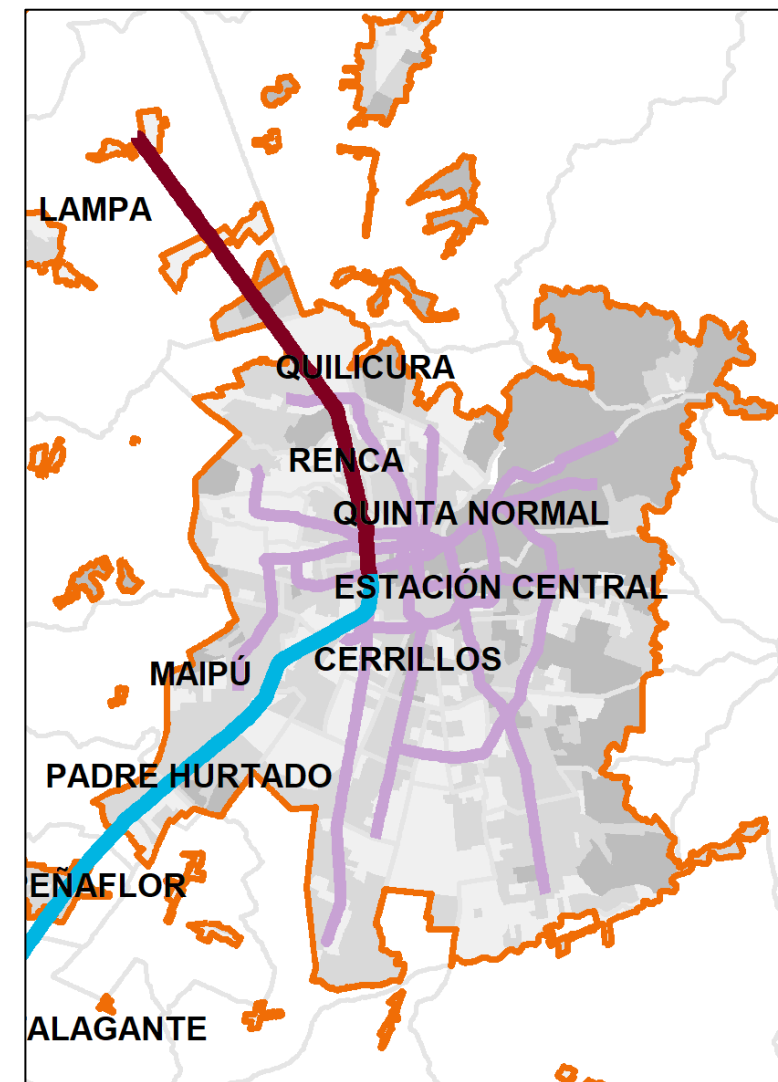
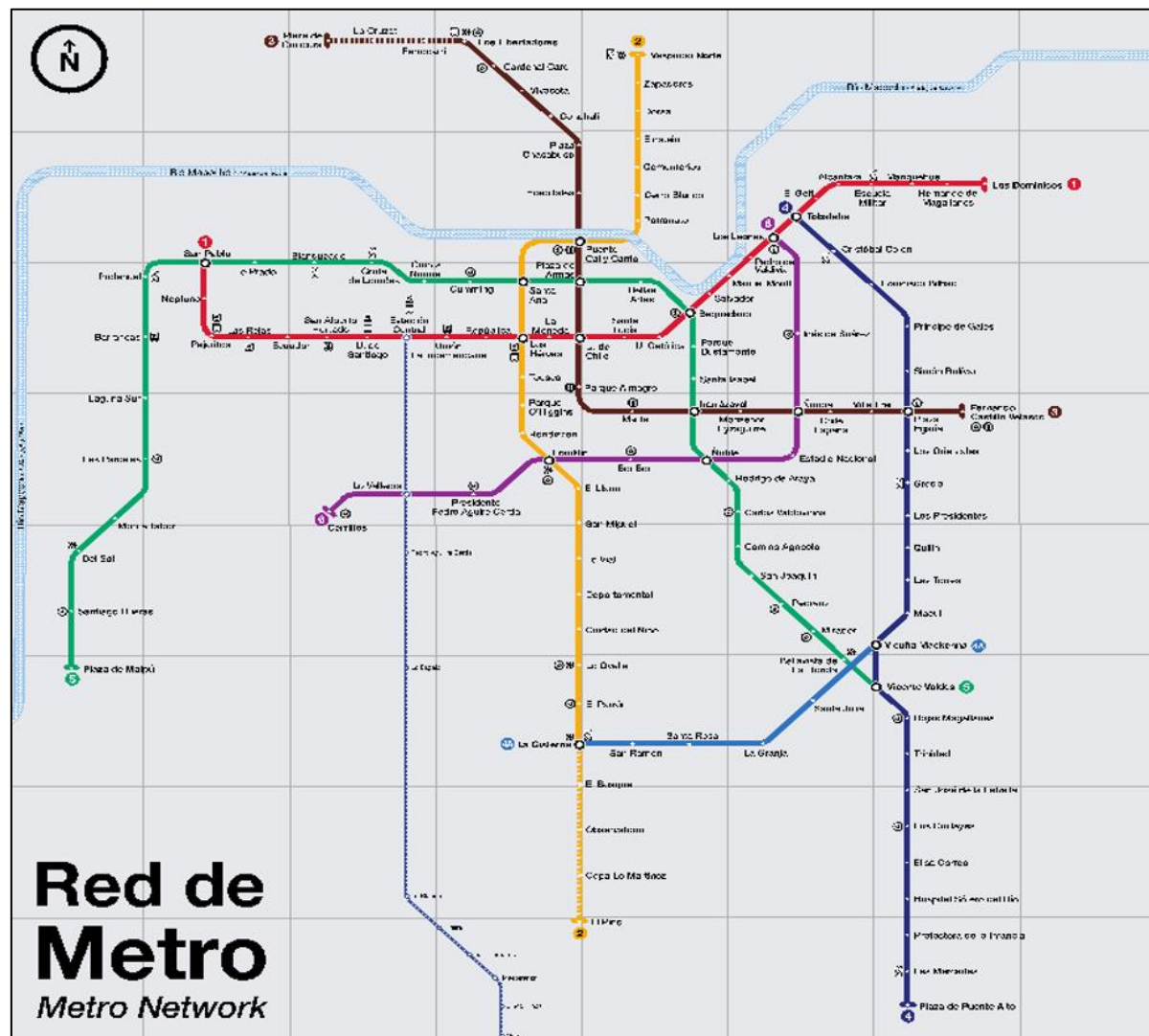
- GIS accessibility indicators: walking, cycling, and transit-based access to food stores
- National data: Chilean accessibility to open street markets by region (Vecchio et al. 2023)
- Ethnographic fieldwork: Santiago Metro station food environments (Jirón et al.)

Modelling Framework

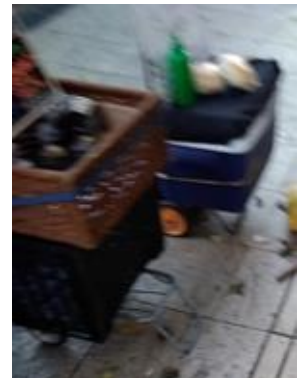
Generalized Heterogeneous Data Model (GHDM) · Structural + Measurement equations · Latent variables for healthy lifestyle propensity, time pressure, and social norms · Multivariate joint modelling linking mobility, store choice, frequency, diet, and BMI simultaneously



Food · Analysis: Santiago's context



Food · Analysis: Santiago's metro station food environments





Food • Analysis: Santiago's metro station food environments





Supermarkets



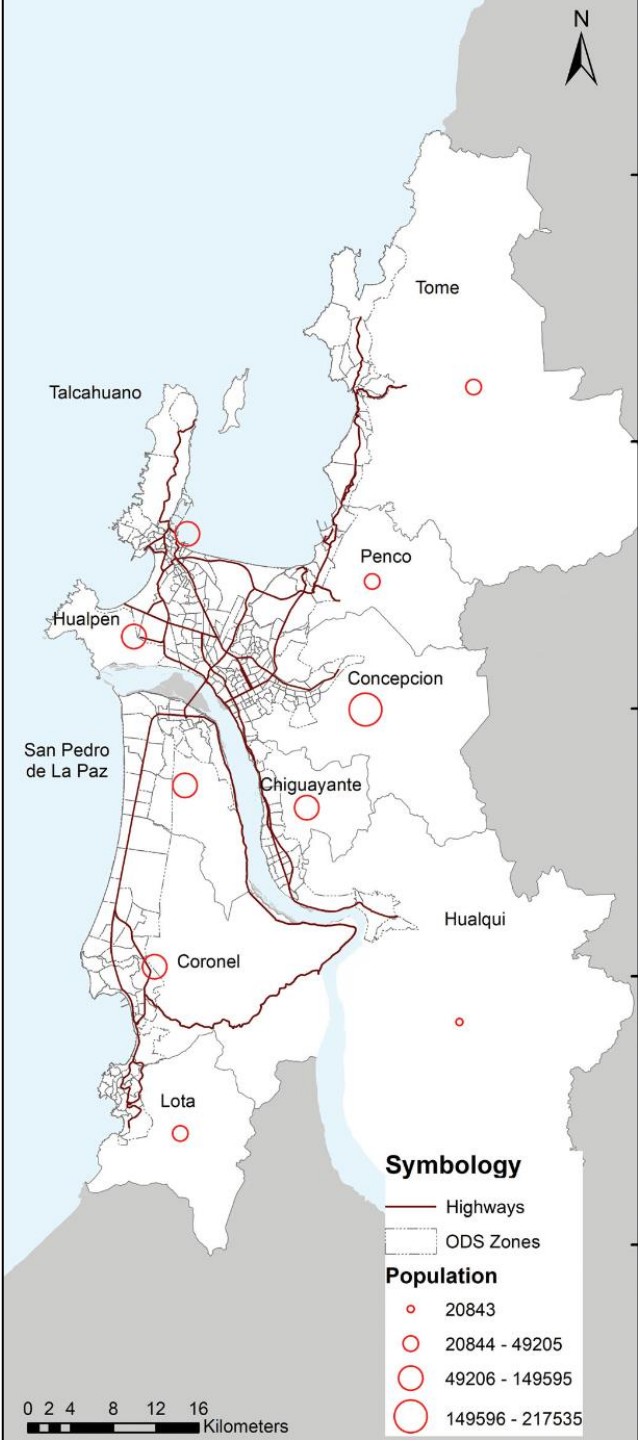
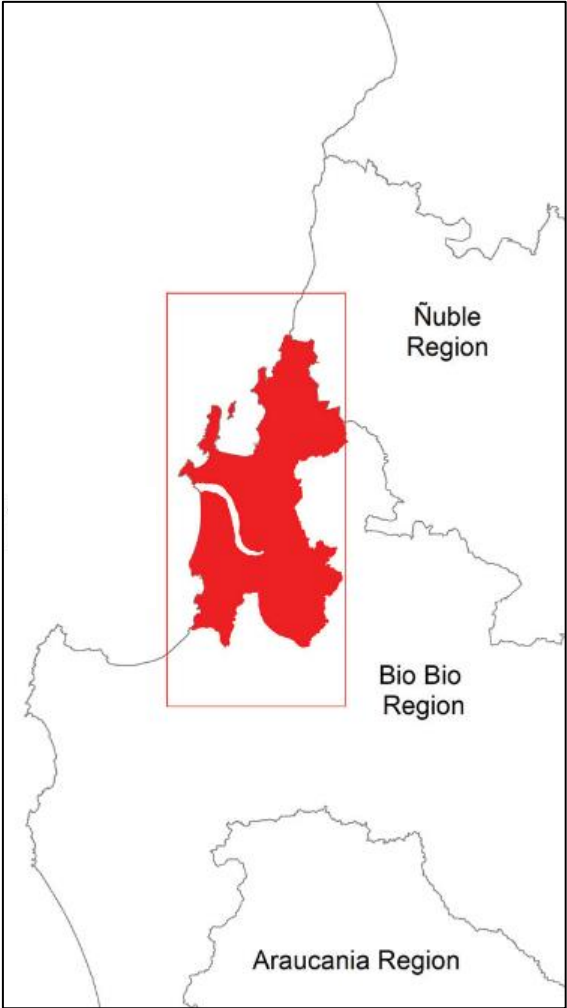
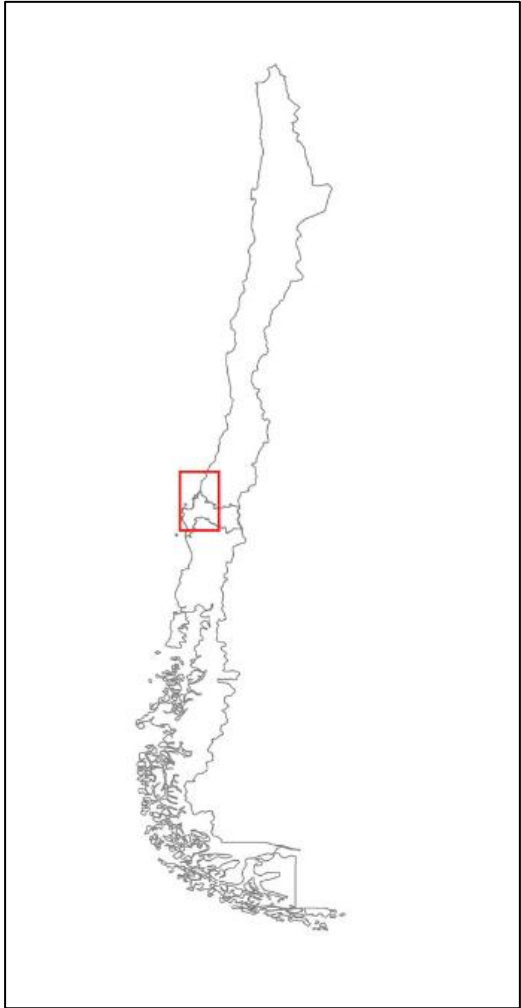
Local stores

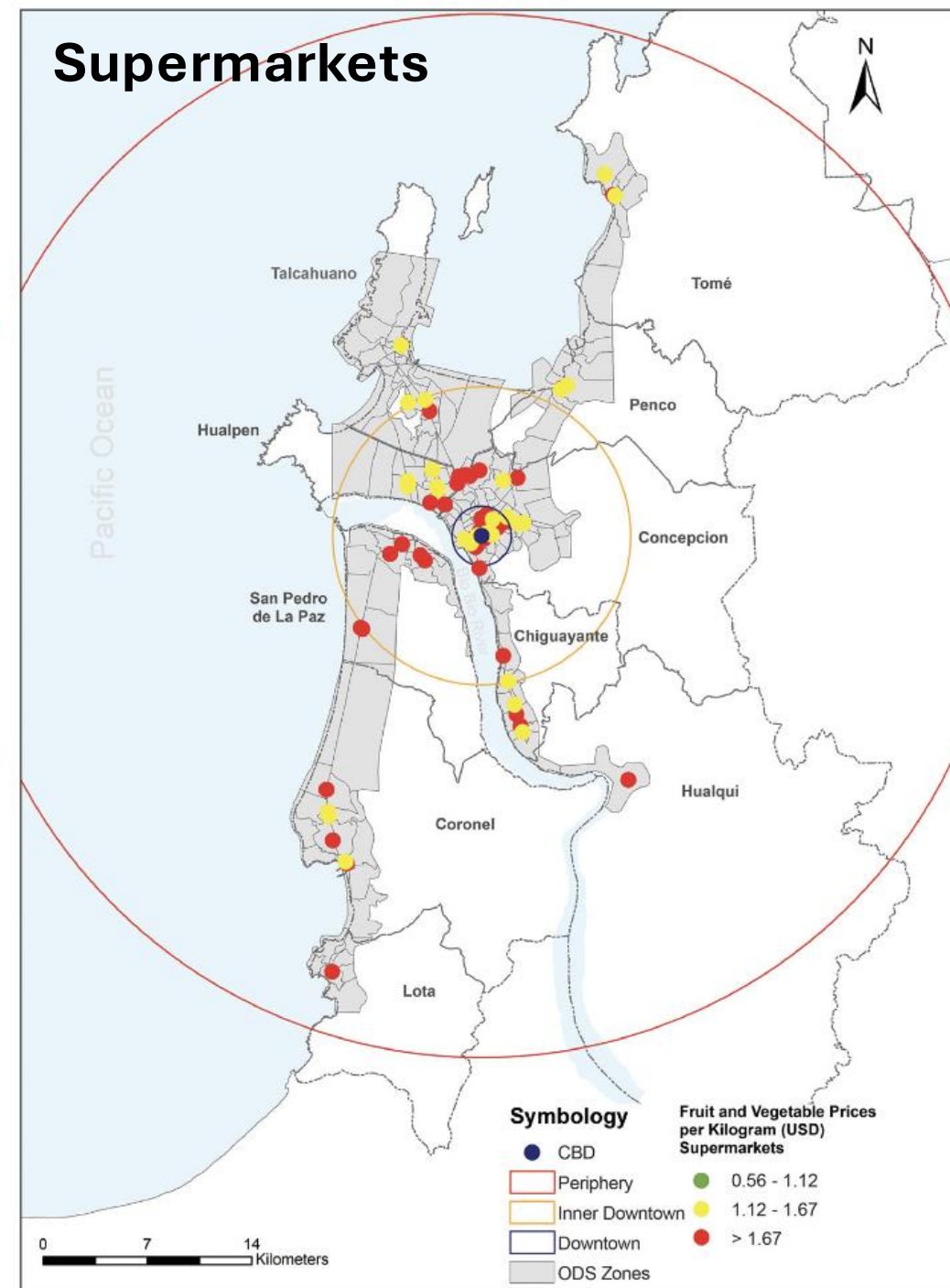
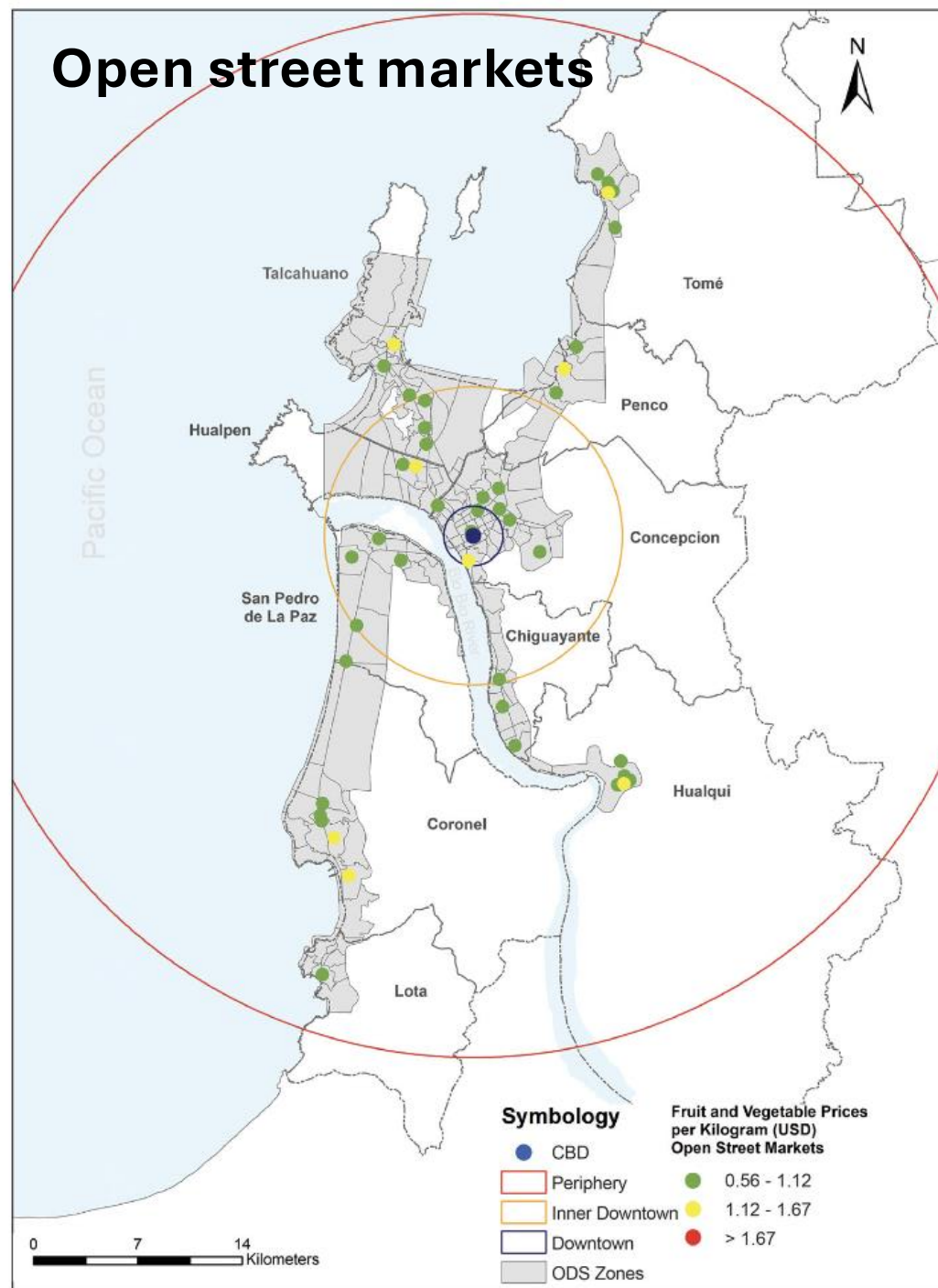


