



Adaptation and Pilot of the Nutrition Environment Measurement Tool for Stores (NEMS-S) in Central and Western Cuba

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**Scholarly Report submitted in partial fulfillment of the MD Degree at
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Student Name: Anna Ruman

Scholarly Report Title: Adaptation and Pilot of the Nutrition Environment Measurement Tool for Stores (NEMS-S) in Central and Western Cuba

Mentor Name(s) and Affiliations:

- Dr. Paul E. Farmer, MD, PhD
Department of Global Health and Social Medicine, Harvard Medical School
Division of Global Health Equity, Brigham and Women's Hospital

- MSc. María del Carmen González Rivero
Biblioteca Médica Nacional, Havana, Cuba

Collaborators, with Affiliations:

- Dr. Karen Glanz, PhD, MPH
Center for Health Behavior Research, University of Pennsylvania

Abstract:

TITLE: Adaptation and Pilot of the Nutrition Environment Measurement Tool for Stores (NEMS-S) in Central and Western Cuba

Anna M. Ruman, Paul E. Farmer, María del Carmen González Rivero

Purpose: Cuba has experienced rapidly increasing obesity rates over the last fifteen years. Among other factors, consumer nutrition environments – defined by the availability, price, and quality of healthy foods – predict individuals’ food choice and population-level obesity prevalence. However, data describing Cuba’s nutrition environment remain scarce. Furthermore, existing assessment instruments, such as Glanz, et al.’s Nutrition Environment Measures Survey for Stores (NEMS-S), have not been validated in the Cuban context. Consequently, our project aimed to modify NEMS-S for use in Cuba and pilot the adapted instrument in geographically distinct Cuban communities.

Methods: We first modified NEMS-S to incorporate typical healthy and unhealthy Cuban foods; key informant interviews strongly influenced this process. Next, we utilized housing quality and population density data to identify two 1 km squared survey tracts, one each in the cities of Havana and Cienfuegos. Rather than pilot the adapted NEMS-S in peri-urban and rural Cuba, we deviated from our initial project plan; controlled for urban location, population density, and socioeconomic status; and varied by region to account for regional dietary variation. We piloted the adapted NEMS-S in a total of 40 food retail outlets (21 in Havana, 19 in Cienfuegos) classified into five distinct categories, collecting data on indicator food availability, price, and quality.

Results: Our data analysis included descriptive statistics for both composite and non-composite food availability, price, and quality for the 10 indicator food categories, five types of food retail outlets, and two regions. We also utilized geomapping techniques to map distribution and type of food outlets within the two survey tracts to assess the viability of mapping community nutrition environments in limited resource settings. Lastly, we leveraged qualitative analysis techniques to assess how effectively the adapted NEMS-S captures: A) availability, price, and quality of healthy and unhealthy Cuban foods; and B) the uniqueness of Cuba’s socialist food system and food pricing structure.

Conclusions: Our survey did not demonstrate variation in composite nutrition environment quality scores between Central and Western Cuban cities; however, our analysis revealed substantial variation in

nutrition environment quality scores and healthy food availability by type of food outlet. Project findings will impart improved understanding of factors influencing obesity prevalence in Cuba; suggest public health policy implications, both for Cuba and other countries; provide baseline data describing the Cuban nutrition environment before trade liberalization with the United States; and offer insight into how to best modify nutrition environment assessments for developing country settings.

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➤ Section 1: Introduction

Overview

Cuba has experienced rapidly increasing obesity rates over the last fifteen years. Among other factors, nutrition environments – settings where people procure food, such as supermarkets – predict individuals’ food choices and population-level obesity prevalence. However, data describing Cuba’s nutrition environment remain scarce. Furthermore, existing nutrition environment assessment instruments, such as Glanz, et al.’s Nutrition Environment Measures Survey for Stores (NEMS-S), have not been validated in the Cuban context. Consequently, this project will modify the NEMS-S instrument for use in Cuba and pilot the adapted instrument in geographically distinct Cuban community areas. Project findings will impart improved understanding of factors influencing obesity prevalence in Cuba; suggest public health policy implications, both for Cuba and other countries; provide baseline data describing the Cuban nutrition environment before trade liberalization with the United States; and offer insight into how to best modify nutrition environment assessments for developing country settings.

