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Exploring Diversity of Hispanic Health Outcomes Through Prism of Environmental Justice

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ABSTRACT

In environmental economics studies US Hispanics are frequently depicted as one large homogeneous group, despite diversity in their countries' cultural traditions, genetic background and socioeconomic status (SES). This study aimed to compare Florida's very diverse Hispanic population of Caribbean, Mexican, Central, and South American ancestry. Twelve independent variables were selected from environmental pollution, geospatial challenges, and SES categories. Dependent variables included the relative prevalence of three major chronic diseases: asthma, diabetes, and heart disease. Analysis of pairs correlations was supplemented by multi-variable linear regression. Majority-Hispanic areas have higher than average pollution, diabetes, proximity to disadvantaged neighborhoods, and lower SES. Despite lower pollution than in urban areas, Florida's inland rural areas had higher rates of all major diseases and lower life expectancies. Cuban and Puerto Rican populations of Miami and Orlando metro areas, respectively, have less favorable SES outcomes and higher diabetes. Columbian and Venezuelan communities have significantly higher education levels than other Hispanic cohorts, and they have the best relative outcome among US Hispanics in SES and health, although still lagging US averages. African-American community in Miami-Dade County was by far the most disadvantaged, with significantly lower SES and health outcomes than any other group in the study, including the nearby Cuban-majority community. Our results confirmed the view that Hispanics are environmentally disadvantaged in Florida, with worse outcomes than the US and Florida average in health and economic factors. Furthermore, the study highlighted significant differentiation of SES and health outcomes among various regional Hispanic cohorts.

INTRODUCTION

In demographic surveys, economic and environmental justice literature (Rodriguez, 2012; Mikati, 2018; Casey, 2023; Josey, 2023), Hispanics are portrayed as a homogeneous ethnic group united by a common language and centuries of Spanish colonial experience. This broad unified classification is a significant oversimplification of a complex and nuanced sociocultural reality, as it ignores the rich diversity and multifaceted identities of distinct groups within the Hispanic community. Filling this gap in the environmental economics literature requires more granular methodological frameworks that recognize and investigate the diversity within Hispanic populations.

People of different Latin American national backgrounds differ significantly within the category in terms of socioeconomic status (SES), cultural traditions, history and future trends. US residents of Hispanic descent come from diverse countries, including Mexico, Central America, South America, and the Caribbean. Each of these regions has a distinct history, cultural expressions, and social dynamics. Mexicans are the largest by far subgroup of US Hispanics (55%), with a distinct cultural heritage that combines indigenous traditions with Spanish colonial influences. This experience differs significantly from the cultural backgrounds of Hispanics from Caribbean countries, where African, indigenous Caribbean and European heritages got intertwined.

The Caribbean cohort on its path to the US residency has more differences than similarities. Puerto Ricans have the advantage of automatic US citizenship, which provides them with complete and reversible flexibility in terms of destination and time of their immigration to the mainland US. Cuban immigrants have much more favorable US immigration status than any other Hispanic country, ever since the Fidel Castro regime took over in the 1960s. In contrast, immigrants from the Dominican Republic and other smaller Caribbean nations have a much more difficult path to the US, as they do not have the above-mentioned preferences of Cubans and Puerto Ricans, and yet they do not have a land border as a transit route available for Mexicans and Central Americans.

Central American countries such as Guatemala, El Salvador, and Nicaragua have a history of extended civil unrest, consistent economic challenges, lower levels of education and cultural traditions that differ significantly from those of South Americans in Argentina, Brazil, and Chile. South American countries developed significantly independently over the past century hence their population has a wide range of cultural diversity, from the European-influenced southern cone to the more indigenous Andean countries. Consequently, educational attainment, income levels, and health outcomes can vary widely among Caribbean, Mexican, Central, and South American cohorts, reflecting the diverse challenges and

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opportunities encountered by these communities over the past century (Burchard, 2005). Therefore, it is crucial to apply the prism of Environmental Justice to the Hispanic community with emphasis on its largest diverse components from various countries.