Open street or farmer's markets

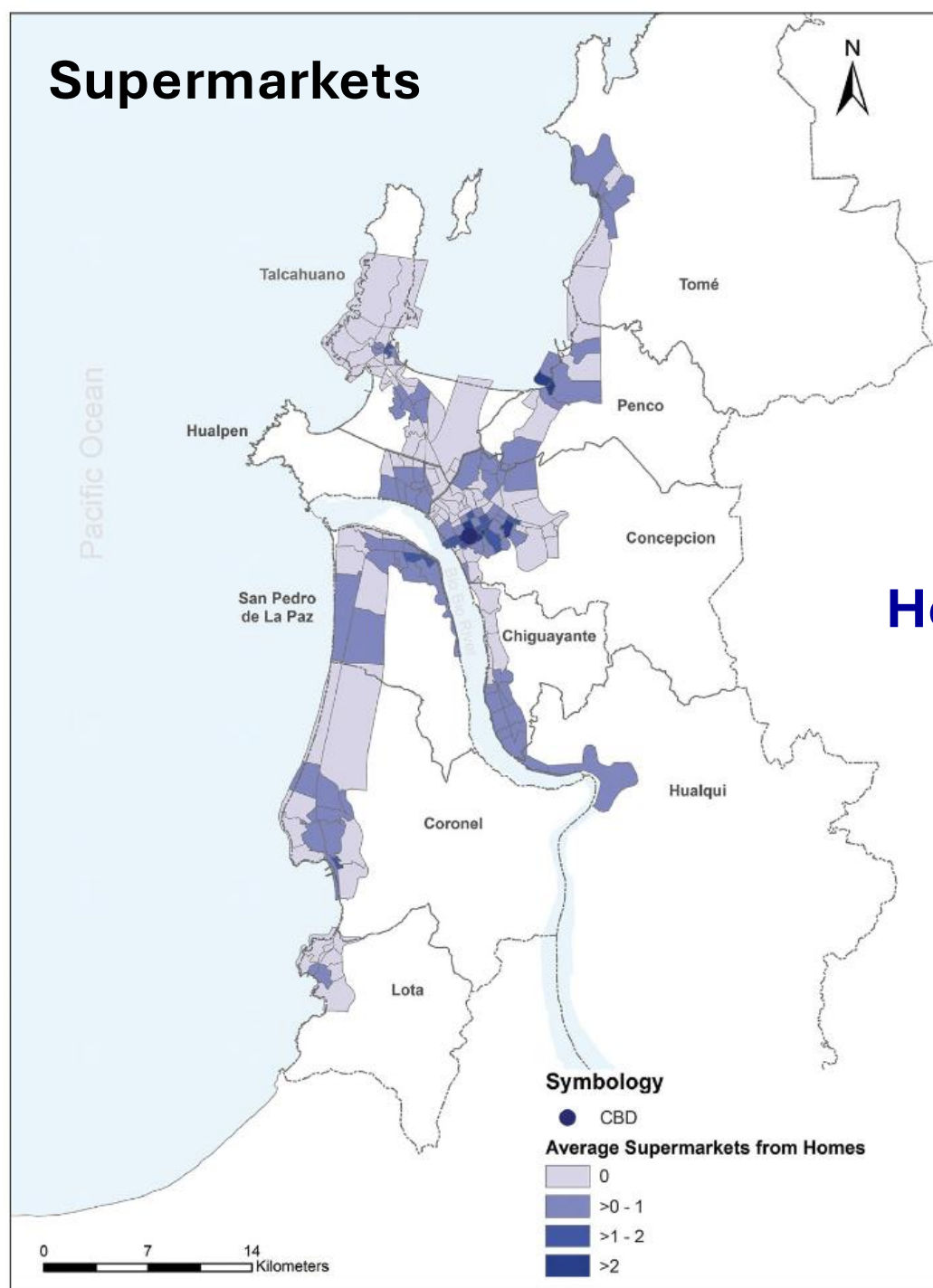


Context

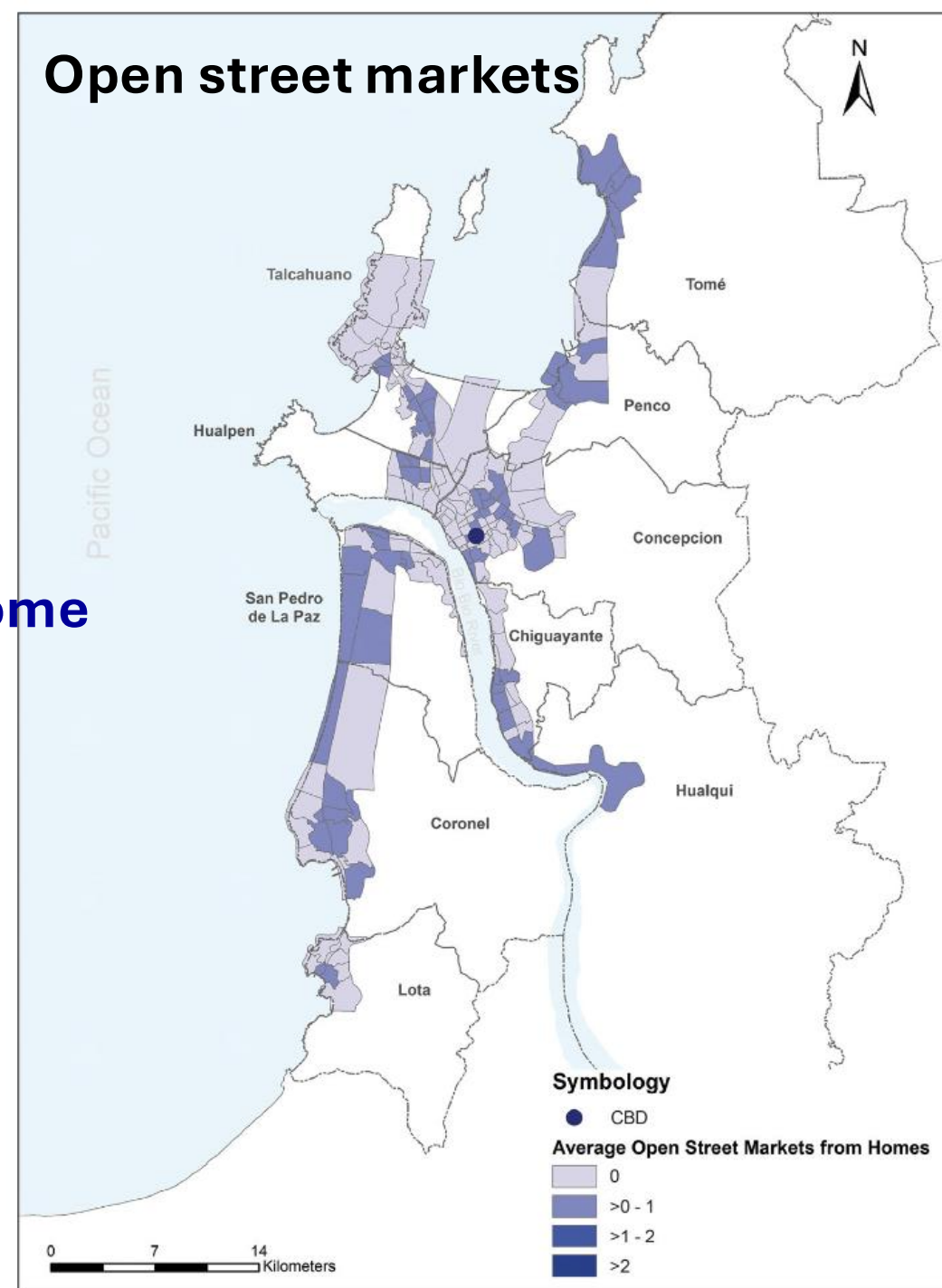




Supermarkets

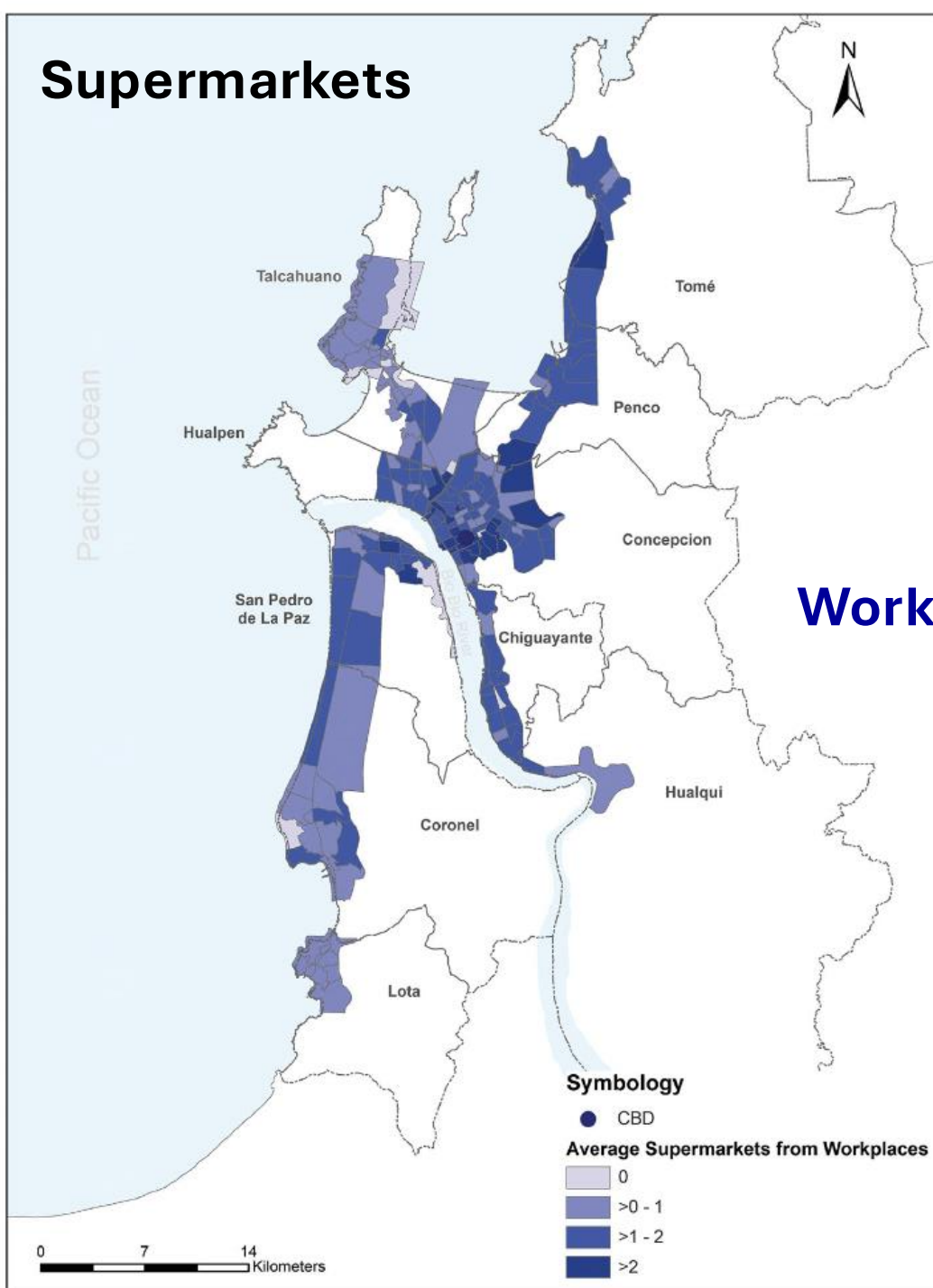


Open street markets

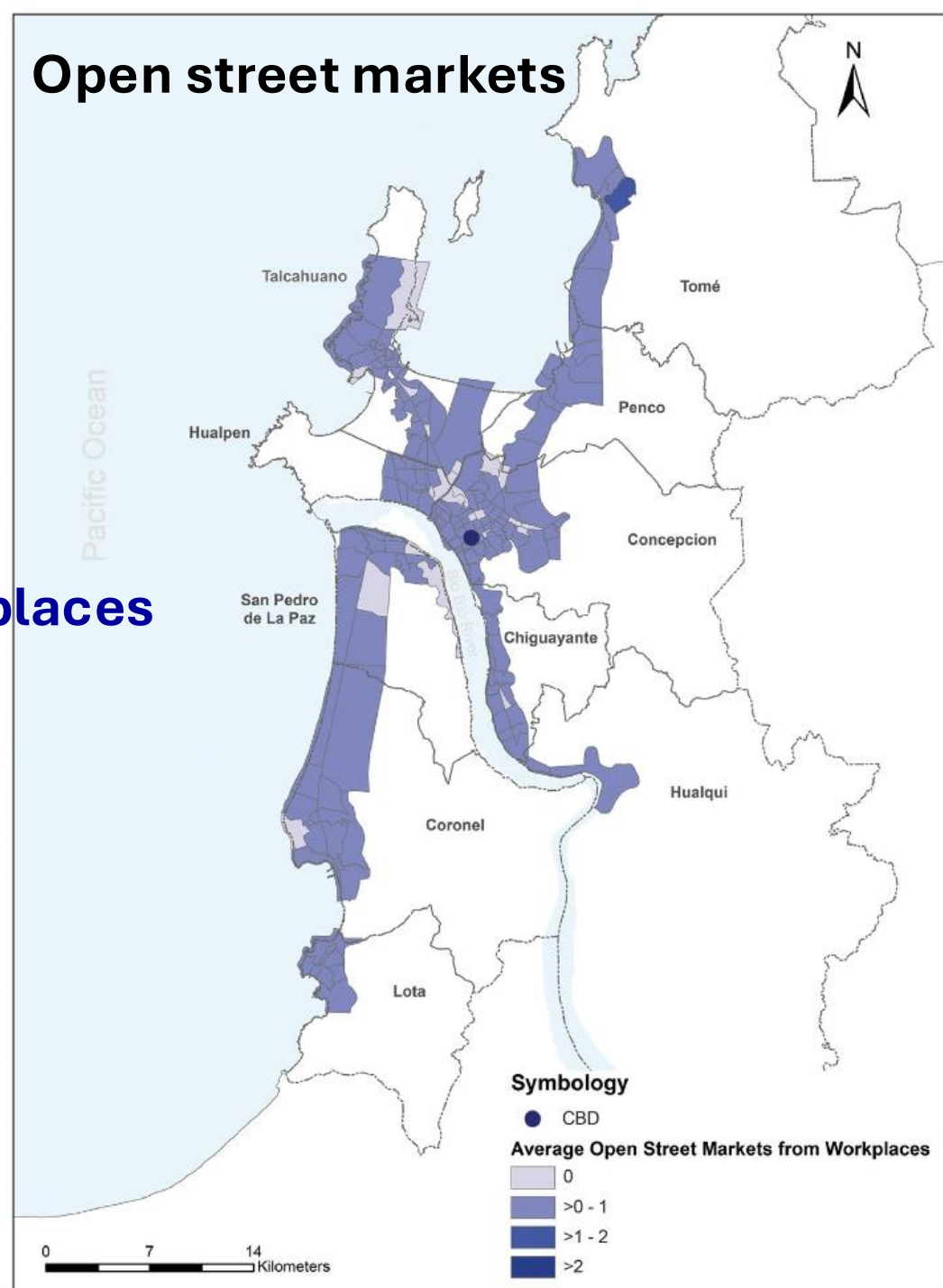


Home

Supermarkets



Open street markets

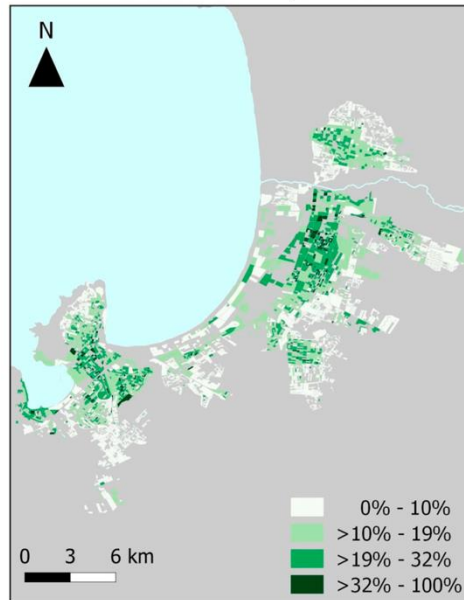


Workplaces

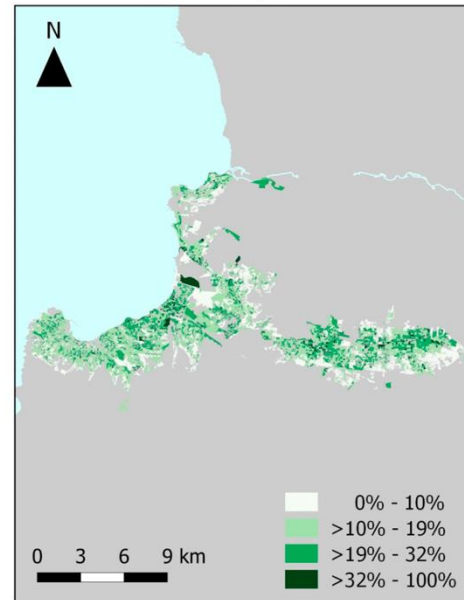
Senior's 10-minute walking distances to open street markets