Aims

- (1) Adapt the Glanz, et al. *Nutrition Environment Measures Survey for Stores (NEMS-S)* consumer nutrition environment assessment instrument for use in Cuba.
- (2) Pilot the adapted NEMS-S instrument in two geographically distinct Cuban census tracts.

Background

The nutrition transition paradigm describes widespread shifts in diet – typically towards a dietary pattern high in saturated fat, sugar, and refined foods and low in fiber – that provoke nutritional outcomes such as increased obesity prevalence.¹ This model includes five dietary patterns associated with a society’s level of economic development, demographic characteristics, and epidemiological phase. Cuba’s improved prosperity over the last fifteen years has co-occurred with the Pattern Four diet: rich in fat, meat, and sweeteners and poor in carbohydrates and fiber, resulting in increasing obesity prevalence.^{2,3} A 1998 study in Havana indicated that female obesity prevalence increased by 64% from 1993 to 1998, and male obesity prevalence increased by 161% during the same time period.⁴ The 2000-2001 national risk factor and chronic disease survey (ENFRENT II) revealed that adult obesity prevalence had reached 11.8%, with obesity prevalence twice as high in women (15.4%) as in men (7.9%).⁵ By 2008, countrywide adult obesity prevalence had reached 21.5%.⁶

Among other factors, food environments – defined as “settings where people procure food, such as workplaces, schools, restaurants and supermarkets” – have been shown to predict individuals’ food

choice, and by extension, population-level obesity prevalence.⁷ Food environment assessment includes evaluation of the following constructs: i) access to, pricing, and quality of healthy versus unhealthy foods; (ii) advertising; (iii) density of fast food restaurants and other stores; (iv) non-traditional food stores; (v) nutrition information or labeling at the point-of-purchase; (vi) portion size; and (vii) pricing in vending machines.⁸ These measures of local food environments are typically grouped into three categories comprising (i) the community nutrition environment, including the number, type, location and accessibility of food outlets that are available to the general population; (ii) the organizational nutrition environment, relating to food outlets within settings, such as schools and workplaces; and (iii) the consumer nutrition environment, including the availability, cost, and quality of food and beverage products.⁹

The Cuban consumer nutrition environment differs substantially from that of the United States and includes a complex blend of state and non-state food distribution. The *State-Run Rationing Program* allocates food via two types of stores (bodegas and placitas), and each person holds a booklet valid at their local ration store.¹⁰ Two types of state-run, non-rationing food retail outlets (*Cuban Peso Tiendas* and *Cuban Convertible Peso Tiendas*) supplement food products not available via the rationing program.¹¹ In addition, formal and informal non-state sector mechanisms provide alternative food sources for Cuban communities. At *Free Agricultural Markets* (mercados agropecuarios), farmers sell surplus product not required for sale to the state. *State Markets* (puntos de venta) represent another variety of farmers' market with fixed, low prices and a limited variety of products.^{12 13} Many Cubans also participate in an Informal Economy comprised of *Community-run Gardens* (parcelas), the underground market, and the black market.¹⁴

Researchers conduct consumer nutrition environment assessment using observational tools such as Glanz, et al.'s Nutrition Environment Measures Survey for Stores (NEMS-S), which measures the availability, cost, and quality of indicator food and beverage products in retail food outlets.¹⁵ While developing NEMS-S, Glanz, et al. also extensively tested the instrument's inter-rater and test-retest reliability and examined sampling and generalizability issues.¹⁶ Since completing reliability and validity testing in 2007, the NEMS-S survey instrument has been utilized for over 100 publications in peer-reviewed journals and adapted for use in diverse communities in the United States and abroad.

Importance

Data describing Cuba's consumer nutrition environment remain scarce, and a food environment assessment instrument validated in the Cuban context does not seem to exist. However, the Cuban government and public health system have taken a decisively proactive approach to mitigating the country's obesity epidemic. Cuba's recently released "Comprehensive Plan for the Prevention and

Control of Overweight and Obesity” seeks to identify factors contributing to rising obesity rates and develop a protocol for the prevention, diagnosis, and treatment of obesity at the level of the National Health System. The Plan also emphasizes the importance of optimizing access to healthy food and includes suggestions for modifying Cuba’s food system to help mitigate the obesity crisis.¹⁷ My adaptation and pilot of the NEMS-S instrument in Cuba will offer concrete data about the Cuban food system that could provide valuable insight into factors influencing rising obesity prevalence in Cuba and inform private and public responses to an acknowledged public health concern, both in Cuba and elsewhere. Just as the Cuban healthcare system exemplifies a uniquely successful optimization of health outcomes given limited resources, the Cuban public health response to rising obesity rates will likely serve as a model for the rest of the world. It also remains critical to undertake this research very soon. A NEMS-S instrument calibrated to the Cuban food system will provide baseline data on the Cuban food environment before trade liberalization with the United States, which will almost certainly occur within the next few years.

