SALUD URBANA EN AMÉRICA LATINA

Socioeconomic deprivation and changes in the retail food environment of Mexico from 2010 to 2020

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Retail food environment

- Type, availability and accesibility of food stores.[1]

- Driver of dietary patterns linked to obesity and cardionmetabolic diseases.[2,3]

- The dynamics and drivers of food retail food environment remain largely undestudied.

- **Food environment transformation**

– Associated with the North American Free Trade Agreement (NAFTA), urbanization and growth in per capita income.[4,5,6]

– Increase in unhealthy food stores in more deprived neighborhoods.

Does the change in food environment affects us equally?

1. Glanz et al., 2005; **2.** Caspi et al., 2012; **3.** Cobb et al., 2015; **4.** Schwentesius R et al,. 2002; **5.** Hawkes C., 2006; **6.** Reardon T et al., 2002

Does the change in food environment affects us equally?

Country	Neighborhoods	Results
US. Cross-sectional [1,2]	↓ SES	↑ Grocery stores, convenience stores, fast food restaurants ↓ Supermarkets
US. Cross-sectional [3]	↑ SES	↑ Supermarkets, convenience stores
US. Cross-sectional [4]	↓ SES	Supermarkets, lower healthy food availability
Brazil. Cross-sectional [5]	↓ SES ↑ SES	↑ Fast food restaurants ↑ Supermarkets, full-service restaurants
Mexico. Cross-sectional [6]	↓ SES	"Abarrotes" and "fruterías", lower healthy food availability
Spain. Longitudinal [7]	Increasing SES	↑ Supermarkets ↓ Specialized stores, fruit and vegetable stores

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1. Moore LV, et al. 2006; 2. Bower KM, et al. 2014; 3. Morland K, et al. 2002; 4. Franco M, et al. 2008; 5. Duran AC, et al. 2013; 6. Bridle-Fitzpatrick S, et al. 2010. 7. Bilal U, et al. 2018.

Knowledge gaps

- Unhealthy food environment is expanding.
  - Unequally distributed according socioeconomic position.

- Evidence on the association of food environment and socioeconomic position.
  - Most evidence are cross-sectional, conducted in developed countries, evaluates only a single type of food store.

- In Mexico.
  - No information about disparities in food environment change from the public health perspective.

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Aim

1. To analyze the change of food stores in municipalities of Mexico from 2010 to 2020, and to assess if trends are modified by area-level socioeconomic deprivation.

Hypothesis:

1. The number of food stores has increased in Mexico from 2010 to 2020.
2. Municipalities with higher socioeconomic deprivation will have a relatively steeper increase in the number of supermarkets, convenience stores and candies-ice cream stores, and a relatively steeper decline in the number of traditional food stores like fruit and vegetable stores, specialty stores and small food retail stores compared to those with lower socioeconomic deprivation.

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Design and measures

- **Study design:** Ecologic longitudinal design.
- **Unit of analysis:** Municipality-level (L2) – 2,454 municipalities.
- Analyses were stratified by whether the municipality belongs to a city, as defined in the SALURBAL study. Cities are agglomerations of administrative units that are covered by the urban extent of the city.
- **Outcome variables:** Number of food stores by type at municipality level. DENUE 2010, 2015 and 2020.
- **Exposure variable:** Time in years from baseline.
- **Effect modifier variable:** Area-level socioeconomic deprivation – 4 categories: very low, low, medium, and high-very high deprivation (marginality index from 2010). CONAPO data.
- **Other Covariates:** Total population from 2010, 2015 and 2020. National Census data; Total per capita income from 2010 and 2015. The United Nations Development Program (UNDP) data.
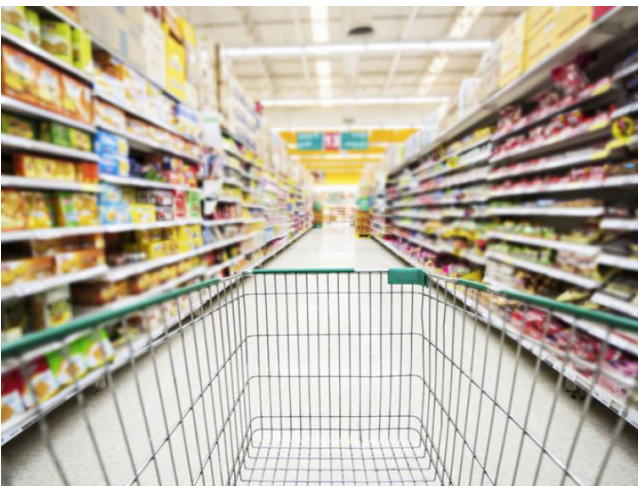
Seed and grain stores;
Specialty food stores;
Fruit and vegetable stores

Candies and ice cream stores;
Small food retail stores;
Convenience stores (searched by name: OXXO, 7-Eleven, Circle K, among others)

7 types based on NAICS codes, product assortment and prior studies

Supermarkets

Data analysis

Descriptive analysis

Area-level sociodemographic characteristics of the municipalities and food stores at baseline and for each year of follow-up.