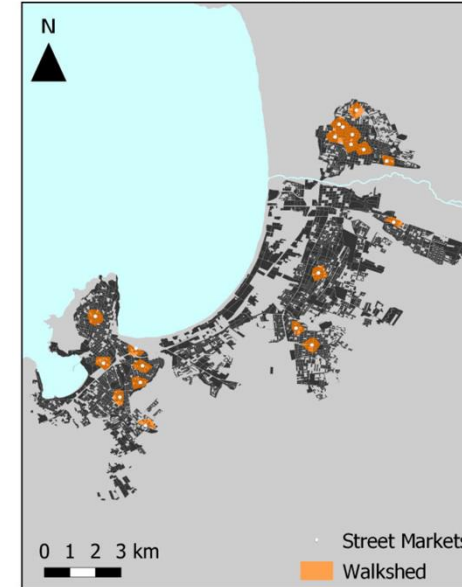
La Serena-Coquimbo



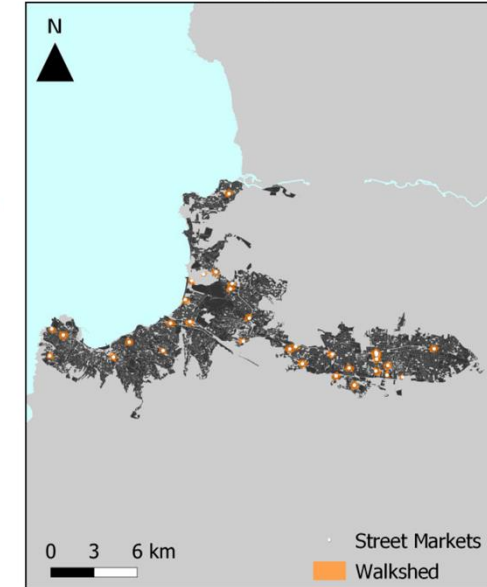
Gran Valparaíso



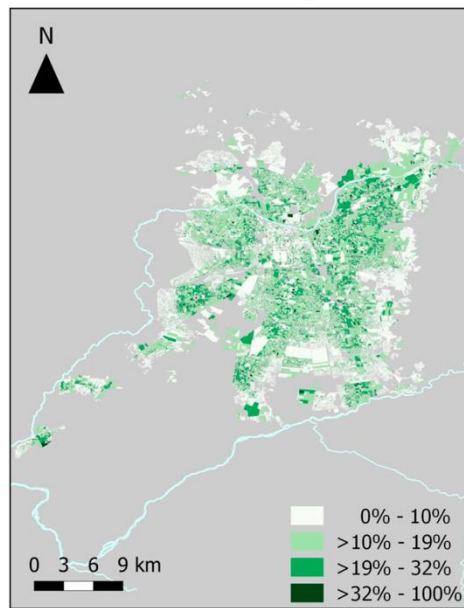
La Serena-Coquimbo



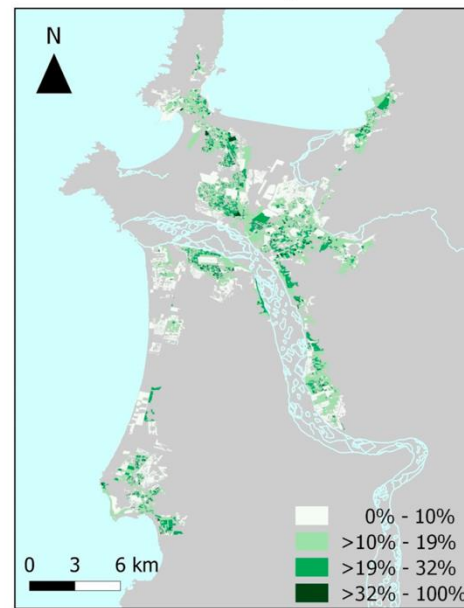
Gran Valparaíso



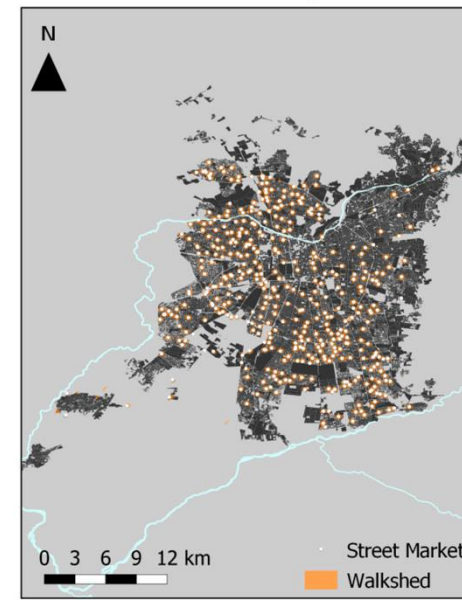
Gran Santiago



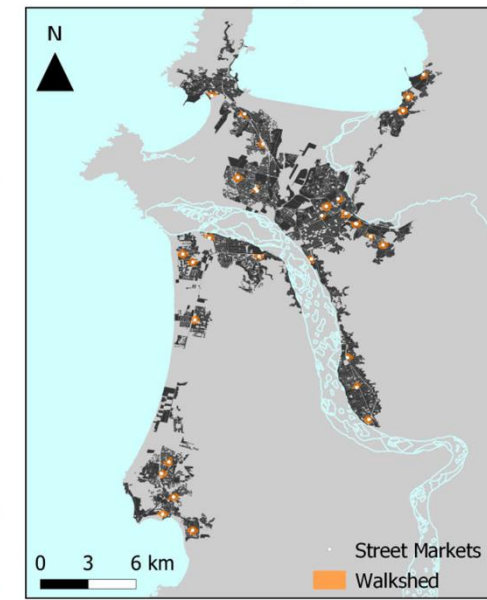
Gran Concepción



Gran Santiago



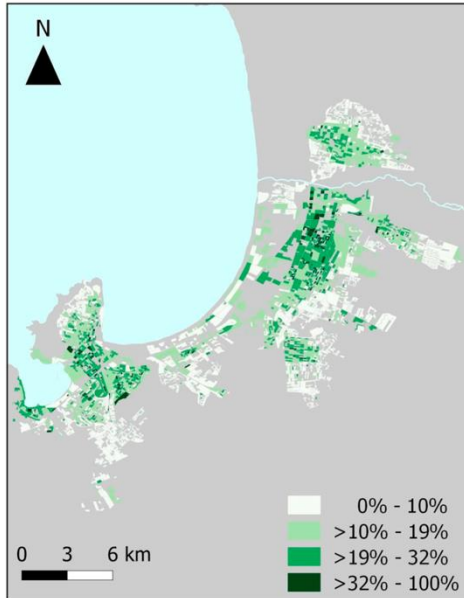
Gran Concepción



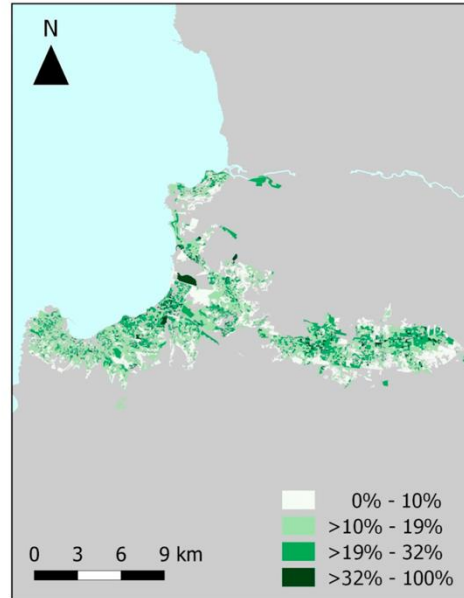
Areas with and without walking access to open street markets



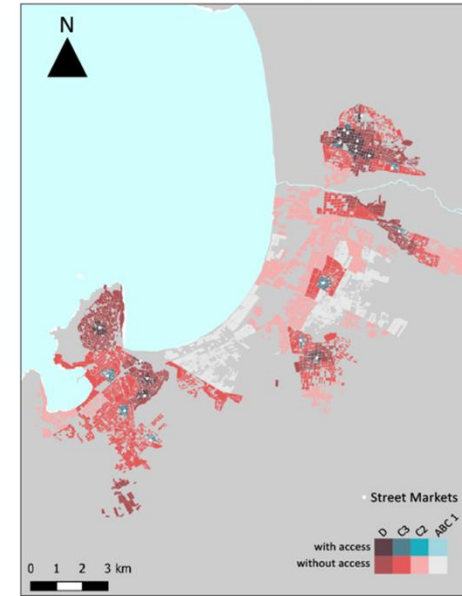
La Serena-Coquimbo



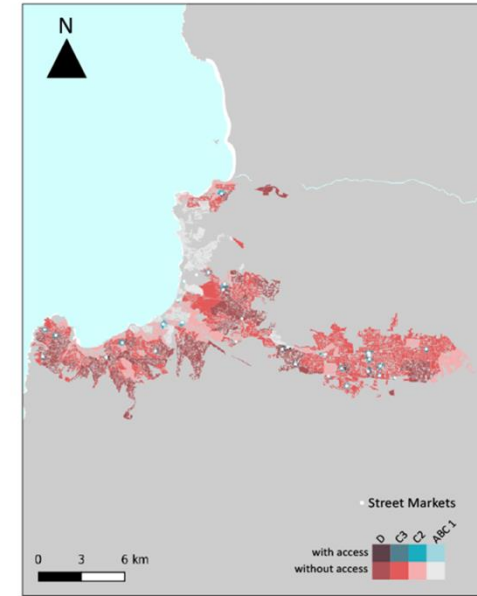
Gran Valparaíso



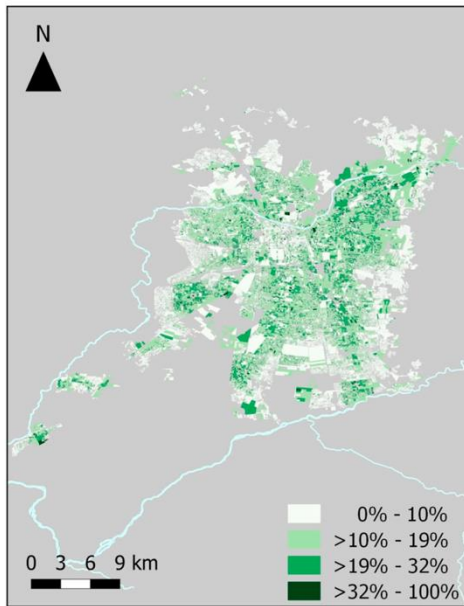
La Serena-Coquimbo



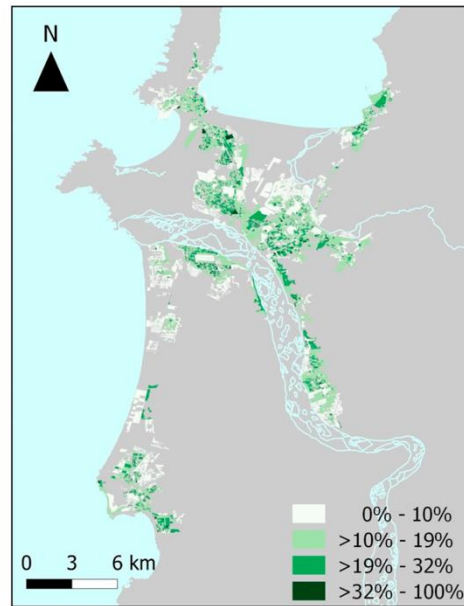
Gran Valparaíso



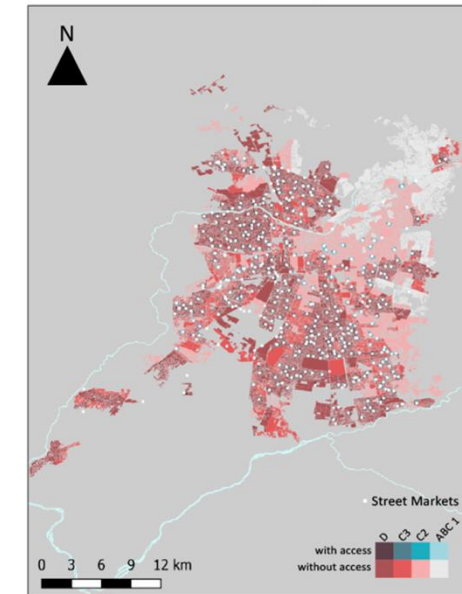
Gran Santiago



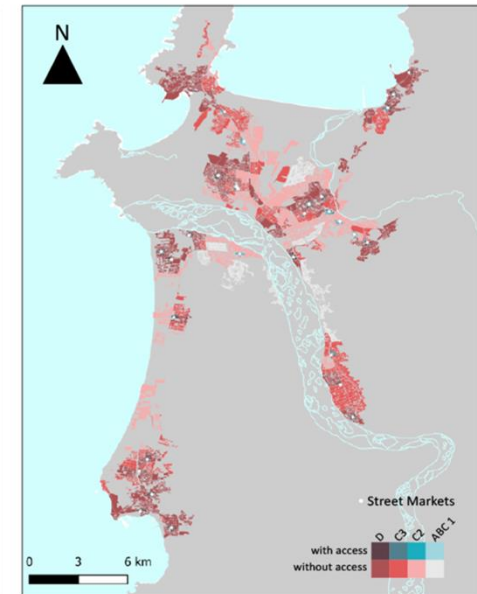
Gran Concepción



Gran Santiago



Gran Concepción



Food • Analysis: Intercept survey

N = 850 supermarket and open street market customers, including what people purchased that day

Food purchasing behavior

- Store type (8): supermarket, open street markets, butchery, fishmonger, greengrocery, minimarket, local stores, other
- Frequency
- Trip chaining and transportation modes (car, bus, bicycle, walking)
- *Store locations*
- Reasons to choose the specific stores
- Who in the household buys food

Food consumption behavior

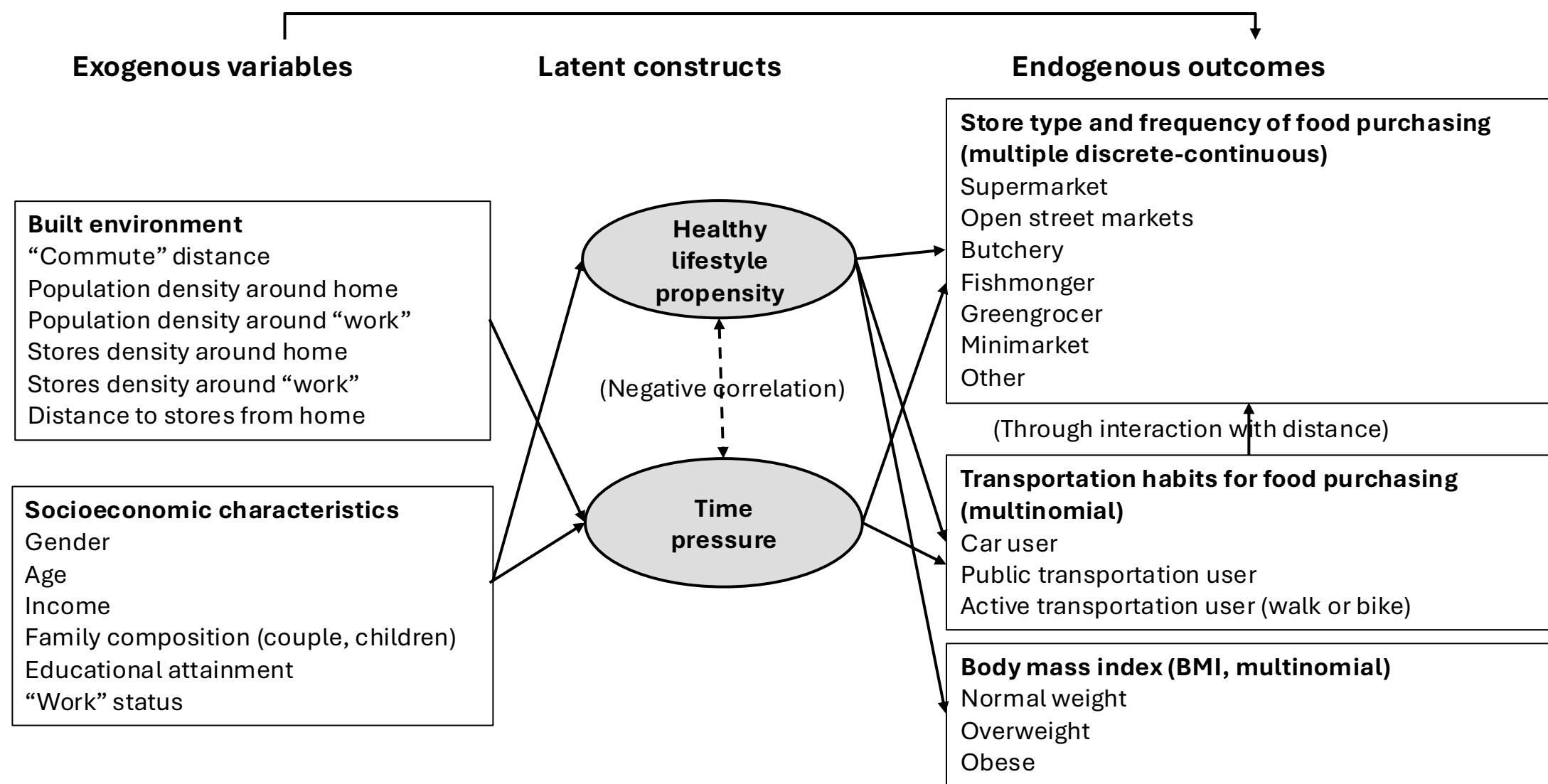
- Weekly food consumption (broad questions regarding frequency of key food types)
- Location of food consumption and preparation





Food • Analysis:

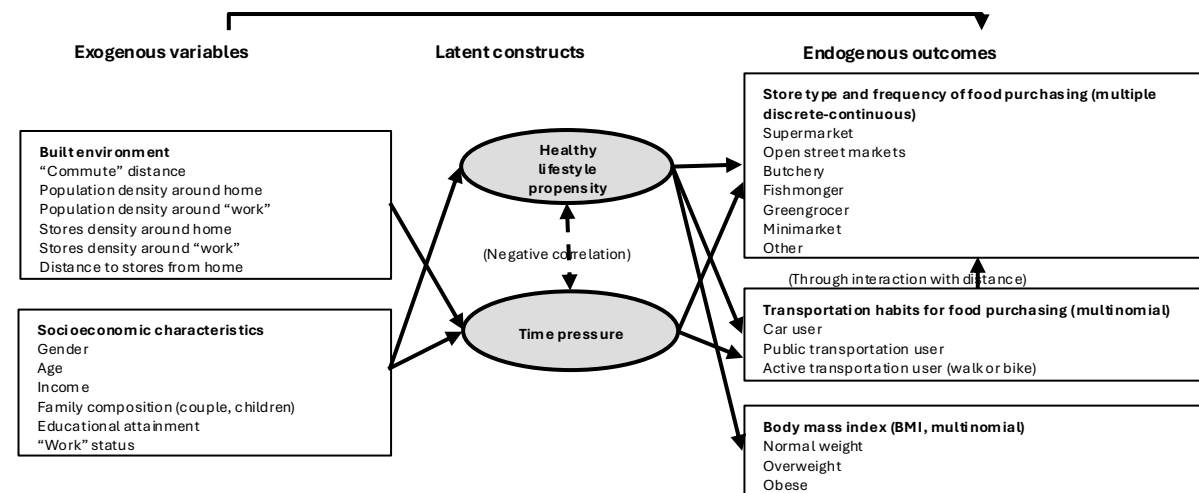
Food purchasing, transport and health outcomes



Food • Analysis:

Food purchasing, transport and health outcomes

- **A healthy lifestyle** is correlated with **healthy food access and consumption**, but mediated by transport
- Increasing access to **multiple modes of transportation** can impact food purchasing locations in monthly patterns
- **Active transportation modes** (lifestyle?) may not necessarily lead to healthy outcomes
- **Time pressure** is key to linking people's preferences on store type choice and food habits
- More income, more **time pressure**, but also more access to cars (but low-income groups have longer distances – get up earlier)



Food • Analysis: Data (2)