Innovation

Modifying and implementing the NEMS-S instrument for the Cuban consumer nutrition environment represents an innovation in two ways. First, the adaptation and pilot of existing nutrition environment assessment instruments for use in a socialist food system represents an advancement of the field. Although the NEMS-S instrument has demonstrated widespread feasibility in urban, peri-urban, and rural communities in the United States and developing countries, the survey has not been adapted to reflect alternative economic models. Previous modifications of the NEMS-S tool for capitalist Latin American contexts include a 2013 study by Duran, et al. in Brazil and an ongoing collaboration between the Institute of Nutrition of Central America and Panama (INCAP) and the Center for Studies on Sensory Impairment, Aging, and Metabolism (CeSSIAM) in Guatemala. However, these studies espouse different methodologies for modifying the NEMS-S tool – one study modified the NEMS-S tool before piloting, and the other piloted the original tool without modification -, and neither study set a precedent for how to record food prices in an atypical market.^{18 19} Not only does fulfilling my specific aims have the potential to provide invaluable nutrition environment insight to Cuban policymakers, but the process through which I adapt and pilot the instrument will also inform future modifications for alternative economic system milieus.

Second, the Cuban food environment has changed and will continue to change rapidly as the United States trade embargo weakens. With the exception of North Korea, Cuba remains the most economically isolated country from the United States, and the Cuban food system has remained similarly protected from US influence. Analysis of Cuba’s current consumer nutrition environment will provide

context for baseline comparison once US products become available. Ultimately, the availability of baseline data could offer a unique case study of how changing trade relationships with the United States impact consumer nutrition environments over time.

➤ **Section 2: Student role**

Anna Ruman, a student at Harvard Medical School, developed the initial project idea and secured appropriate mentorship to support her research goals. In conjunction with collaborators and key informants, Anna selected and modified the Nutrition Environment Measures Study: Store Measures (NEMS-S) instrument. She also functioned as the sole administrator and scorer for the pilot of the adapted NEMS-S instrument. Lastly, she took responsibility for analyzing project outcomes and, with mentorship, recommended future research directions.

➤ **Section 3: Methods**

We modified and piloted the Nutrition Environment Measures Study: Store Measures (NEMS-S) survey instrument and protocol for the Cuban consumer nutrition environment using the following methodology. The original NEMS-S instrument, enumeration procedures, administration protocol, and scoring system are included in Appendices 1-4.²⁰

I. Survey instrument modification

The NEMS-S instrument assesses availability, cost, and quality of A) foods recommended for healthful eating (“healthy foods”) and B) foods contributing the most calories to the American diet (“unhealthy foods”). The 10 indicator food categories include: fruit, vegetables, milk, ground beef, hot dogs, frozen dinners, baked goods, beverages, whole grain bread, and baked chips. We first modified NEMS-S to incorporate typical healthy and unhealthy Cuban foods; key informant interviews and collaboration with the NEMS-S tool creators (Glanz, et al.) influenced this process. Anna also completed a 30-hour NEMS-S administration and modification training in April 2014; all survey instrument alteration followed published NEMS-S modification guidelines.

II. Neighborhood selection

Our initial neighborhood selection process intended to pilot our modified survey in urban, peri-urban, and rural Cuban communities utilizing the published NEMS-S Enumeration Procedures. However, we deviated from our initial project plan; controlled for urban location, population density, and socioeconomic status; and varied by region to account for regional dietary variation. We utilized

neighborhood-level housing quality and population density data from the 2010 Cuban census to identify two 1 km squared survey tracts, one each in the cities of Havana (Western Cuba) and Cienfuegos (Central Cuba), in which to assess the consumer nutrition environment. Each tract included at least 15 retail food outlets to ensure sufficient variability for the measurement study.