Inferential analysis

1. To study the change of number of food stores from 2010 to 2020.

Seven separate fixed-effects Poisson regression models

Outcome: # of each food store type, with an offset with the log of the total population.

* Time was centered in 2010, and re-scaled to represent 10-year increments.

* Analyses stratified by urbanization (SALURBAL cities)

$$\log(\#food\ stores_{it}) = \beta_1 * Time_{it} + \beta_2 * Income_{it} + \log(Total\ Population_{it}) + \alpha_i$$

Data analysis

2. To test whether trends vary by area-level socioeconomic deprivation.
Seven separate fixed-effects Poisson regression models
* Interaction term (time *deprivation) to evaluate modifying effect of socioeconomic deprivation in change of food stores.
* Time was centered in 2010, and re-scaled to represent 10-year increments.
* Analyses stratified by urbanization (SALURBAL cities).

$$\log(\#food\ stores_{it})$$
$$= \beta_1 * Time_{it} + \beta_2 * \boldsymbol{Deprivation_i} + \beta_3(Time_{it} * \boldsymbol{Deprivation_i}) + \beta_4$$
$$* Income_{it} + \log(Total\ Population_{it}) + \alpha_i$$

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RESULTS

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Table 1. Municipality-level characteristics by year (2010, 2015, 2020) and urbanization: the National Statistical Directory of Economic Units (DENUE).

	Year		
	2010	**2015**	**2020**
Non-urban areas*	***n=2048***	***n=2048***	***n=2048***
Population density (residents/km^2), [median (p25,p75)]	39 (15, 88)	40 (15, 91)	41 (15, 94)
Per capita income (USD), [median (p25,p75)]	1315 (872, 1800)	1630 (1097, 2174)	1630 (1097, 2174)
Socioeconomic deprivation, [%]			
Very low		3.5	
Low		12.7	
Medium		42.6	
High and very high		41.1	
Urban areas*	***n=406***	***n=406***	***n=406***
Population density (residents/km^2), [median (p25,p75)]	425 (169, 1161)	459 (192, 1299)	503 (204, 1425)
Per capita income (USD), [median (p25,p75)]	2546 (2062, 3169)	2825 (2353, 3587)	2825 (2353, 3587)
Socioeconomic deprivation, [%]			
Very low		46.8	
Low		34.2	
Medium		17.5	
High and very high		1.5	

* Urbanization is defined by the population in 2010: urban areas are municipalities that belong to a city with more than 100,000 residents, while non-urban areas refer to all other municipalities (see Methods section).

p25 = 25th percentile, p75 = 75th percentile.