Second half 2019

One person per household

N=378

Dimensions

Food consumption

Habit

Perceptions

Attitudes

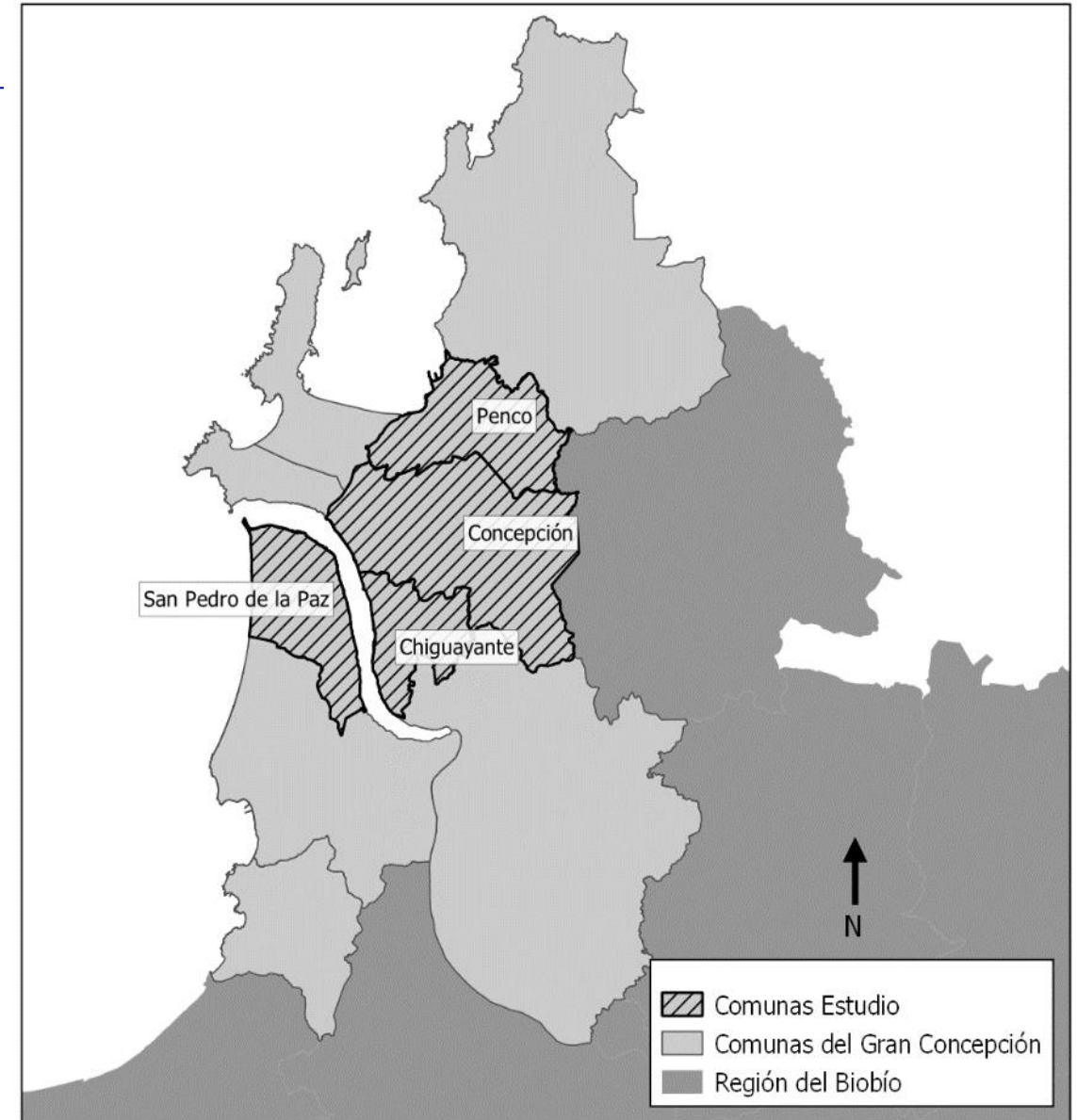
Sociodemography

Health

Social networks

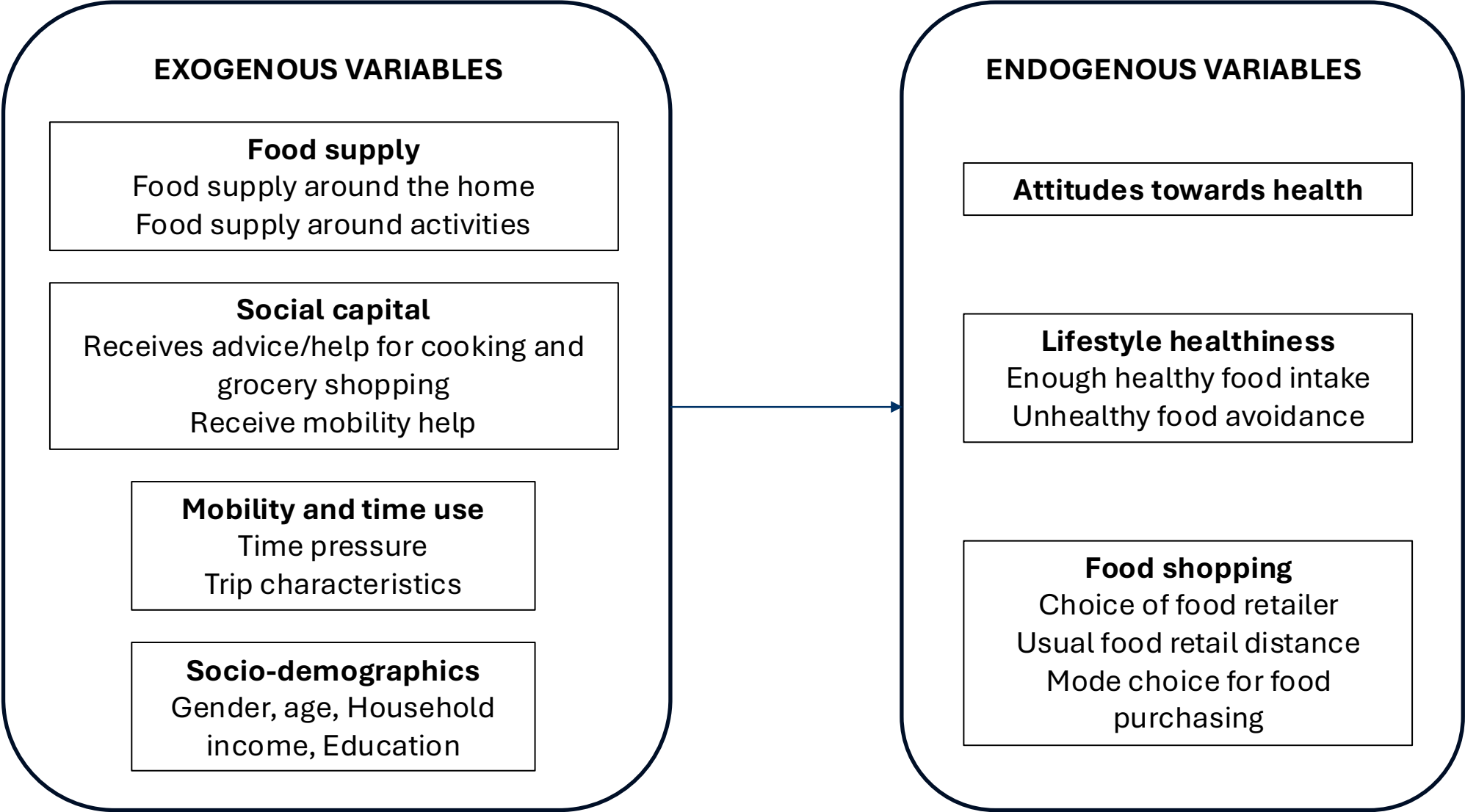
Activities

Transport





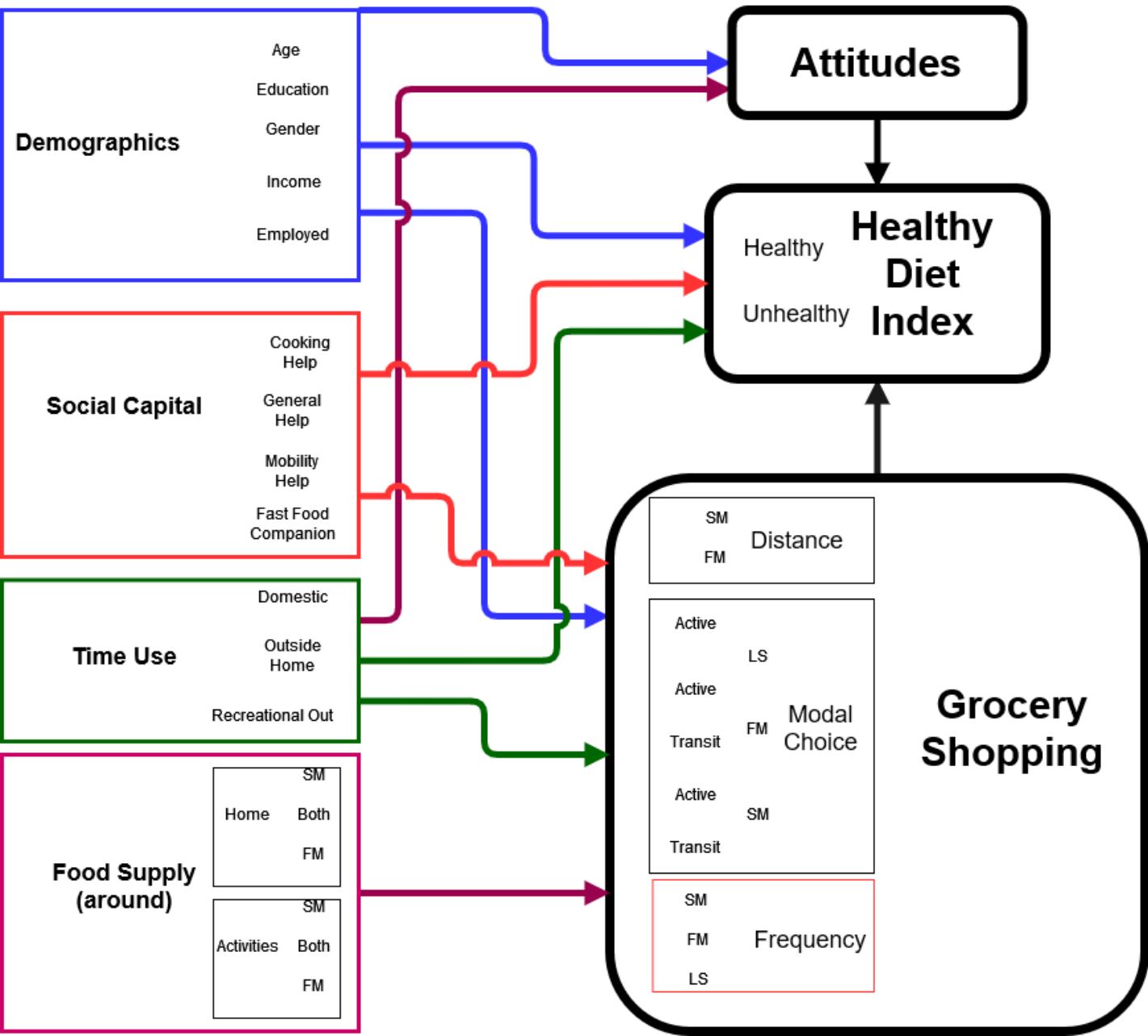
Food • Analysis: Food purchasing and eating patterns – Mobility, social networks, and attitudes on healthy diets





Food • Analysis: Results

- **Food consumption** and purchasing need a more integrated analysis
- **Social factors** (social influence and network capital)
- **Built environment** (availability, role of farmer's market)
- **Mobility and time use** are useful behavioural complements
- **Attitudes** provided a “control variable” role
- Challenging agenda to continue disentangling these factors





Food • Key Findings

- **Eating-in-motion:** Metro station food environments in Santiago serve millions daily, especially lower-income workers — largely invisible in nutrition and transport policy (Jirón et al.)
- **Open-street markets** have health-protective roles: trips to ferias use active modes and are associated with better diet quality (Rojas et al.; Vecchio et al.)
- No direct BMI–transport link when latent constructs are included: health-conscious people both eat better and move more (Astroza et al. 2022)
- **Spatial proximity** alone does not determine diet quality — mobility patterns and transport mode play the key mediating role (Miranda et al. 2025)
- **Group differences:** lower-income groups and women consistently show poorer access to healthy food stores and higher reliance on proximity

Part 2

Care and Mobility

Mixed methods, gendered mobility, and policy implications

Jirón, Carrasco, and Imilan (2026) · Book chapter · Eating on the move

Jirón & Carrasco (2020) · Sustainability · Daily mobility strategies

Jirón, Carrasco & Rebolledo (2020) · Transport Research Part A · Gendered barriers

Jirón et al. (2022) · Revista INVI · Spatialization of care through mobility

Henríquez, Carrasco & Astroza (2025) · Transportation Letters · Care segments

Ortiz, Carrasco et al. (2026) · WCTR · Care diamond profiles



Care • Methods: Multi-instrument data

Ethnographic Fieldwork

Mobile ethnography and shadowing (Jirón method). Accompanies individuals through their daily journeys — revealing invisible barriers, interdependencies, and negotiation strategies invisible in surveys.

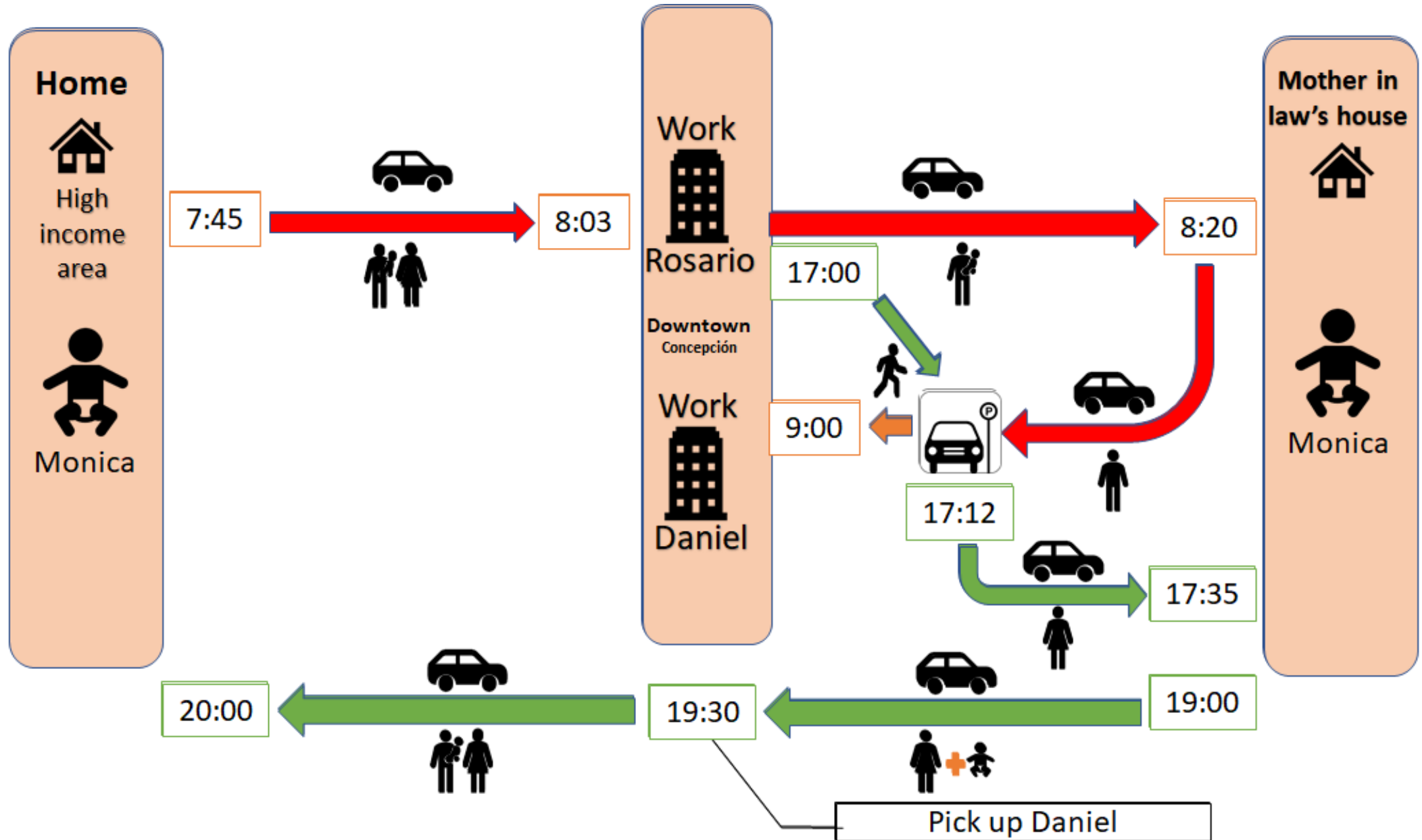
Time-Use Survey

Weekly activity-travel diary capturing time allocation, mode use, purpose (including care); six neighbourhoods in Concepción. Enables segmentation and comparison of care activities between groups.

Care and mobility Survey

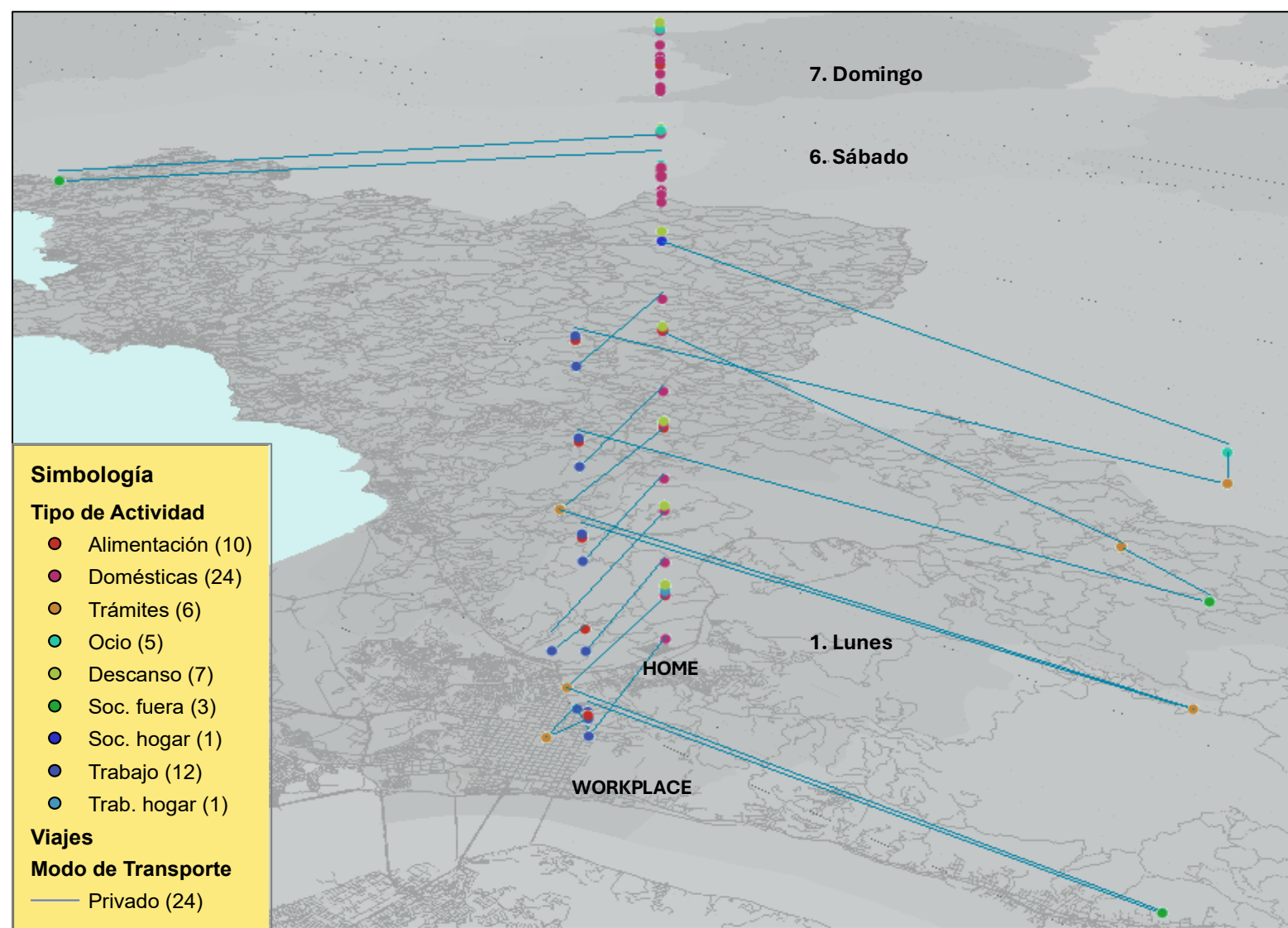
300 respondents in Greater Concepción (skewed toward women). Captures: caring obligations, household responsibility distribution, use of public/private care services, community participation, and transport mode use.