Florida was chosen for the analysis of Hispanic diversity for several compelling reasons. It is the third largest US state by population, with a ratio of urban and rural population close to the US national average. Florida is the second most popular tourist destination (after California) and a magnet for US retirees (21.6% vs. 17.3% of people >65 years old). However, Florida's population has a 10% lower household income vs. the US national average and a slightly higher percentage of poverty prevalence, 12.7% vs. 11.5% for the US average (Shrider, 2023). The number of Floridians without health insurance (13.9%) is significantly higher than 9.3% for the US average, in agreement with prior observations (Branch, 2022). These factors are very relevant to the health focus of our research. Compared to the US average, Florida has a higher African-American population (17% vs. 13.6%) and a lower Asian population (3.1% vs. 6.0%). The most

significant difference is a larger Hispanic/Latino segment in Florida at 25.9% vs. 19.1% in the US.

Despite being the sixth state in the US in the percentage of the Hispanic population, Florida has by far the most diverse Hispanic community by country of origin, as shown in Table 1. The largest Hispanic states (California, Texas, New Mexico, Arizona, and Nevada) are quite similar to each other in terms of Hispanics origin, with Mexican descendants being by far the largest contingent of Hispanics in those states. Notably, US residents of Mexican descent represent 55% of the overall US Hispanics, 77% of Texan, and 82% of Californian Hispanics. In contrast, Mexicans comprise only 9% of Hispanics in Florida, being the fourth region of Hispanic origin after the Caribbean (55%), South American (24%), and Central American (12%), as shown in Table 1.

The main goal of this study is to explore the impact of ancestral differences among Florida Hispanics in several aspects: community geospatial factors, personal socio-economic status (SES), environmental burden, and ultimately health outcomes.

Table 1: Hispanics by Country of Origin, % of Total Population in USA, the states of Texas and Florida.

	USA	TX	FL
Mexican	55%	77%	9%
Caribbean	22%	2%	55%
Puerto Rican	9.2%	0.1%	18%
Cuban	6.6%	1.6%	33%
Dominican	5.8%	0.3%	4.2%
Central American	17%	13%	12%
Salvadoran	6.6%	6.0%	1.2%
Guatemalan	4.7%	2.0%	2.6%
Honduran	3.2%	3.5%	3.0%
Nicaraguan	1.2%	0.4%	2.9%
Costa Rican	0.4%	0.1%	0.3%
Panamanian	0.4%	0.1%	0.5%
South American	13%	5%	24%
Colombian	4.0%	1.6%	9.2%
Ecuadorian	2.2%	0.2%	1.4%
Peruvian	2.2%	0.5%	2.7%
Venezuelan	2.1%	1.6%	7.2%
Argentinean	0.9%	0.2%	1.5%
Spaniard	0.7%	0.3%	0.7%
Chilean	0.5%	0.1%	0.5%
Bolivian	0.4%	0.0%	0.2%
Uruguayan	0.2%	0.0%	0.3%
Paraguayan	0.1%	0.0%	0.0%
Hispanic as % of total population of a state	19.1%	39.4%	25.9%

Source: US Census Bureau, 2020 Census Redistricting Data

LITERATURE REVIEW

Environmental Justice area of economic research focuses on identifying discriminatory disparities in the allocation of environmental hazards across different population groups, particularly for people with lower incomes and less societal voice, such as racial and ethnic minorities. The ecosystem is highly complex, with numerous channels of influence and feedback loops connecting various components. Human health has deep genetic roots stemming from those regions’ development history and a diverse ancestor population. In general, the current population of the Americas Hispanic region includes descendants of three distinct ethnic groups: indigenous Indian tribes, Spaniards, and Africans brought by the slave trade over three centuries starting from the 17th century. The relative mix varies significantly by country, depending on the history of people’s movements over centuries. In the Caribbean, the indigenous population mostly vanished, and newcomers absorbed the remaining few natives. A large number of Africans were transported to the Dominican Republic and Haiti, but to a lesser extent to Cuba and Puerto Rico, defining their currently different racial mix. In Central America and the northern part of South America, indigenous people coexisted and blended with Spaniards, while Latin Africans represented less than 3-5% of the total population. The importance of tracing racial roots stems from the fact that Europeans, indigenous Indians, and Latin Africans have quite different disease predispositions based on their genetics and cultural habits such as prevalent diet, as noted by Buchard (2005). More granular intra-ethnic research could logically begin with a more detailed understanding of the population’s genetic predisposition to specific types of diseases based on their heritage (Comonos, 2015). For example, it is well known that African Americans have a much higher prevalence of asthma than other Americans, which can be attributed to both genetics and living conditions (Pratt, 2015; Josey, 2023). Meanwhile, even after controlling for age, gender, and income, US Hispanics have a significantly higher incidence of diabetes than the US white population (Flegal, 1991; Schneiderman, 2014; Fernandez, 2021). Overall, Hispanics had the highest diabetes prevalence (22.1%), followed by non-Hispanic