III. Identification and classification of stores

We piloted the adapted NEMS-S in a total of 40 food retail outlets (21 in Havana, 19 in Cienfuegos) classified into five categories:

1. State-Run Rationing Outlets – *bodegas*
2. Cuban Peso Tiendas – *tiendas moneda nacional*
3. Cuban Convertible Peso Tiendas – *tiendas CUC*
4. Free Agricultural Market – *agropecuarios*
5. State Market – *puntos de venta*

IV. Tools and procedures

In addition to providing a data collection framework, the NEMS-S instrument includes a scoring system that translates indicator food availability, price, and quality into an overall Nutrition Environment Quality Score for a given store. For example, availability scores assign two points per indicator for the availability of healthier options, and an extra point for more varieties. Price scores assign two points for a lower-priced, healthier option and -1 point for a higher-priced, healthier option. The rater assigns three additional points for the presence of acceptable quality produce. The total Nutrition Environment Quality Score ranges from -8 to 50. Detailed administration procedure is available in the Appendix.²¹ We collected data on indicator food availability, price, and quality for the 40 outlets included in the study.

➤ Section 4: Results

We first modified the NEMS-S survey instrument for the Cuban context (see Figure 1) and collected data as discussed in our Methods section. Our data analysis included descriptive statistics for both composite and non-composite food availability, price, and quality for the 10 indicator food categories, five types of food retail outlets, and two cities. We also utilized geomapping techniques to map distribution and type of food outlets within the two survey tracts to assess the viability of mapping community nutrition environments in limited resource settings. Lastly, we leveraged qualitative analysis techniques to assess how effectively the adapted NEMS-S captures: A) availability, price, and quality of healthy and unhealthy Cuban foods; and B) the uniqueness of Cuba's socialist food system and food pricing structure.

Figure 1: NEMS-S adapted for Cuban food context – note modified indicator food categories.

Outlet Type:	Outlet Address:	Outlet ID:		
<p>Nutrition Environment Measures Survey (NEMS) Store Measures for Cuba: Variables to be Derived</p>				
A.	Fruits ¹	# varieties	quality	price range
B.	Non-starchy vegetables ²	# varieties	quality	price range
C.	Roots/tubers (viandas) ³	# varieties	quality	price range
D.	Fresh Meat, Fish, and Eggs			
	• Beef	availability	-	price
	• Chicken	availability	-	price
	• Eggs	availability	-	price
	• Fish	availability	-	price
	• Pork	availability	-	price
E.	Milk			
	• Skim/1%	availability	-	price
	• 2%/whole	availability	-	price
F.	Bread			
	• Whole wheat bread	availability	-	price
	• White bread	availability	-	price
G.	Rice			
	• White rice	availability	-	price
	• Brown rice	availability	-	price
H.	Beans	# varieties	-	price
I.	Processed meats			
	• Ground meat (picadillo)			
	o Beef regular	availability	-	price
	o Beef light	availability	-	price
	o Turkey	availability	-	price
	• Chorizo	availability	-	price
J.	Beverages			
	• Juice			
	o 100% juice	availability	-	price
	o Juice drinks	availability	-	price
	• Soda			
	o Diet (0 kCal)	availability	-	price
	o Regular	availability	-	price

¹ Indicator fruits: Banana, Mango, Orange, Pineapple, Watermelon, Guava, Mamey, Papaya, Grapefruit, Apple
² Indicator vegetables: Tomato, Cucumber, Lettuce (not iceberg), Cabbage, Beet, Pumpkin, Bell pepper, Carrot, Green Beans, Spinach
³ Indicator viandas: Cassava (Yuca), Sweet Potato, Taro (Malanga), Yam (Boniato)

Figure 2: Survey pilot locations in Central Cuba (Cienfuegos) and Western Cuba (Havana).