Rosario



Rosario

Activities



Routines: Work, children, grandmother, lunch as a couple, household chores on weekends, (few) friends outside the neighbourhood

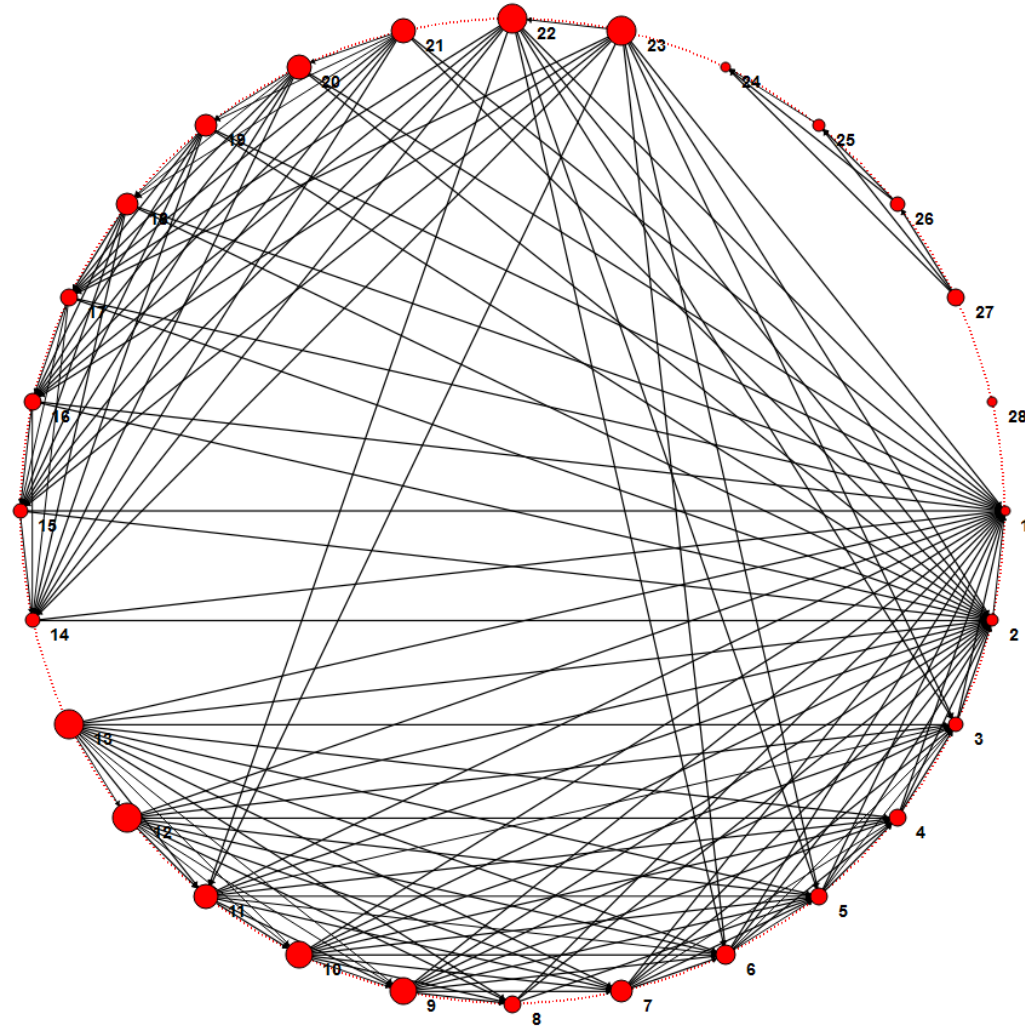
Territory: Neighborhood scope versus city scope (key destinations)

Gender and safety

Mobility of care: Children, older family members

Rosario

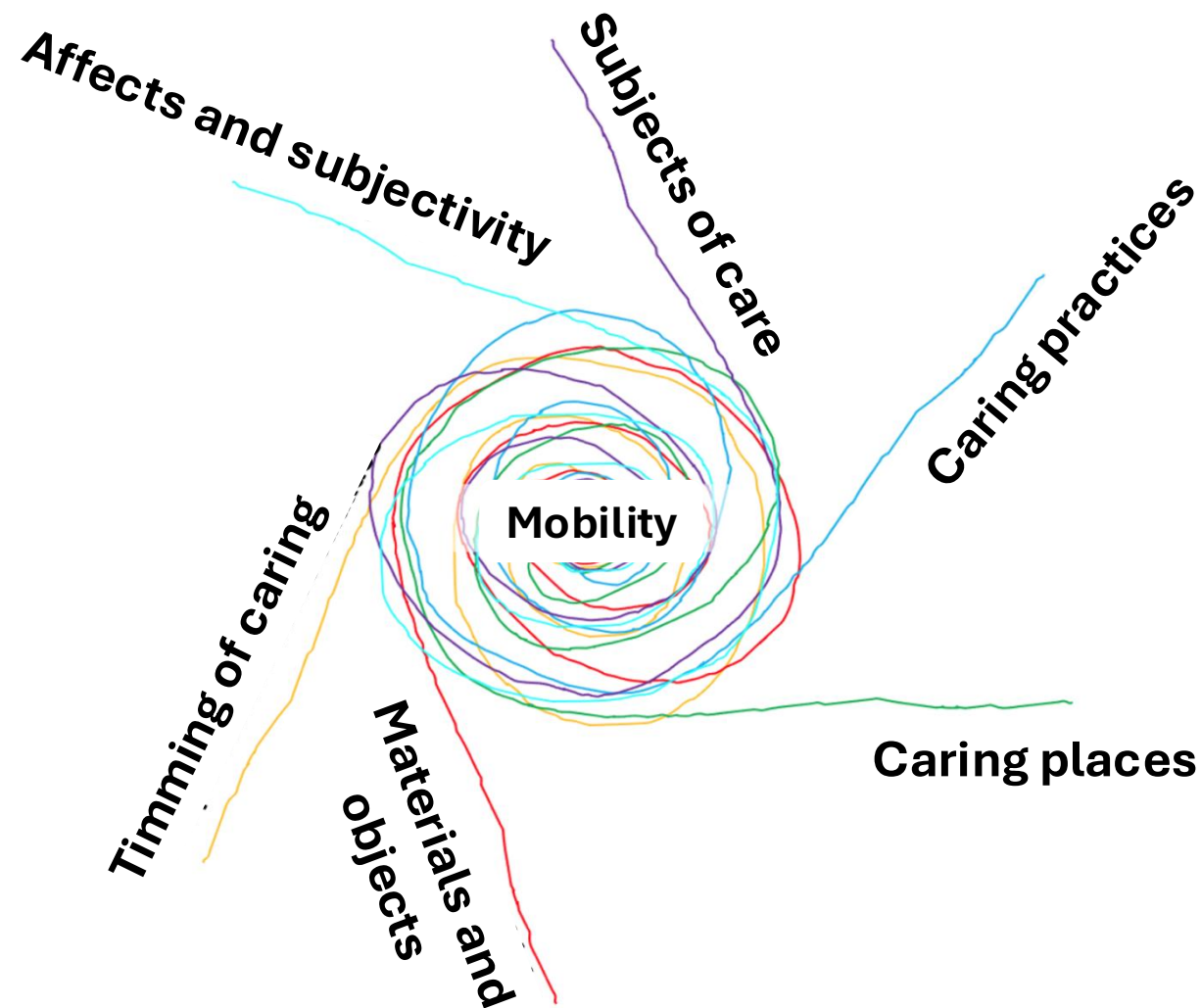
Social
networks



Socio-spatial foci: neighborhood, downtown, other places; related with network composition

ICT plays different roles on interacting with people in the network

Care · Methods: Integrating Qualitative Methods



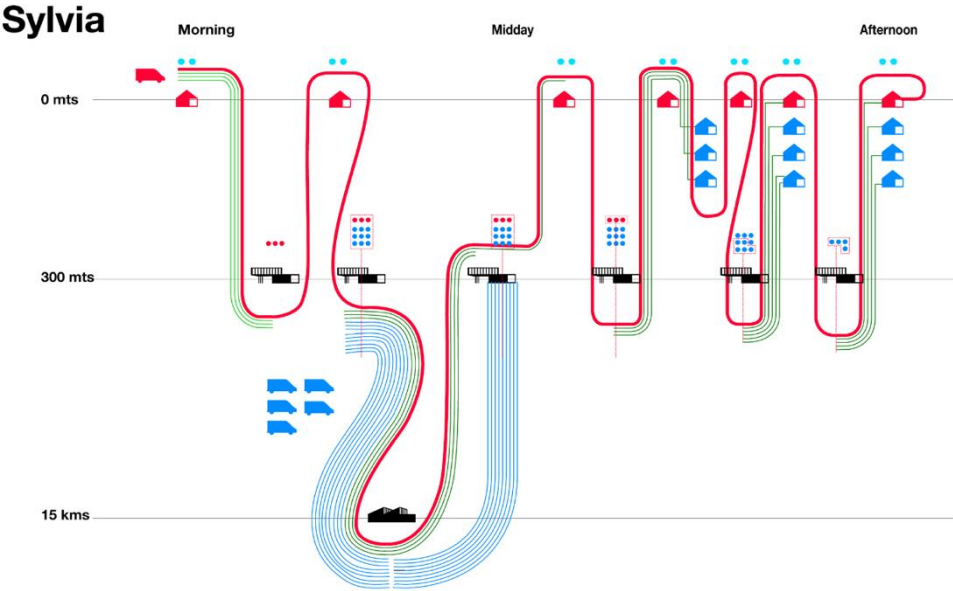
Care · Methods: Integrating Qualitative Methods

Chains of care



Fuente: Elaboración propia. Dibujo: Macarena Solar-Ortega

Temporal rhythms of care



Things of care



Bultos



Bastón / Burrito



Mochila



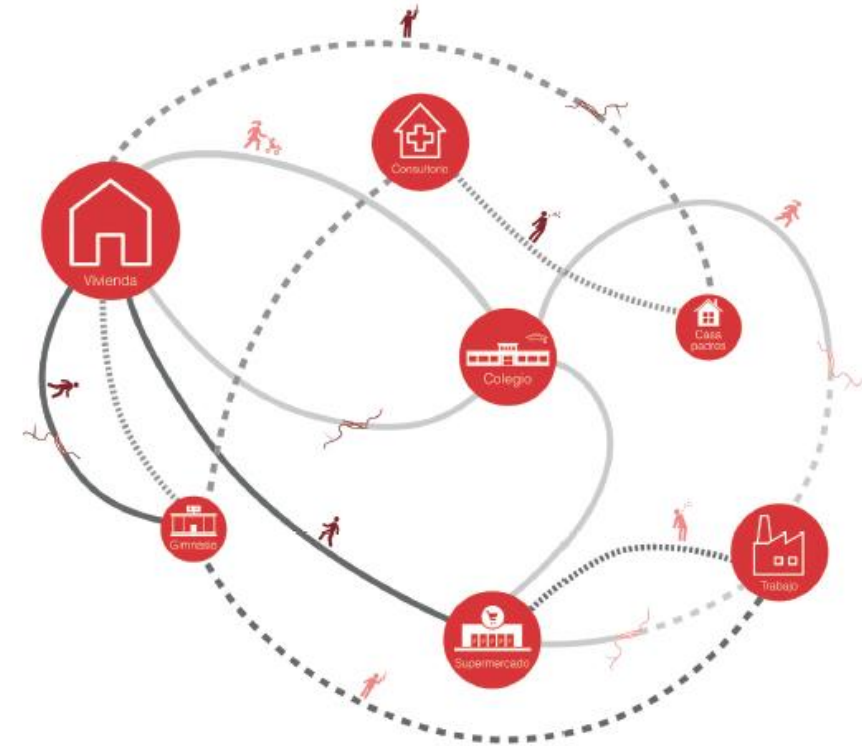
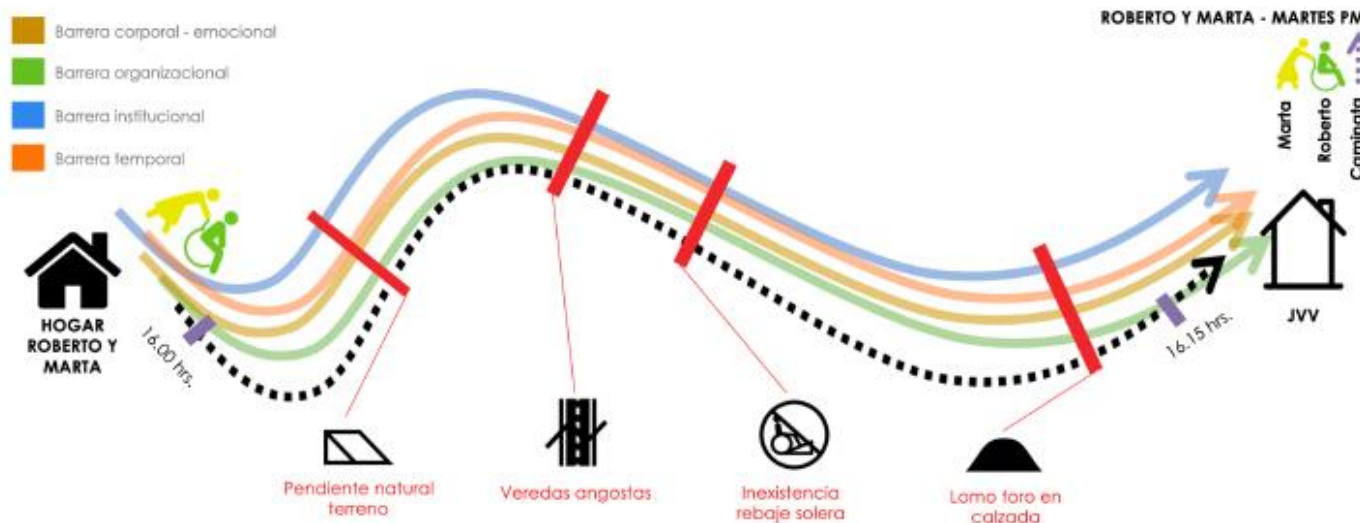
Bolsa(s) de Compra(s)



Carrito Compras

Care · Methods: Integrating Qualitative Methods

Networked Infrastructures of care



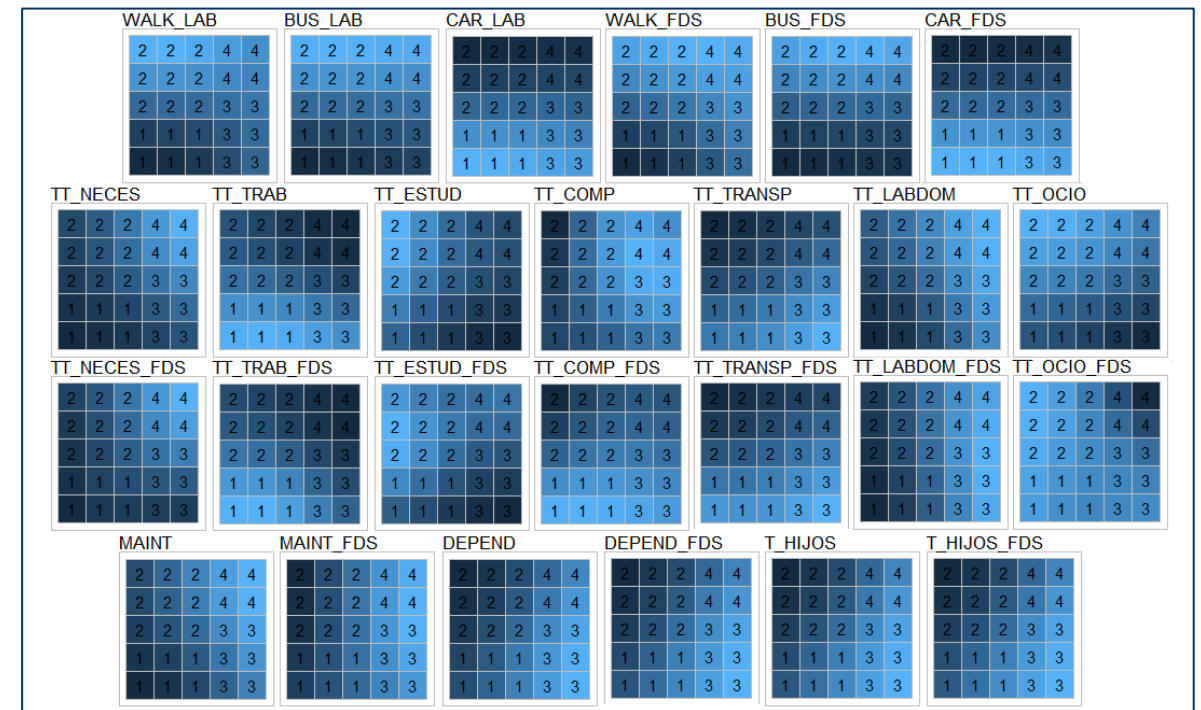
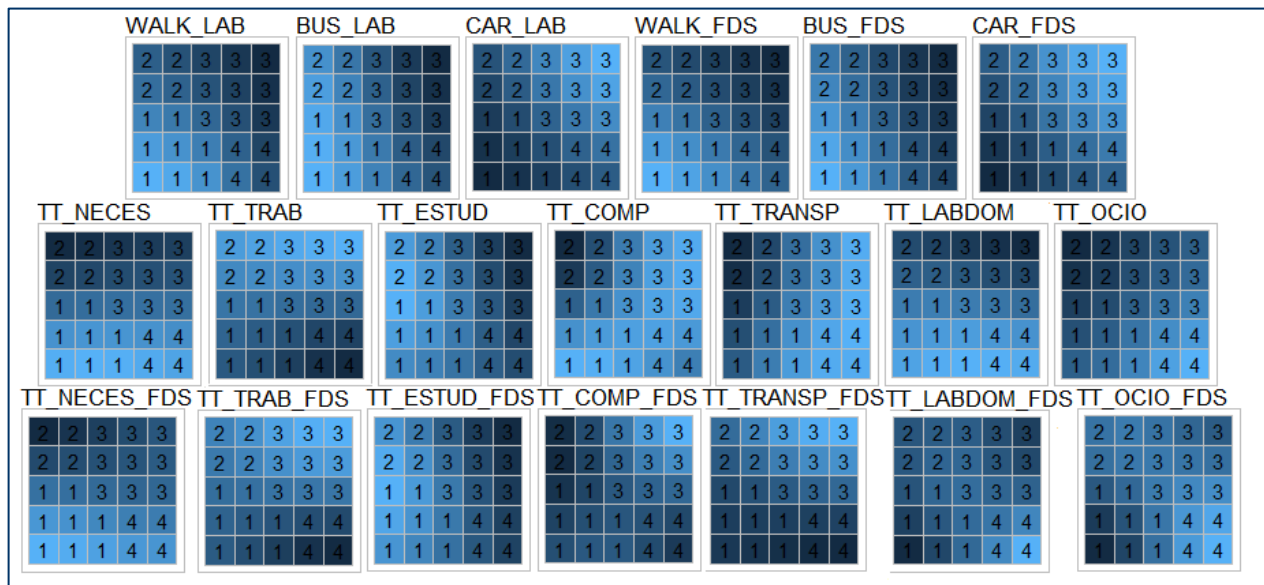
Care infrastructure – Chain of places