African Americans (20.4%), Asians (19.1%), and non-Hispanic whites (12.1%). Furthermore, Cheng (2019) reported heterogeneity in the distribution of diabetes among US Hispanic adults of various national origins: Mexicans (24.6%) have the highest percentage, followed by Puerto Ricans (21.7%), Cubans/Dominicans (20.5%), Central Americans (19.3%), and South Americans (12.3%). Body Mass Index (BMI) is the most commonly used measure of obesity. The diabetes prevalence trend was generally aligned with the BMI trend: the highest for Mexicans at 30.5 and the lowest for South Americans at 26.5, with other groups’ BMI close to 29 (CDC, 2023). For calibration, BMI ranges from 25 to 30 indicates overweight, and BMI greater than 30 indicates obesity. Importantly, US residents of South American origin had a much lower frequency (5.9%) of very high BMI > 35, compared to other US Hispanics: Mexicans (20%), Puerto Ricans (15.4%), and Cubans (13.8%). Higher levels of obesity were found to be positively correlated with diabetes, though specific causality is more difficult to determine (Chobot, 2018).

The task of identifying, quantifying, regulating and monitoring environmental pollution sources is performed by the US Environmental Protection Agency (EPA), with the help of various state and local authorities, setting standards and rules and enforcing compliance. The next step is to quantitatively assess the health of a population with different socioeconomic statuses (SES), both “at a point in time” and longitudinally, when possible. Table 2 depicts several major US Hispanic groups. Hispanics of Mexican descent make up the majority of US Hispanics (55%). The next largest subgroup is from the Caribbean, accounting for 17%, followed by a smaller group from Central America (9%), South America (5%), and others (US Census, 2020).

While the above differences among Hispanics were discussed in the medical literature, there is a clear gap in existing economic and environmental literature, that still continues addressing Hispanics as one large homogenous category, despite apparent heterogeneity in this diverse ethnic group. Our study aims at filling this gap with a more focused emphasis of identifying Hispanic sub-groups and classifying their SES and health outcomes.

Table 2: Diversity of US Hispanics by Different Origins

	Mexico	Caribbean			Central America	South America					
		Puerto Rico	Cuba	Dominican R.		Guatemala	Honduras	Columbia		Venezuela	Peru
Population in native country, M	127.5	3.2	11.2	11.2	6.3	17.4	10.4	51.9	28.3	34.1	47.4
US residents vs Native Country, %	29%	181%	21%	21%	39%	10%	10%	3%	2%	2%	2%
Population in US, Million	37.2	5.8	2.4	2.4	2.5	1.8	1.0	1.4	0.6	0.7	1.0

Foreign born	29%	2%	53%	50%	53%	58%	63%	57%	76%	59%	12%	
U.S. citizens	81%	99%	82%	78%	66%	58%	51%	79%	51%	79%	95%	
Median age in years	27.9	31	40	30.1	30.3	26.6	26.9	36.1	36	38	34.2	
Bachelor's degree or more	15%	24%	30%	22%	13%	11%	14%	38%	57%	36%	40%	
English proficient	74%	83%	64%	61%	56%	51%	47%	66%	56%	65%	95%	
Median household income, \$K/year	\$59	\$52	\$59	\$50	\$61	\$52	\$50	\$69	\$65	\$69	\$74	
Homeowners	53%	34%	56%	31%	46%	34%	31%	53%	39%	56%	63%	
Living in poverty	18%	21%	14%	20%	17%	23%	26%	12%	13%	11%	13%	
Without health insurance	20%	8%	12%	10%	24%	34%	40%	13%	15%	12%	7%	
							Lower average income, higher poverty	Higher average income, lower poverty				