Figure 1. Percentage of food store types in municipalities by year (2010, 2015, 2020) and urbanization: the National Statistical Directory of Economic Units (DENUE).
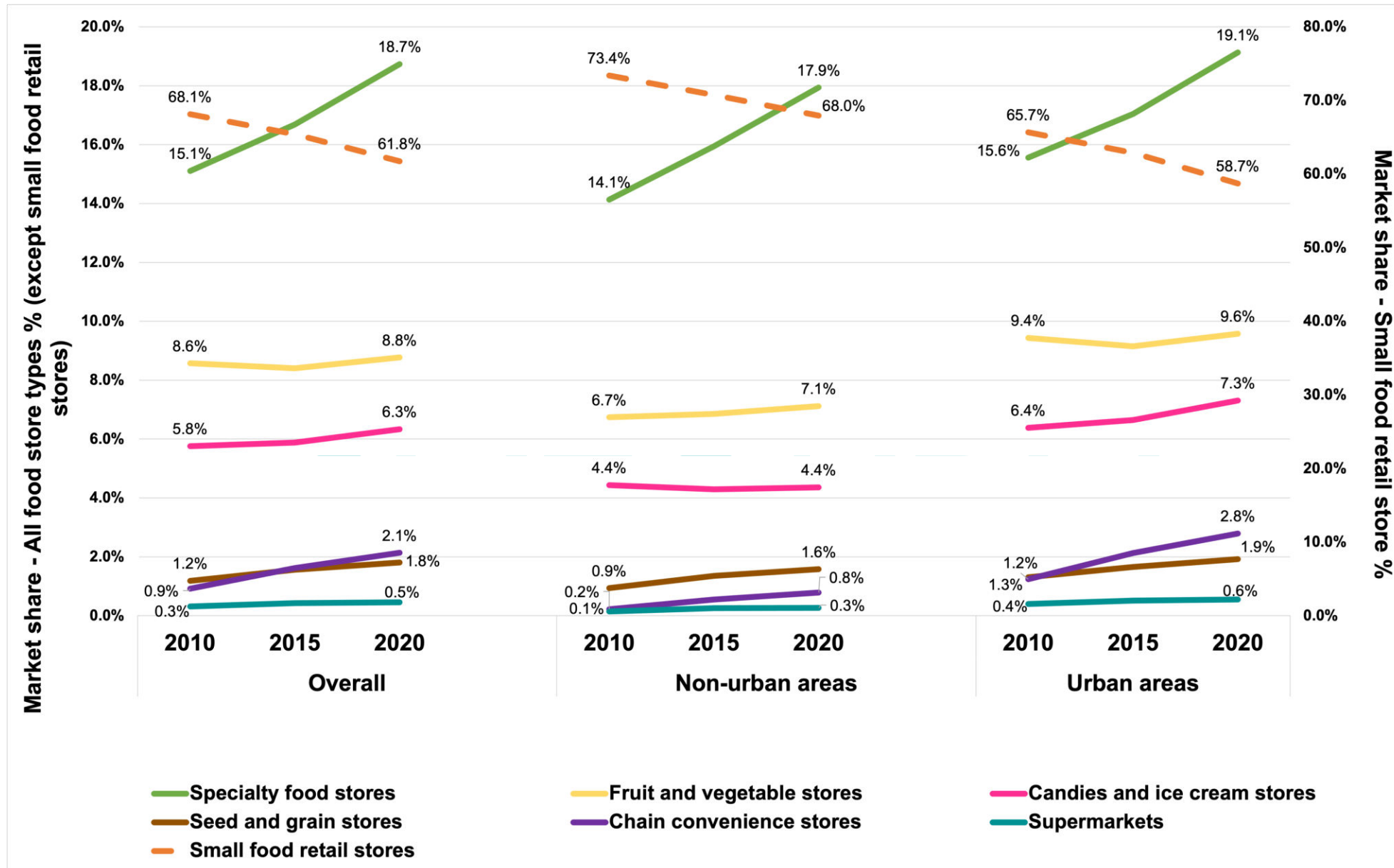
Table 2. Adjusted rate ratio of per capita change in food stores per 10-year increase, stratified by urbanization: the National Statistical Directory of Economic Units (DENUE), 2010-2020.

Food store type[1]	Overall Time trend (+10 years) IRR (95% CI)	Non-urban areas* Time trend (+10 years) IRR (95% CI)	Urban areas* Time trend (+10 years) IRR (95% CI)
Small food retail stores	0.91 (0.90, 0.93)	0.98 (0.96, 1.00)	0.87 (0.85, 0.89)
Specialty food stores	1.25 (1.23, 1.27)	1.33 (1.30, 1.36)	1.21 (1.18, 1.23)
Fruit and vegetable stores	1.04 (1.01, 1.08)	1.10 (1.05, 1.16)	1.02 (0.98, 1.06)
Candies and ice cream stores	1.10 (1.05, 1.16)	1.04 (1.00, 1.08)	1.12 (1.06, 1.19)
Seed and grain stores	1.50 (1.44, 1.56)	1.61 (1.49, 1.75)	1.44 (1.38, 1.50)
Chain convenience stores	2.14 (2.01, 2.28)	2.91 (2.68, 3.16)	2.04 (1.90, 2.18)
Supermarkets	1.32 (1.26, 1.38)	1.62 (1.46, 1.79)	1.25 (1.19, 1.31)

[1] Seven fixed-effects Poisson regression models adjusted for per capita income, each outcome (food store type) included an offset with the log of the total population.

* Urbanization is defined by the population in 2010: urban areas are municipalities that belong to a city with more than 100,000 residents, while non-urban areas refer to all other municipalities (see Methods section).

IRR = Incidence rate ratios, 95% CI = 95% Confidence interval.