Care : Mainstreaming care in mobility analysis

Transport
Time use

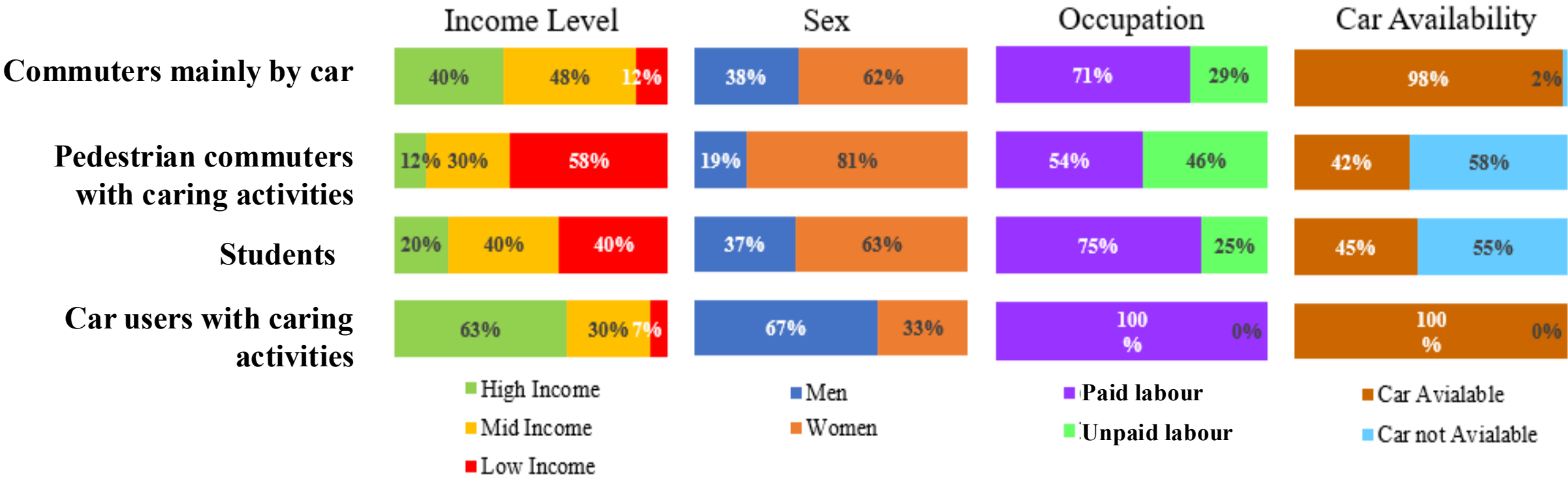
Care activities

Number of activities with dependent people
Time spent with children

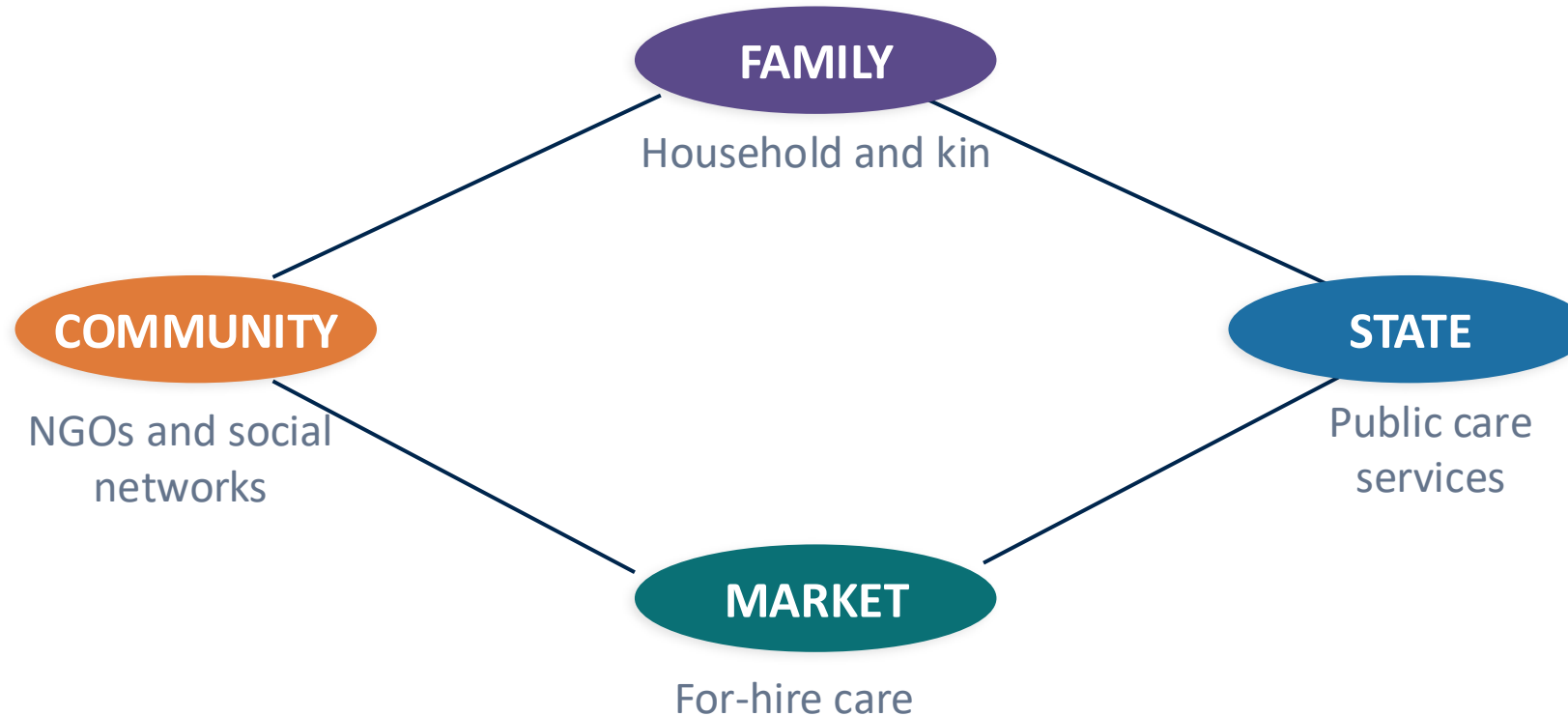




Care : Mainstreaming care in mobility analysis



Care • Theoretical approach: Diamond of Care



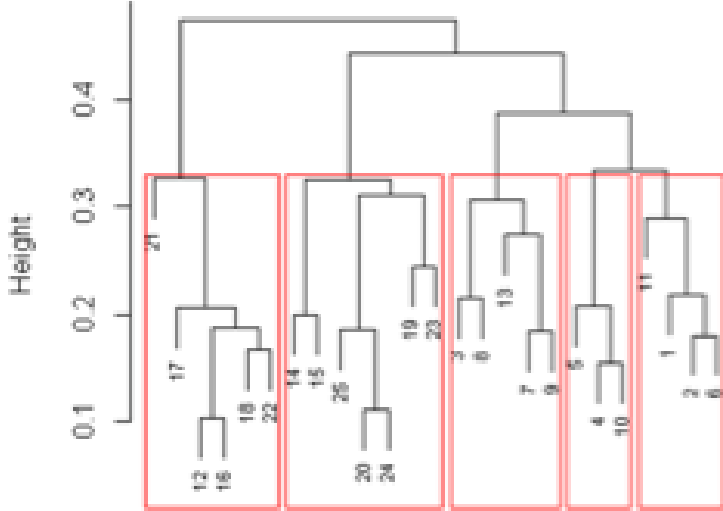
- Razavi (2007): care responsibilities distributed across four “institutions”
- People who cannot access market or state services depend on family — limiting spatial mobility
- **Mobility lens:** Each institution implies different activity-travel behaviour patterns (trip types, distances, and transport mode availability)



Care · Analysis:

Care profiles (Self organized Maps - SOM)

Variable name	Description	Values
DIST_CUID	The person has caring obligations	Binary: take care (1) / does not take care (2)
CUID_DIR	Degree of responsibility to perform care activities: emotional or escorting people	Does not participate (0) / responsible (1) / collaborates (2)
CUID_HOG	Degree of responsibility to perform care activities: Household maintenance	
CUID_REC	Degree of responsibility to perform care activities: Household organization and shopping	
CUID_ADM	Degree of responsibility to perform care activities: Household financial maintenance	
CUID_IN_OUT	Performing care activities within or outside the household	Within the household (1) /out-of-the-household (2) / both within and out (3)
USO_SERV_PUB	Uses private care services	Binary: uses/does not use any service (0) / uses at least one (1)
USO_SERV_PRIV	Uses public care services	Binary: uses/does not use any service (0) / uses at least one (1)
PART_ORG	Participates in a non-profit organization	Binary: no (0), yes (1)
CANT_ORG	Number of non-profit organizations the person participates	Integer number



12	8	13	0	38
0	22	0	7	0
16	0	5	1	15
28	0	20	2	13
41	0	13	0	34



Care · Analysis: Care profiles (SOM)

A

Community-Supported Caregivers

High community org participation
Shared household responsibilities
Moderate service use

D

Public-Service Dependent

Highest reliance on state services
Many children under 12
Low car use / walking

B

Solo Burden Bearers

Care concentrated in ONE person
Predominantly women
Lowest car ownership

E

In-Home Self-Reliant

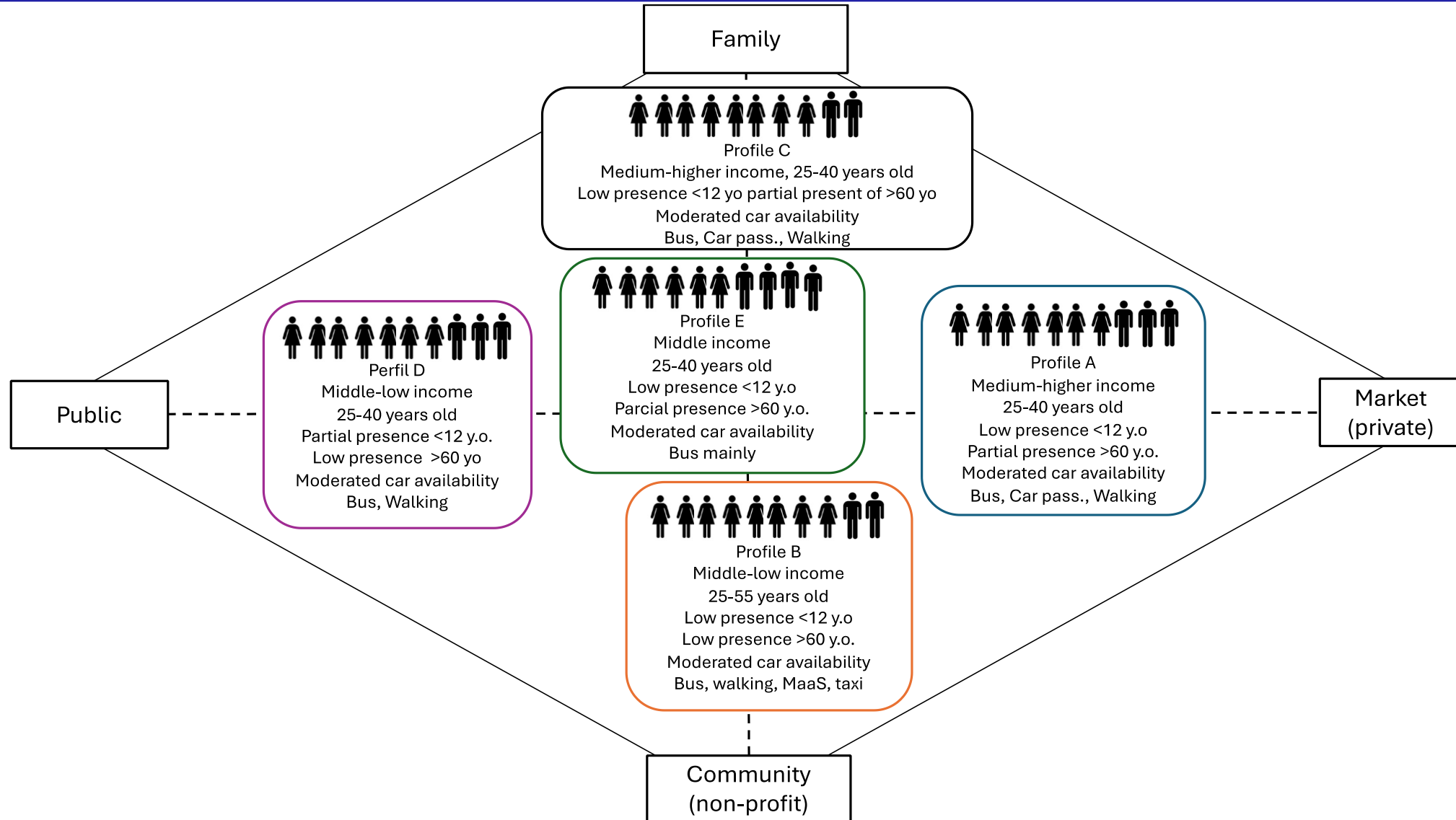
Activities mainly within home
Limited external service use
Moderate income & mode use

C

Market-Reliant Time-Pressed

High use of private care services
More paid working hours
High car driver use

Care · Framework: Diamond of Care and mobility





Care · Analysis: Care profiles (SOM) - characteristics

Profile	Primary Institution	Income	Children <12	Seniors >60	Key characteristic	Dominant Modes
A – Community	Family + Community	Mid-high	Some	Some	High community participation	Car, MaaS, Transit
B – Solo Burden	Household (solo)	Low	Some	Some	Care in one person	Walking, Transit, MaaS
C – Market	Market (private)	Mid-high	Some	Rare	Time-pressed, service users	Car driver, Taxi
D – Public Service	State (public)	Low	Most	Some	Public service reliant	Bus, Walking
E – Self-Reliant	Mixed / balanced	Mid	Some	Some	In-home focused	Varied



Care · Analysis: Care profiles (SOM) – transport modes

	Car driver	Car pass.	Transit	Walking	MaaS/Taxi
Profile A: Community	High	High	Medium	Medium	High
Profile B: Solo Burden	Low	Medium	Medium	High	High
Profile C: Market	High	Medium	Medium	Medium	Medium
Profile D: Public Service	Low	Low	High	High	Medium
Profile E: Self-Reliant	Medium	Medium	Medium	Medium	Medium

 Low  Medium  High



CARE · Key Findings: Care, Gender & Transport

- Care activities are **systematically invisible** in standard travel surveys — missing from trip-purpose categories, hidden within chains of trips (Jirón et al. 2020)
- Caring activities are **bundled and interdependent** — ethnographic methods reveal simplified survey categories fail to capture negotiated, multi-person mobility strategies
- **Care spatialization**: mobility itself is a care act — moving through the city to enable others' activities, escort dependents, access services (Jirón et al. 2022)
- Profiles that rely heavily on public services show lower car use and higher transit/walking dependence — **vulnerable** to transit service cuts and spatial mismatches
- Women bear **disproportionate care burdens**: solo-caregiver profiles are predominantly female, with lower car ownership and higher dependence on transit and walking (Ortiz et al. 2026)

Part 3

Spatial Accessibility and Railway Assessment

Incorporating justice principles in suburban railway evaluation

Werner, Carrasco, Tiznado-Aitken & Vecchio (2025) · Journal of Transport Geography

PRINCIPALES METAS EFE

(CMF 4.1)

2 x passengers



**150 MM DE PASAJEROS
PARA EL 2030**

El tren como solución
a las necesidades de
conectividad y desarrollo.

3 x freight



**DUPLICAR CARGA
TRANSPORTADA PARA 2030**

Aumentar eficiencia de la
cadena logística y más
de 80% de la carga con
destino a puerto.

Línea base año 2018.

+ accessibility



**+ ACCESIBILIDAD
(META EN DEFINICIÓN)**

Cantidad de personas/
comunales con acceso a
transporte público – tren/
bus.

Carbon neutral



**CARBONO NEUTRAL
PARA 2035**

Medición línea base 2021-
2022.

Reducción de emisiones.

+ female workers



**30% PARTICIPACIÓN
FEMENINA PARA EL
2026**

Avanzar hacia la equidad
de género y contribuir a
un futuro más sostenible.

financing



**EBITDA 0
PARA 2029**

Sostenibilidad financiera

Reducir los -25.000 MM\$
de ebitda alcanzados el
2021 hasta llegar a punto
de equilibrio operacional.