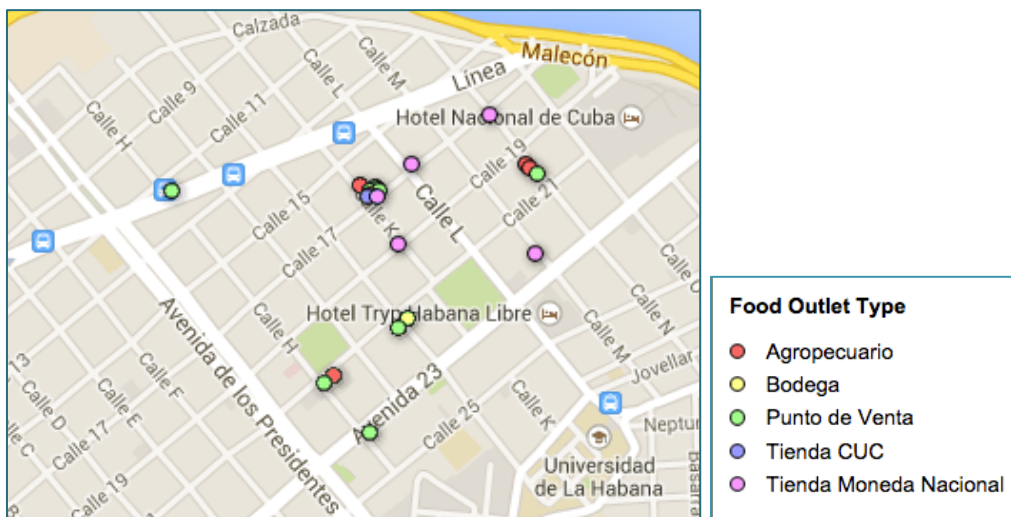


Figure 3: Havana survey area (Vedado neighborhood: Avenida de los Presidentes to Calle N, Avenida 23 to Linea) with food outlets marked. We converted street addresses obtained via walking survey to geographic coordinates and mapped using Google Fusion Tables.

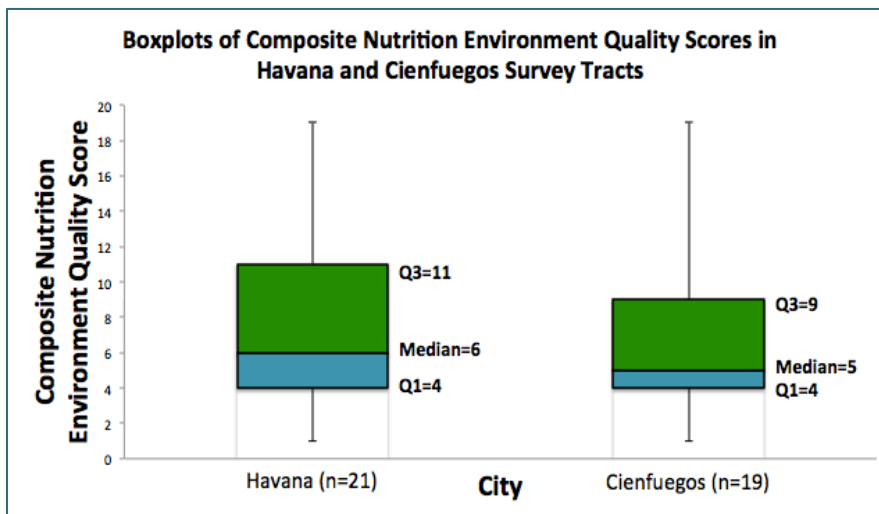


Figure 4: Boxplots of comparative statistics for composite Nutrition Environment Quality Scores for surveyed food outlets in Havana versus Cienfuegos. A higher score indicates better food availability, price, and quality.

Figure 5: Median composite nutrition environment quality scores and indicator food availability for the five types of food outlets.

	Agropecuario (n=3)	Bodega (n=11)	Punto de Venta (n=3)	Tienda CUC (n=12)	Tienda MN (n=11)
Median Composite Nutrition Environment Quality Score	19	5	14	5.5	4
% with fruit in stock	100	0	100	0	18
% with vegetables in stock	100	0	100	0	18
% with roots/tubers in stock	100	0	100	0	18
% with beef in stock	100	0	0	42	27
% with chicken in stock	0	0	0	67	36
% with eggs in stock	0	36	0	24	18
% with fish in stock	0	0	0	58	0
% with pork in stock	100	0	0	33	27
% with skim/1% milk in stock	0	0	0	0	0
% with 2%/whole milk in stock	0	100	0	75	0
% with whole wheat bread in stock	0	0	0	0	0
% with white bread in stock	0	0	0	42	55
% with brown rice in stock	0	0	0	0	0
% with white rice in stock	0	0	0	50	0
% with legumes in stock	100	100	0	50	0
% with beef hot dogs (regular) in stock	0	0	0	75	0
% with beef hot dogs (low fat) in stock	0	0	0	0	0
% with turkey hot dogs in stock	0	0	0	33	0
% with chorizo in stock	33	0	0	83	0
% with 100% juice in stock	0	100	0	75	0
% with juice drink in stock	0	0	0	83	0
% with diet soda (0 kCal) in stock	0	0	0	0	0
% with regular soda in stock	0	0	0	92	0