Source: Pew Research Center, based on US Census data

The lower section of Table 2 compares various socioeconomic factors, highlighting a wide range of outcomes. The median annual household income ranges from \$50-52K for Caribbean and Central American descendants to \$69K for Hispanics from Columbia and Peru (compared to the US average of \$75K). Aside from average income for a given cohort, two other factors are more important in terms of health outcomes: poverty and a lack of health insurance. Poverty rates range from 20-26% for Caribbean and Central American descendants, while it is 11-13% for South Americans, similar to the US average of 12.4%. Health insurance is a major determinant in maintaining good health, and its availability is typically defined by two interrelated factors: level of household income and employment at mid-to-large US companies that typically provide health insurance to their employees. According to the data, Central Americans have the most challenging socioeconomic status, whereas South Americans are relatively well-positioned among US Hispanics. As a result, the Hispanic community in the United States varies greatly depending on their country of origin, which has an impact on health (Rodriguez, 2012; Velasco-Mondragon, 2016; Yanez, 2016; Shaw, 2017). This is critical background to understand before analyzing the effects of environmental pollution on health.

MATERIALS AND METHODS

The most recent US Decennial Census (2020) provided extensive demographic data such as population race/ethnicity, age, education, income, and poverty. Distinct terms are assigned to five racial groups and also two ethnic groups: Hispanic or Latino (of any race). Hispanics are defined as descendants of Spanish-speaking countries, whereas Latinos include Hispanics as well as Latin American countries that speak Portuguese (Brazil) or French (Haiti). The American Community Survey (ACS) provides additional US Census data on demographics, social, economic, and housing. The ACS and US Census databases differ in frequency (annual vs. one-in-decade) and data collection (ACS' sample estimates vs. official

counts of US Census). As a result, ACS has a margin of sampling error, which is typically between 0.3% and 0.5% for larger categories such as the Hispanic population. Table 3 shows that our research approach defined independent and dependent research variables from categories of environmental pollution, personal socioeconomic status, and health outcomes.

The collected data was checked for completeness across all variables to assure comprehensive analysis. The size of the entire dataset was very large (>50,000 datapoints) to provide for robust statistical significance in all aspects, including focused analysis of various Hispanic regional cohorts. Established statistical research methods were utilized across the entire study, including pair-wise correlations and multi-variable liner regression analysis.

Selection of Independent and Dependent Variables

The US Environmental Protection Agency (EPA) provided environmental pollution data on diesel particulate matter (DZL), hazardous waste sites (HAZW), the proximity of Superfund NPL sites (NPL), and RPM facilities. The personal Socio-Economic Status (SES) dataset was obtained from the US Census and included data on linguistic isolation (LINGO), unemployment rate (UEMPL), poverty PVRT (% of tract population below 100% US Federal level), and education (WHSD, defined as a percentage of adults above the age of 25 without a high school diploma).

A variety of potential variables were examined, and four the most relevant were selected in each category. In case of environmental contaminants, concentration of diesel particles in the air is a clear indicator of proximity to high-intensity roads. Diesel exhausts by trucks are well known as the worst type of land-based vehicle exhaust pollution, in contrast to passenger cars run on a much cleaner gasoline fuel. In addition to dynamic pollution sources, three dimensions of static pollution sources were selected: proximity to Superfund sites, proximity to more general hazardous waste sites and finally, proximity to less impactful but most numerous Risk Management Plant (RPM) facilities. For SES group, the selected factors

are most commonly mentioned in the environmental literature (Collins, 2016; Mikati, 2018; Liu, 2021; Josey, 2023): poverty, lack of education, unemployment and linguistic isolation from the prevailing English language-based US culture. The four dependent variables are

recognized by the US health authorities as more common major diseases (Rodriguez, 2012; Shaw, 2017). As shown on Figure 1, Florida population has a very uneven distribution of health outcomes, stemming in a large part from the selected chronic diseases.