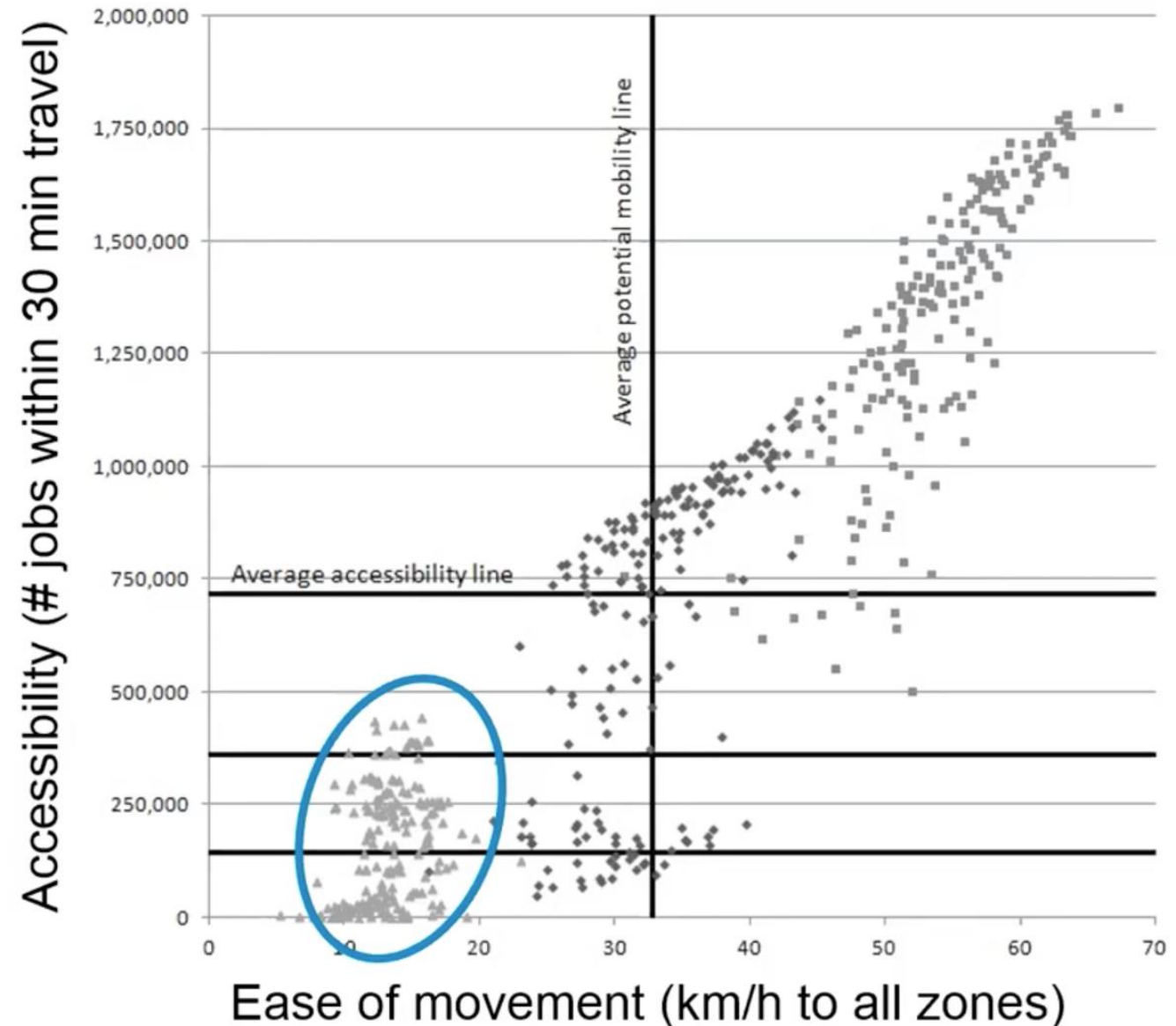


Accessibility · Incorporating Justice in Transport Evaluation

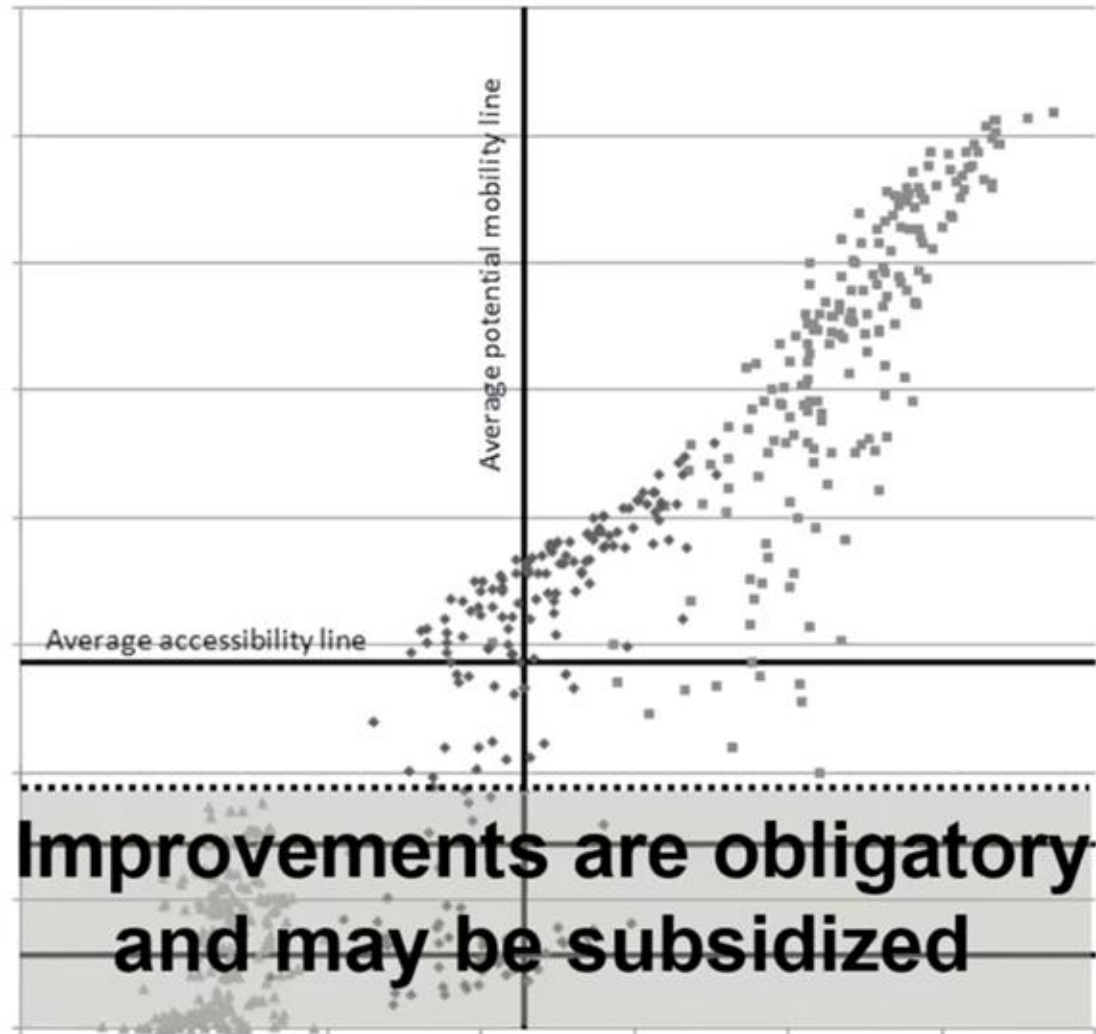
Transport Justice Framework

How do we apply it on a specific projects?

Transport justice: Designing Fair Transportation systems,
Karel Martens (2017)

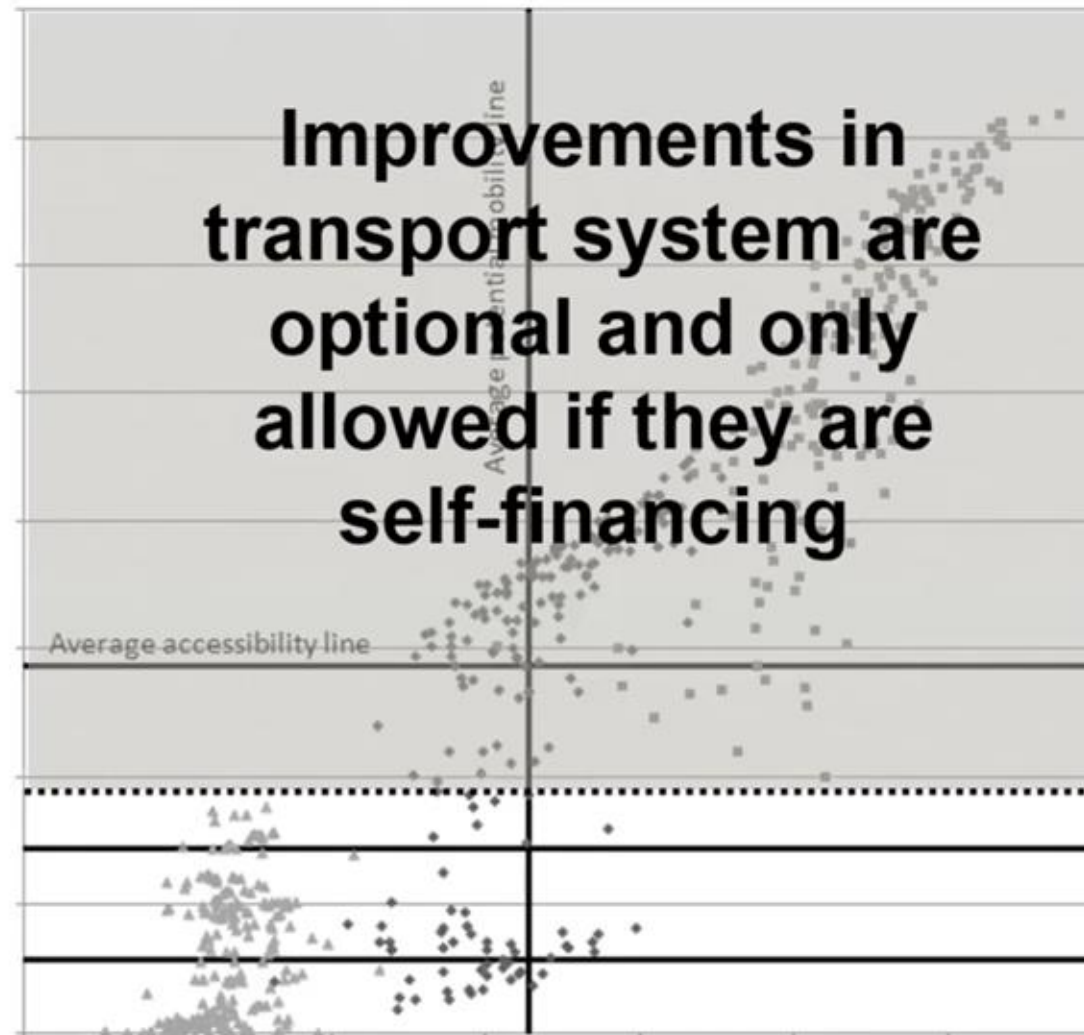


Accessibility · Incorporating Justice in Transport Evaluation



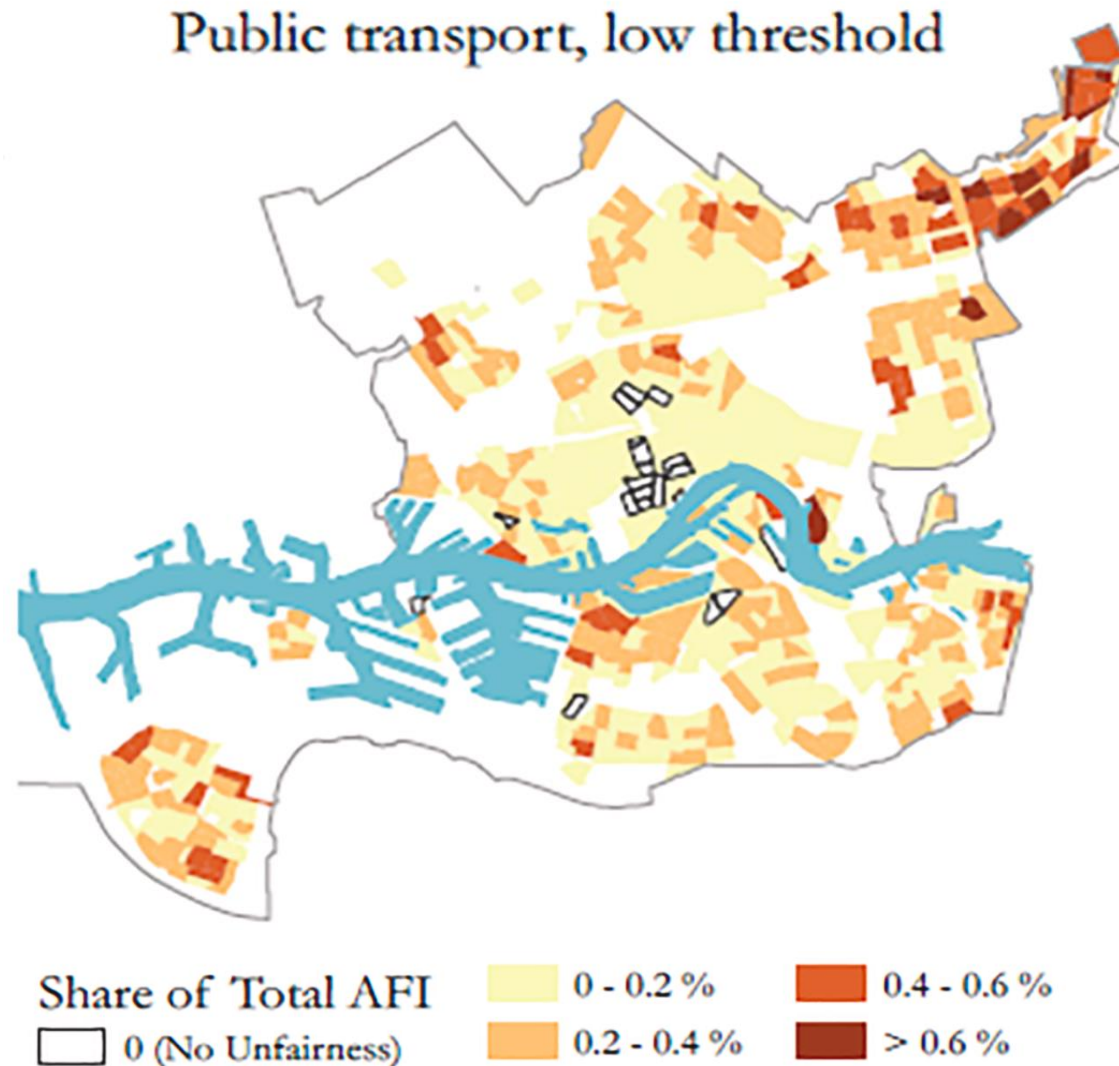
Martens (2017)

Accessibility · Incorporating Justice in Transport Evaluation



Martens (2017)

Accessibility · Incorporating Justice in Transport Evaluation



Martens (2017)

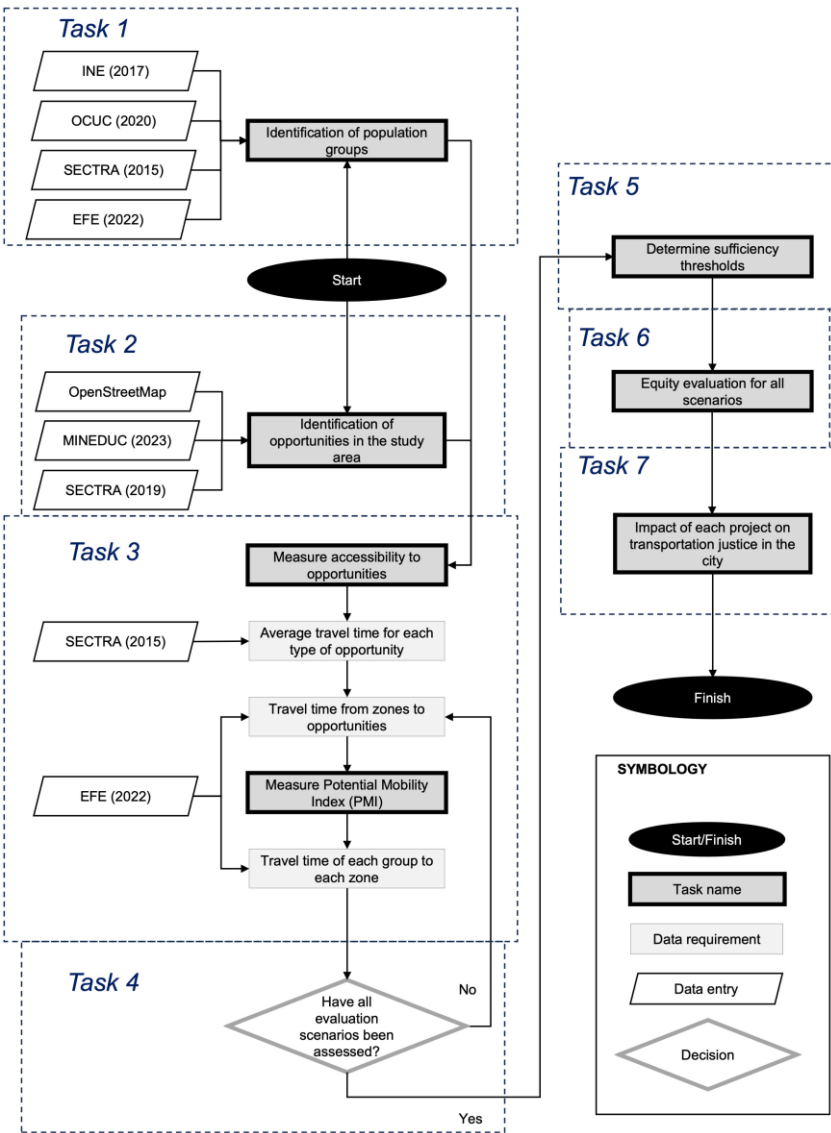
Accessibility · Incorporating Justice in Transport Evaluation

1. Identification of population groups

2. Identification of opportunities

3. Measuring accessibility and Potential of Mobility

4. Scenario evaluation



5. Sufficiency thresholds

6. Equity evaluation

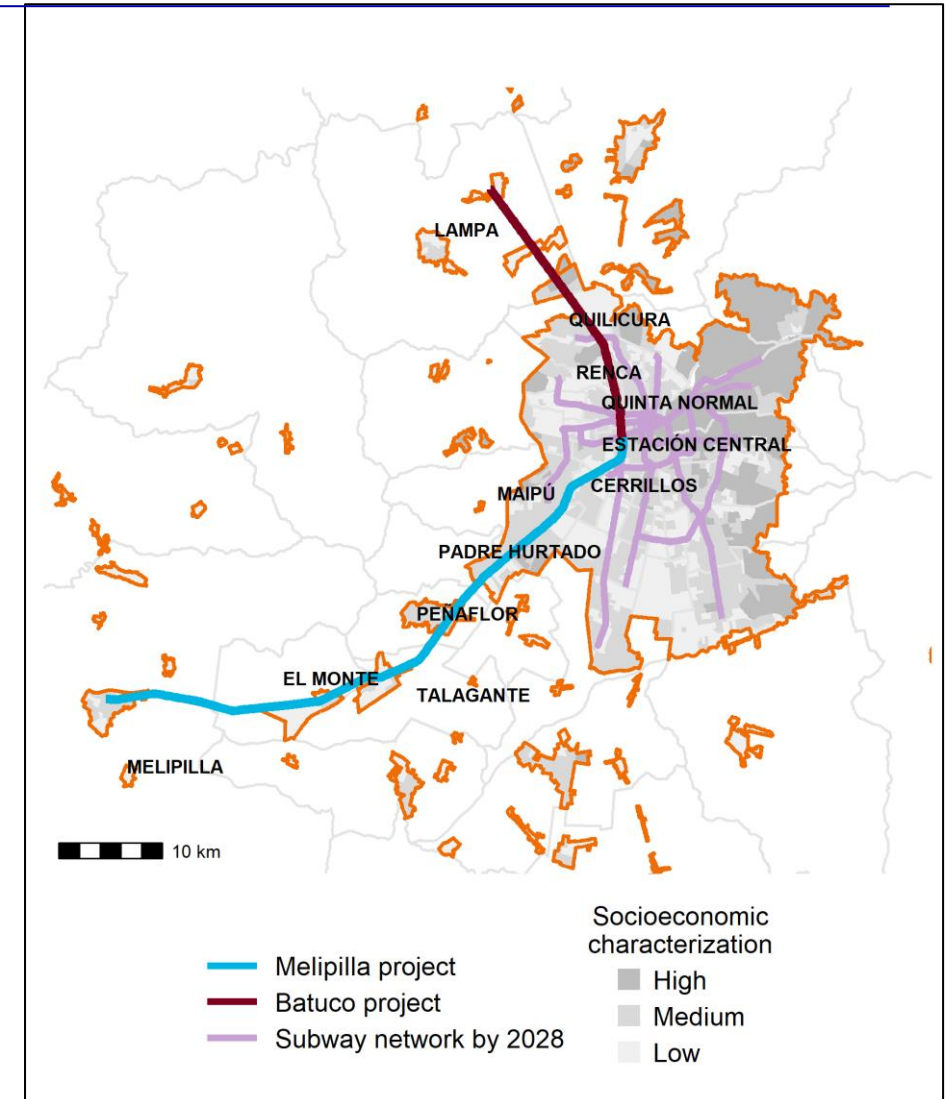
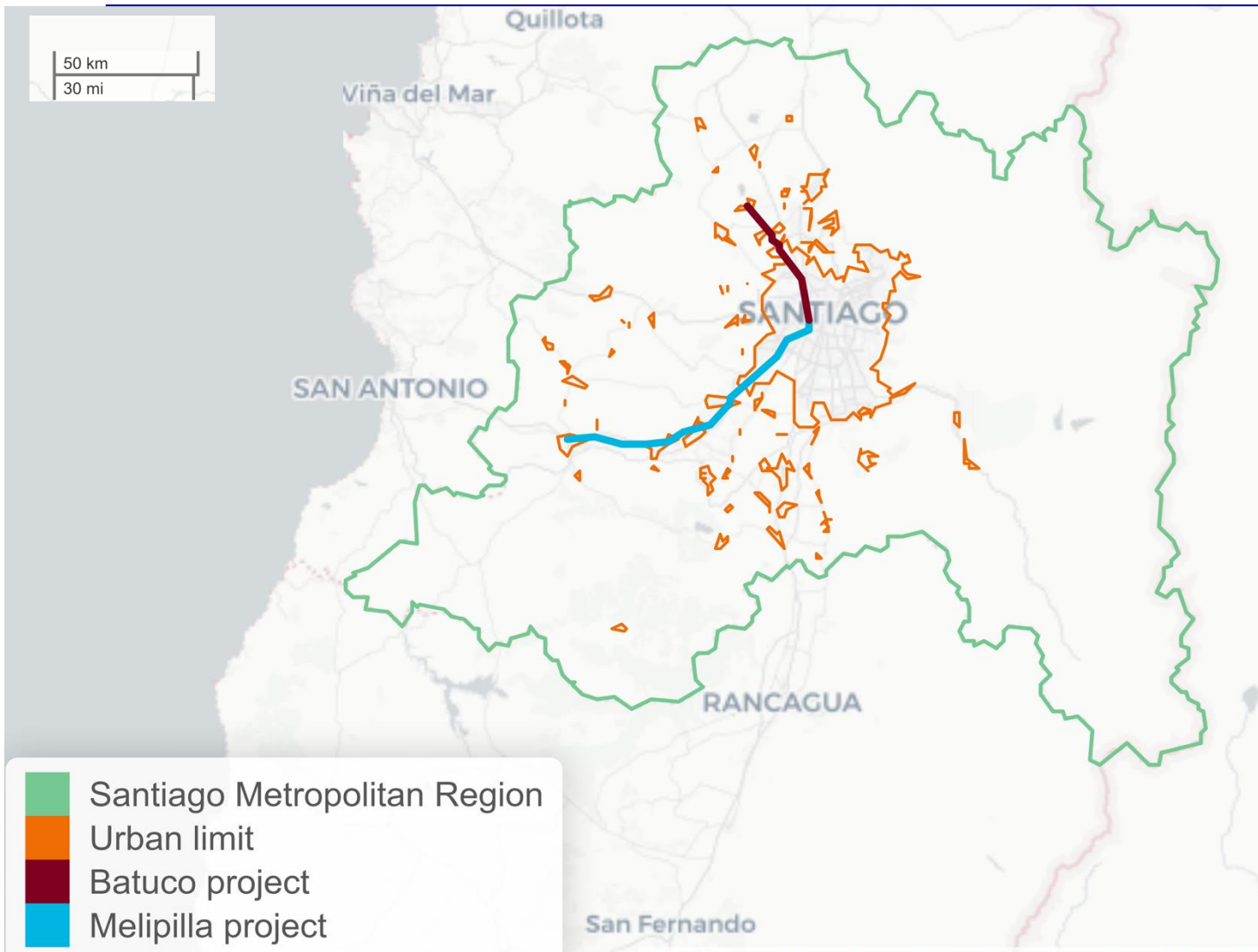
7. Impact on each zone