Figure 2. Adjusted rate ratios of food stores per capita per 10-year increase, by socioeconomic deprivation: the National Statistical Directory of Economic Units (DENUE).
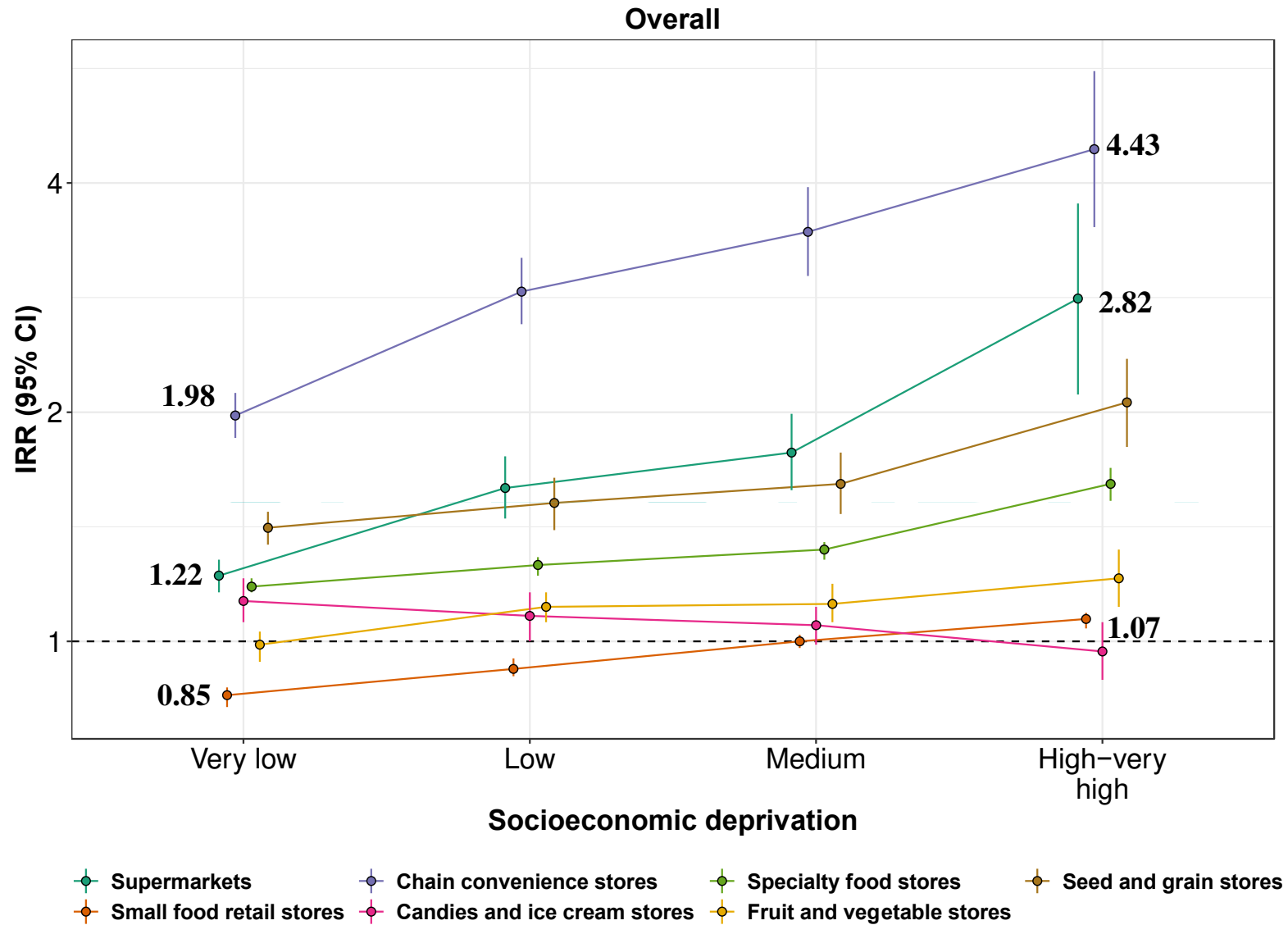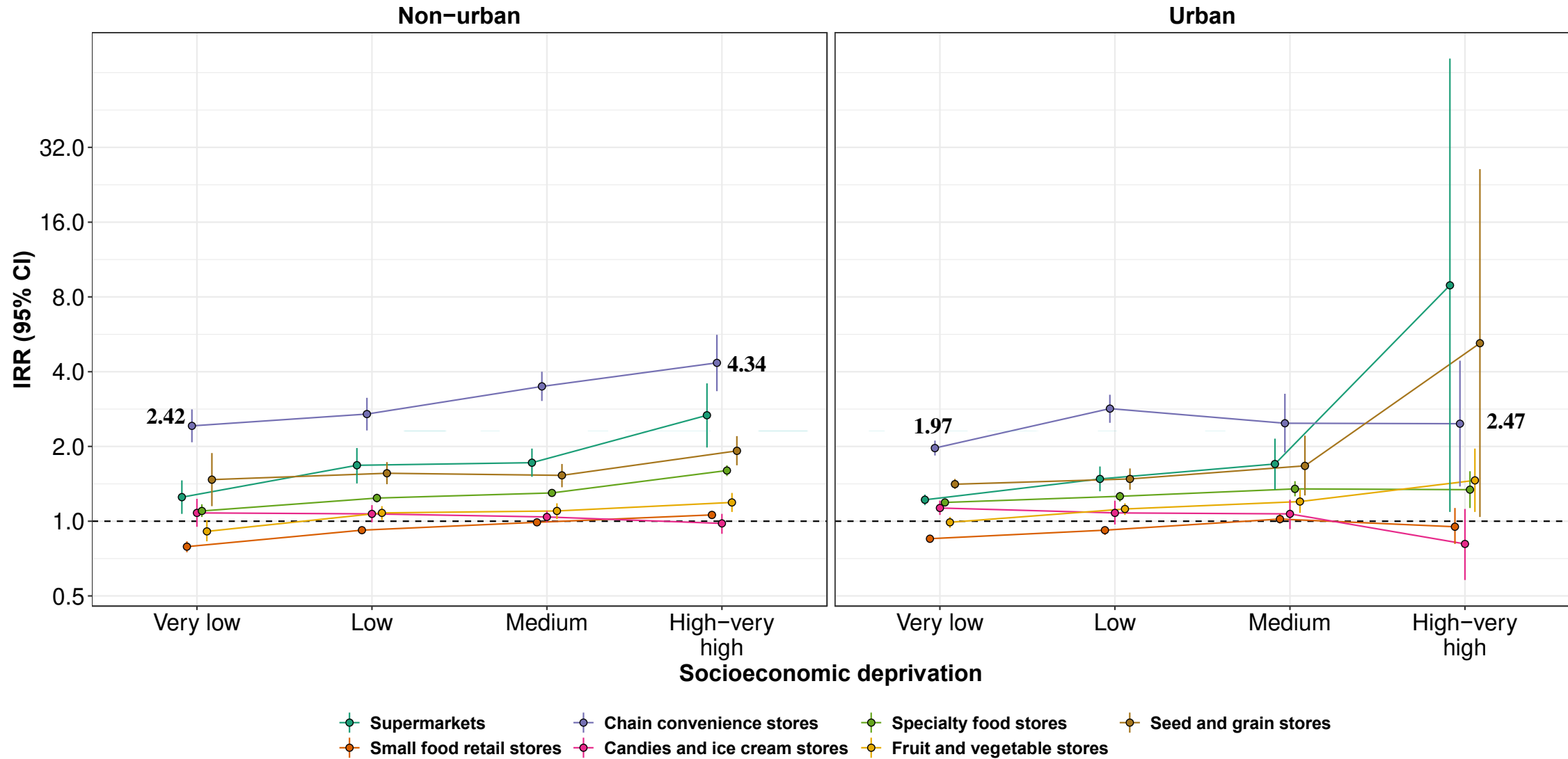
Figure 3. Adjusted rate ratios of food stores per capita per 10-year increase, by socioeconomic deprivation and urbanicity: the National Statistical Directory of Economic Units (DENUE). the National Statistical Directory of Economic Units (DENUE).

Conclusions

There was an increase in the total number of almost all food stores in ten years, and a decline of the small food retail stores.

Small/local food stores represents almost the 83% of food stores evaluated in Mexico, but convenience stores showed the highest increase, followed by the supermarkets.

Chain convenience stores and supermarkets, but also those food stores that mostly sell unprocessed food showed a steeper increasing trend in areas with higher deprivation and less urbanized.

Small food retail decreased in the least disadvantage municipalities and increased in the most disadvantaged areas.

The steepest increases in stores selling unhealthier foods have been concentrated in poorer areas, creating an unhealthy food environment for a population that already has the highest rates of obesity.

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- SALURBAL team.

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Thank you.
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