➤ Section 5: Discussion, Limitations, Conclusions, and Suggestions for Future Work

Discussion and Limitations

Our study first modified the Nutrition Environment Measures Study: Store Measures (NEMS-S) to incorporate typical healthy and unhealthy Cuban foods. We next utilized housing quality and population density data to identify two 1 km squared survey tracts, one each in the cities of Havana and Cienfuegos. We piloted the adapted NEMS-S in a total of 40 food retail outlets (21 in Havana, 19 in

Cienfuegos) classified into five distinct categories, collecting data on indicator food availability, price, and quality.

Our survey did not demonstrate variation in composite nutrition environment quality scores between Central and Western Cuban cities; descriptive statistics of scores in Havana versus Cienfuegos were similar (See Figure 3 - Havana dataset Q1, median, and Q3 of 4, 6, and 11 versus Cienfuegos Q1, median, and Q3 of 4, 5, and 9). However, our analysis revealed substantial variation in nutrition environment quality scores and healthy food availability by type of food outlet. Agropecuarios and puntos de venta primarily sell minimally processed, non-animal products; bodegas provide staples as part of the national rationing program; tiendas moneda nacional collectively sell a variety of products with limited offerings at a given store; and tiendas CUC primarily sell processed foods, including many animal products, at extraordinarily high prices. Consistent with these observations, agropecuarios and puntos de venta had the highest median composite Nutrition Environment Quality Scores, highest percentage availability of fruits and vegetables, and lowest availability of soda and juice drinks of the five types of food outlets (See Figure 4).

We encountered three primary challenges while modifying the NEMS-S survey and protocol. First, in many low or middle-income country contexts, reliable lists of store addresses do not exist. In addition, handheld GPS devices cannot be imported into Cuba without special permission. Consequently, we mapped the survey areas on foot and later converted our address data to geographic coordinates. Second, the idea of neighborhood-level variation in socioeconomic status (SES) conflicts fundamentally with the ideals of the Cuban Revolution. However, many nutrition environment studies developed in the US – including NEMS-S – focus on economic and/or racial disparities in food access and attempt to control for socioeconomic status during neighborhood selection. Although most data indicate that Cuba enjoys limited socioeconomic disparity compared to the United States, SES variation does exist in Cuba, and we used housing quality data as a proxy for otherwise unavailable socioeconomic data. Third, collecting information on price variation proved challenging. A single item in a given store shows variable pricing depending on rationing guidelines, few prices are marked, multiple currencies circulate, and quoted prices may vary by customer. We decided to focus our data collection on availability and quality rather than pricing; consequently, we were unable to accurately evaluate how food pricing impacted the composite Nutrition Environment Quality Score.

Conclusions and Suggestions for Future Work

In summary, although many elements of the NEMS-S survey methodology did not neatly dovetail with the Cuban food system context, we obtained valuable insight into how to best modify nutrition environment assessments for developing country contexts. We also collected baseline data describing the

Cuban nutrition environment before trade liberalization with the United States. It is our belief that as the Cuban GDP per capita continues to increase and as trade with the United States continues to open, Cuban consumers will collectively experience greater access to the CUC – the more expensive of the two Cuban currencies – as well as to Tiendas CUC and their less healthy products (evidenced by the tiendas CUCs’ low composite nutrition environment score in our study). The progressive popularity of Tiendas CUC may foster increasing obesity prevalence over time in Cuba – similar to other Latin American and Caribbean countries – and suggests policy implications, particularly given Cuba’s unique regulatory environment compared to peer nations. Future investigation will (A) focus on how to better incorporate price analysis into Cuban nutrition environment assessment, (B) include data collection in Eastern Cuba, a lower income region with distinct culinary traditions, and (C) provide follow-up assessment of processed food availability as trade liberalization continues. Additionally, we recommend continuing to alter the adapted NEMS-S instrument for optimal reliability and validity as additional data on its applicability is collected.