Table 3: Independent and Dependent Variables

Description of Independent Variables					
#	Abbrev.	Environmental Pollution Burden	#	Abbrev.	Socio-Economic Status (SES)
1	DZL	Diesel Particles Matter in the air	5	LINGO	Linguistic Isolation
2	HAZW	Proximity of Hazardous Waste Sites	6	UEMPL	Unemployment rate
3	NPL	Proximity to Superfund NPL Sites	7	PVRT	Poverty (% income < 100% US level)
4	RPM	Proximity to Risk Management Plan facilities	8	WHSD	Adults without High School Diploma
Description of Dependent Variables					
#	Abbrev.	Health Equity - Dependent Variables			
1	ASTM	Asthma			
2	DBTS	Diabetes			
3	HART	Heart disease			
4	SHLF	Shorter Life Expectancy			

Independent variables are expressed as percentiles (compared to the overall US range), making it much easier to compare very different variables using the same scale from 1 to 100. The proximity of a given population tract to geospatial challenges or pollution sources resulted in a higher value of independent variables (i.e. higher values indicate worse outcome for population). According to the US Centers for Disease Control and Prevention (CDC), the prevalence of major chronic diseases such as asthma, diagnosed diabetes, coronary heart disease, and shorter life expectancy was used to calculate the value of health equity-dependent variables.

The Health Equity Index (HEI) is formulated in the following equation for a given US Census tract (i):

$$HEI_i = \beta_0 + \beta_1 * DZL + \beta_2 * HAZW + \beta_3 * NPL + \beta_4 * RPM + \beta_5 * LINGO + \beta_6 * UEMPL + \beta_7 * PVRT + \beta_8 * WHSD + \epsilon_i$$

HEI

Index is the equally weighted average values of asthma, diabetes and heart disease. All data were expressed in values from 1 to 100, as percentiles of outcomes within the US. The lowest value of 1 was ascribed to lowest pollution, unemployment and other factors, while the value of 100 was the highest percentile within US, and value of 50 being the median across the US.

Florida as Research Subject

Prior to investigating the impact of Hispanic origin on health outcomes under environmental pressure, it is preferable first to calibrate the urban-rural dimension, as the availability and quality of US healthcare varies significantly depending on population density. Figure 1 depicts the relative ranking of all 67 Florida counties by

health outcomes, defined as the equal weighting of length and quality of life. All counties were ranked from 1 as calculated by the County Health Ranking (<https://www.countyhealthrankings.org/>). Lighter colors correspond to better health outcomes, while darker colors to relatively worse outcomes.

The Hispanic population is unevenly distributed across Florida, as illustrated in Figure 2. Cubans primarily live in Miami-Dade and nearby Broward counties in the southeast coastal Florida, whereas Puerto Ricans are concentrated in the greater Orlando metro area. The majority of Mexicans live in rural areas in the state's mid-south and northwest. The colored areas represent counties with majority of Hispanic population from Puerto Rico, Cuba or Mexico.

This unequal distribution of Hispanics by country of origin appears counterintuitive at first glance, given that the majority of current Hispanic immigrants arrived in Florida relatively recently, within the last 50-70 years, without any regional settlement constraints or preferences imposed by state or federal authorities. The highlighted majority-Hispanic counties are not adjacent to their home countries (as is frequently the case in Europe), and there were no specific industries designed to attract workers from specific countries. As a result, this map demonstrates the long-term power of social bonds in attracting new immigrants to areas with a large existing population of their compatriots.