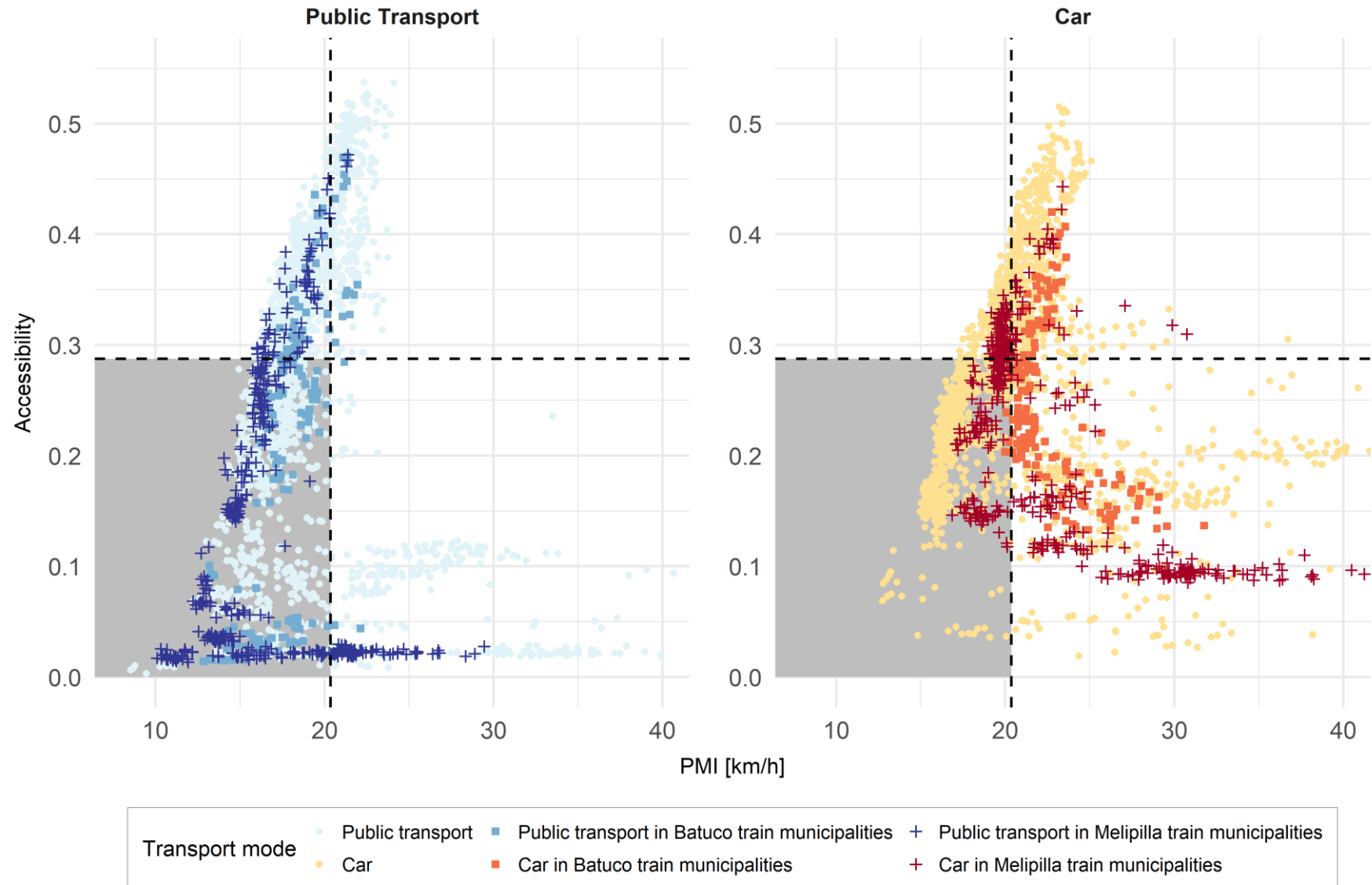
Accessibility • Incorporating Justice in Transport Evaluation

- **Step 1: Group Characterization**
 - Define disadvantaged groups based on sociodemographic, spatial, and transport vulnerability criteria — not just income. Includes gender, age, disability, and car availability.
- **Step 2: Opportunity Characterization**
 - Identify what people need to access: jobs, health, education, commerce. Use high-resolution spatial data (GIS) to map opportunity locations across the metropolitan area.
- **Steps 3 and following: Sufficiency Thresholds**
 - Apply justice principles (Martens 2017): define what constitutes an adequate level of access for each group. Compare pre/post project impacts at the group level.

Accessibility • Incorporating Justice in Transport Evaluation

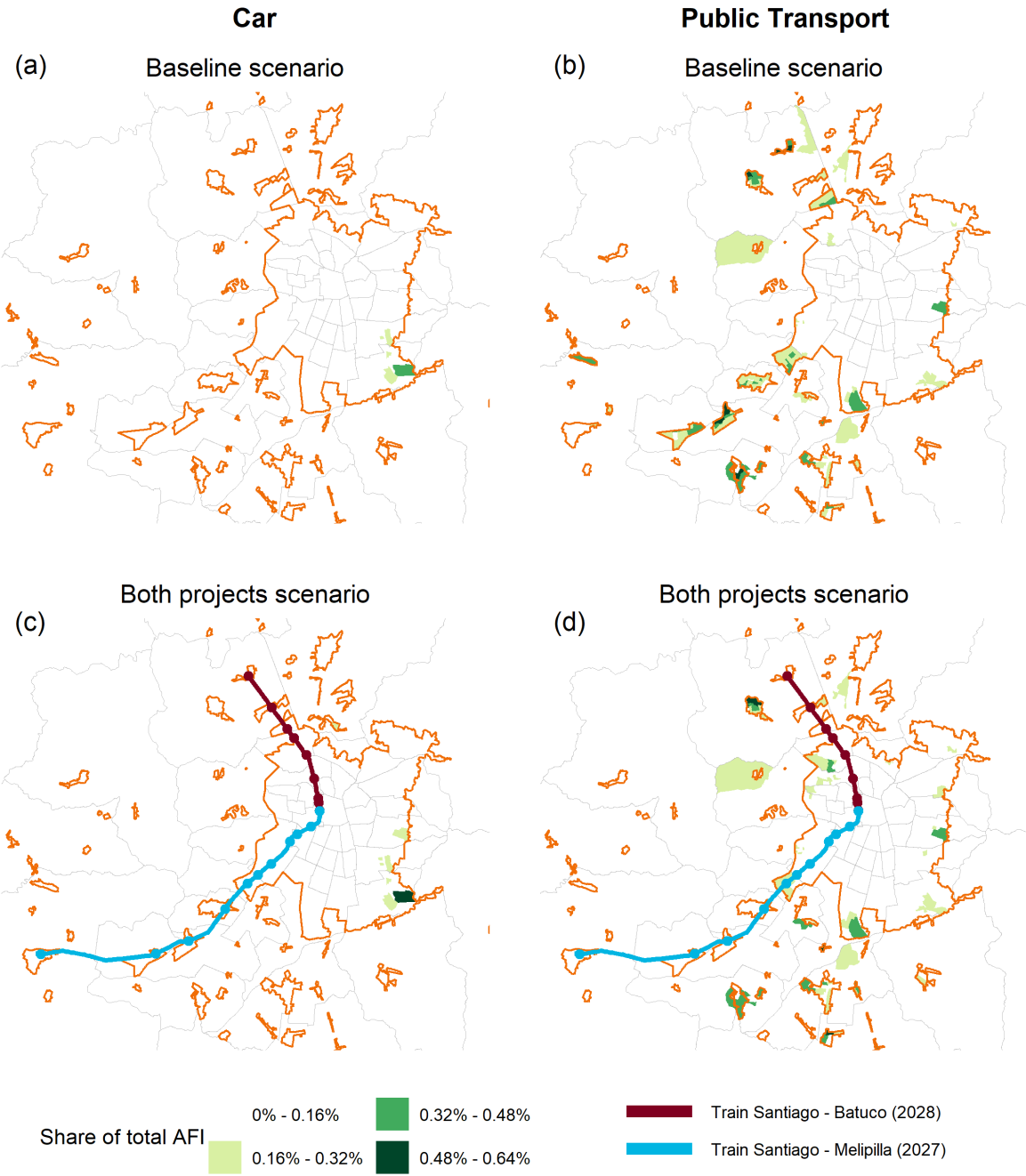


Accessibility · Case Study: Base case



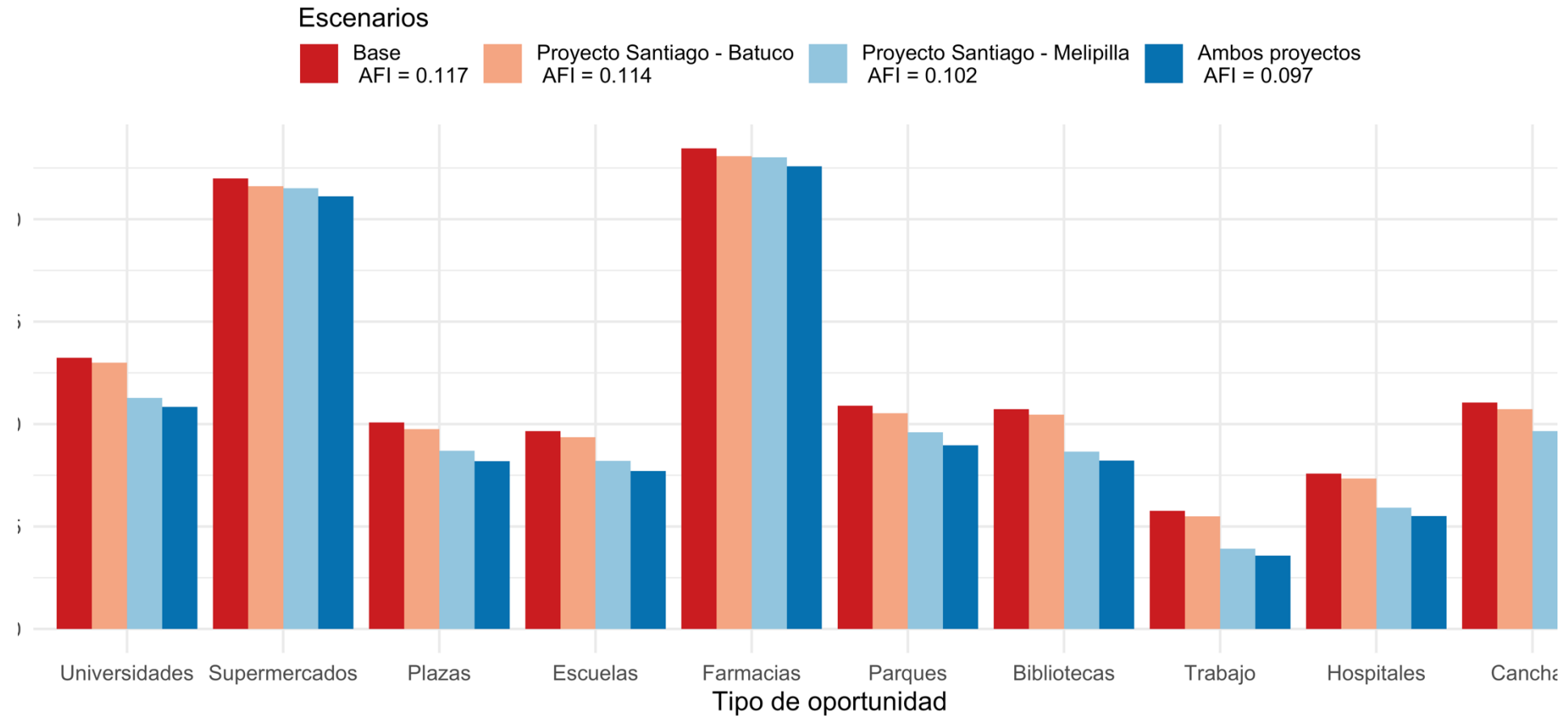
Accessibility • Case Study: Results

AFI that each group contributes to the global AFI by transport mode





Accessibility • Case Study: Results



Cost-effectiveness analysis:

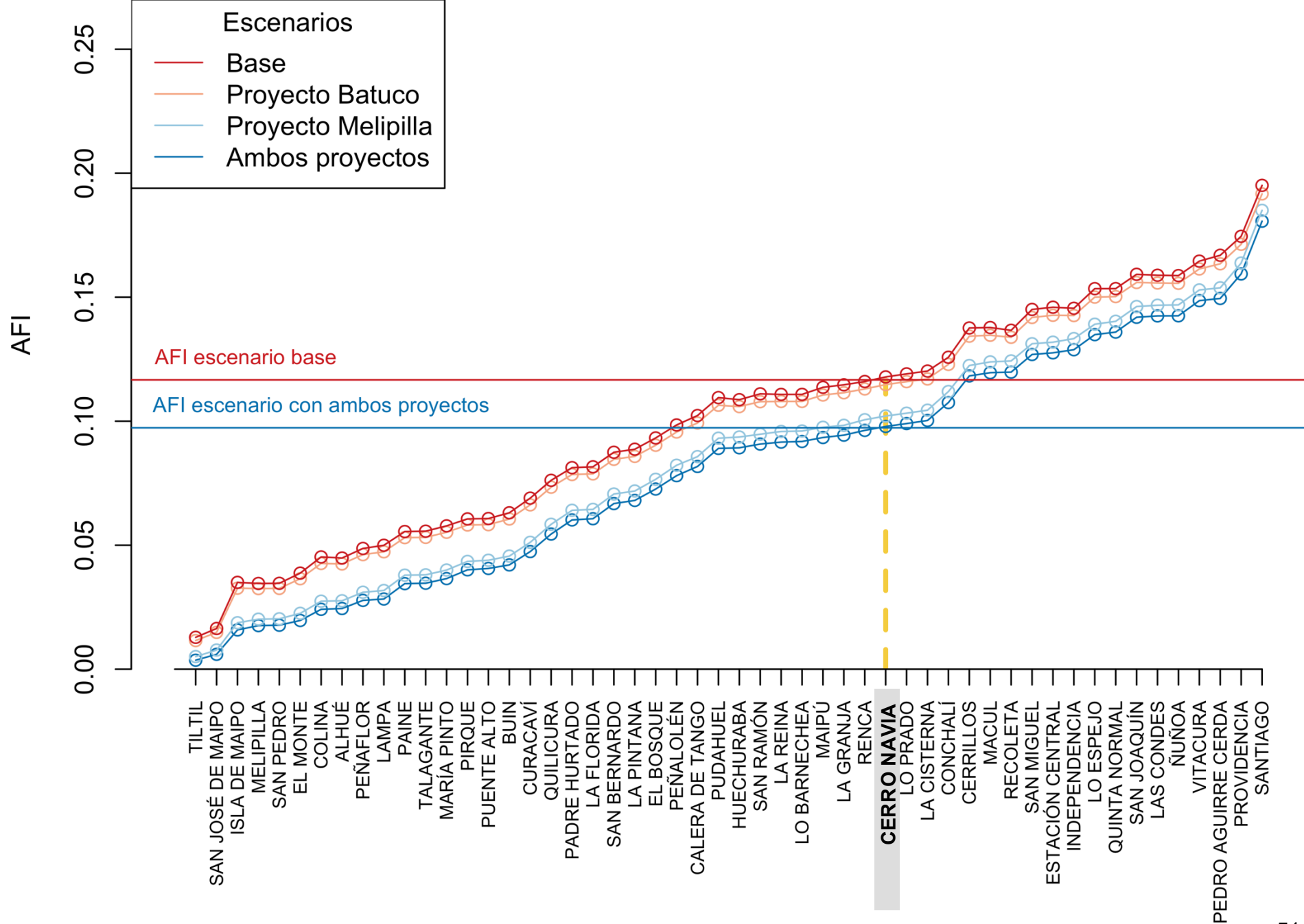
Santiago – Batuco: USD 2,225.37 millones/pb de AFI

Santiago – Melipilla: USD 962.79 millones/pb de AFI

Accessibility

Case Study:

Results





Accessibility • Case Study: Results

- Standard **cost-benefit** analysis overemphasizes benefits for higher-income commuters (time savings) while ignoring accessibility gains for car-less households near stations
- Justice-based accessibility measures reveal significant **variation by group**: peripheral, low-income, and car-less households benefit most, but are rarely the primary evaluation target
- **Sufficiency analysis**: a sizeable share of disadvantaged groups fall below adequacy thresholds even after project implementation — the project improves access but does not close the gap
- First documented application of Martens (2017) justice principles in a **specific project** railway evaluation in Chile — offering a replicable methodology for evaluators and planners



Synthesis: Transport Justice Across Life Domains

- **FOOD** Diet quality as a transport justice issue — who eats well depends on how, and whether, people can move to access healthy food.
- **CARE** Care mobility remains invisible in transport data analysis, yet central to daily life — and gendered inequalities in care translate directly into mobility inequalities.
- **ACCESSIBILITY** Transport investment evaluation to bring the case of justice-based accessibility to provide a tool to ensure infrastructure reduces, not widens, spatial inequalities.

Food, care, and spatial accessibility: Research methods, evidence, and public policies in Chile

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