To elaborate on the role played by the state in creating nutrition environments as well as possible policy implications, the Cuban government’s influence on food access, cost, and quality begins with *la libreta* – a ration book that allows Cubans to purchase a set quantity of staple food items at subsidized prices in *bodegas*. In contrast, the *mercados agropecuarios* and *puntas de venta* – both of which had the highest composite nutrition environment scores in our study – allow the free sale of surplus produce beyond the production agreement between the farmers and the state procurement agency, Acopio.²² These agricultural markets were created to broaden the availability of food outside the ration system during Cuba’s “Special Period” of economic turmoil following the dissolution of the Soviet Union.²³ Of note, government entities continue to administer these markets, which implies that the state currently plays a significant role in the administration of “privatized” food sales in addition to government-administered food distribution.²⁴ Furthermore, Cuba remains far from agricultural independence, importing 80% of its domestic food requirements and spending a total of \$2 billion on imported food products in 2013.^{25 26} Much of this food is utilized in the state rationing system or sold in tiendas CUC, both of which represent food outlets with lower composite nutrition environment quality scores. When reviewed collectively, these data indicate an unparalleled albeit variable level of control on the part of the Cuban government over food availability at different food outlets, ranging from 100% in state-run bodegas to less so in agricultural markets with strong regulatory restrictions. Consequently, we believe that the state has a unique opportunity to incorporate nutrition decision-making and community nutrition environment intelligence to ensure availability of healthy foods as well as to maintain artificially high prices for less healthy, often imported foods – typically purchased with the CUC currency at *tiendas CUC* – even as consumer access to the CUC improves and the United States embargo eases.

Lastly, nutrition environment assessment outside the United States remains in its infancy, so comparing our findings to other developing contexts remains difficult. Few datasets are available, the existence of various nutrition environment metrics makes comparison between studies challenging, and the NEMS-S survey has been piloted with different study aims only in Brazil,²⁷ Guatemala²⁸, and Paraguay²⁹. However, data supporting increasing unhealthy food availability in Latin America remain incontrovertible regardless of metric utilized. For example, a 2016 report by the United Nations Food and Agriculture Organization (FAO) attempts to capture changing nutrition environments in the Caribbean and Latin America, albeit leveraging different metrics than the NEMS-S. While eradicating undernourishment (currently affecting 5.5% of the regional population) remains a public health priority, the report remarks that food availability exceeds population caloric needs, with overweight affecting greater than 50% of the population in all countries in the region with the exceptions of Haiti (38.5%), Paraguay (48.5%) and Nicaragua (49.4%).³⁰ In addition, data from this report capture healthy food availability – but not cost or quality – by indicating food group availability by country in grams/person/day. Based on these numbers, report authors note several concerning regional trends, including higher sugar availability than in developed regions, higher than recommended per capita availability of fats, and lowest per capita fish availability of any region worldwide. These data indicate that while the Cuban food environment differs from others in Latin American and the Caribbean by virtue of its regulatory uniqueness and relative economic isolation, the region as a whole has begun to grapple with rapidly changing nutritional availability as well as associated health consequences. Cuba and its Latin American peers will likely mutually benefit from knowledge-sharing initiatives as well as collective trade agreements and policy.

➤ **Section 6: Acknowledgements**

First, we would like to thank the National Medical Library of Cuba for hosting and mentoring our field research. In particular, we could not have connected with Marcia, a bodega manager in Havana, for a key informant interview without the commitment and guidance of Maria del Carmen Gonzalez Rivero, MSc, and Lic. Sonia Santana Arroyo. Next, I would like to thank Dr. Karen Glanz for guiding the adaptation of the NEMS-S survey instrument to the Cuban food context. Additionally, we appreciate the assistance of the Harvard Center for Geographic Analysis in advising our food outlet mapping techniques. And lastly, I would like to extend a special thanks to Professor Allen Brandt, a wonderful friend and mentor who assisted with this project before being unable to continue for health reasons. The intellectual genesis of this project rests entirely on Professor Brandt's work analyzing the interaction between trade legislation and tobacco consumption in developing countries.

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