Table 4 shows that four areas of Florida were chosen for the current study to represent Hispanic majority from a specific country: Cuba, Puerto Rico, Mexico, and the Northern part of South America (Columbia and Venezuela). In each case, a specific Hispanic group accounted for the majority of the population, ranging

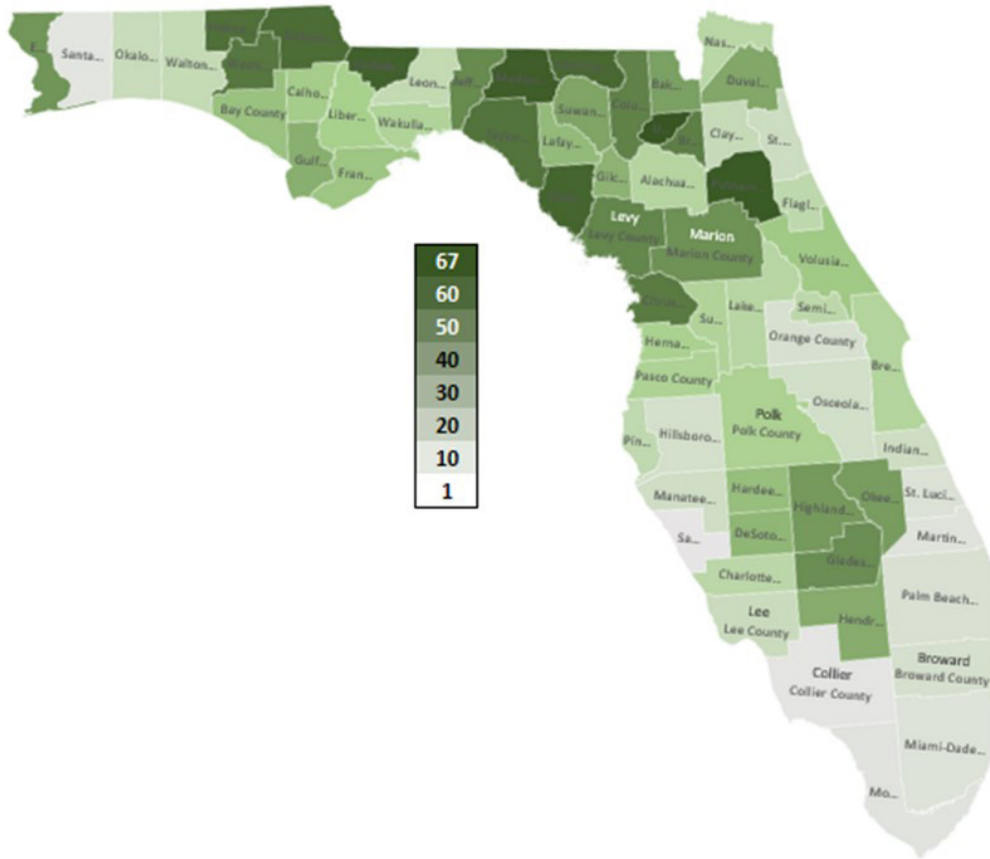


Figure 1: Health outcomes for Florida counties. Florida has a large Hispanic population of various origins.

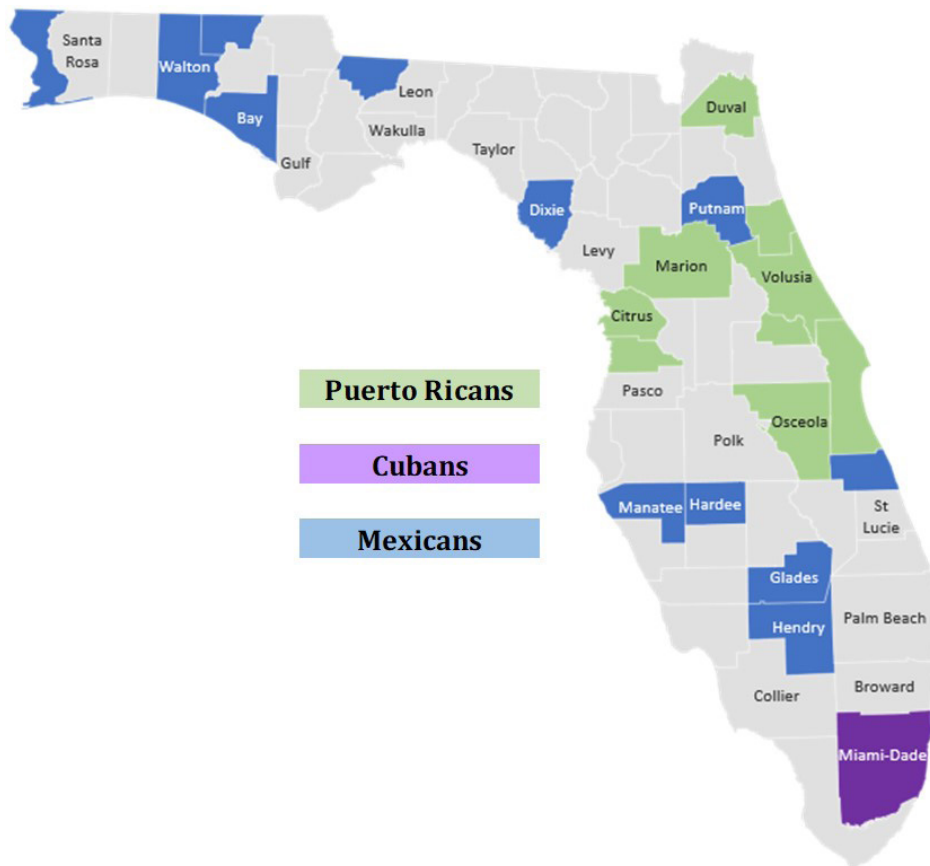


Figure 2: Florida counties of major distinct Hispanic origin

from 51% of Mexicans in the rural south-central area to 92% of the Cuban community prevalence in parts of the metropolitan Miami-Dade County. The objective of this focused segmentation was to explore difference in health outcomes based on the Hispanic country of origin, district's population density and other factors.

A fifth racial minority group was added for comparison: African-American residents of Miami-Dade County who live nearby the Cuban community in different densely populated neighborhoods. Results for ethnic majority-minority areas were compared to one another, as well as the averages of Florida and the US.

Table 4: Description of Floridian Hispanic groups different by national origin

Region / County	Origin	Urban / Rural	Minorities					WHITE
			HISP	BLACK	H + B	ASIAN	Other	
Miami-Dade	Cuba	Highly Urban	92%	2%	94%	0%	0%	4%
Osceola	Puerto Rico	Suburban	64%	12%	76%	2%	0%	19%
Broward & Orange	S. America	Suburban	57%	12%	69%	3%	0%	24%
Hardee & Hendry	Mexico	Rural	51%	5%	56%	0%	0%	37%
Miami-Dade & Duval	Black	Urban	11%	84%	95%	0%	0%	4%
US Average		Mix	28%	12%	40%	6%	1%	50%
FL State Avg		Mostly Urban	23%	15%	38%	2%	0%	56%

Source: US Census Bureau, 2020 Census Redistricting Data

RESULTS AND DISCUSSION

Table 5 displays the median levels of environmental pollution, highlighting a significant difference in the concentration of diesel fumes (DZL) in metropolitan areas versus rural areas: close to the 90th percentage in urban areas vs. 18th percentile in rural areas. The other three independent variables of environmental pollution showed similar contrast in pollution level between cities and rural areas. Notably, the Black community had the highest exposure to all pollutants in majority-Black areas. Meanwhile, the average values of environmental pollutants in Florida and the USA were closer to the 50th percentile.

As shown in Table 5, there was a significant divergence of median outcomes in Socio-Economic Status (SES). All Hispanic minorities in their majority-population areas

naturally had very high linguistic isolation (LINGO) – a traditional measure of social disadvantage. However, it may not be a disadvantage in South Florida, where the Spanish language is so widely spoken that it has become the primary language in many large areas. Unemployment (UEMPL) and poverty (PVRT) rates were higher for all minorities compared to the baseline in Florida and the United States, with the Black community being the most disadvantaged, with the highest (worst) SES values. All five minority groups had higher medians for adults without a high school diploma (WHSD) factor, likely contributing to lower wages and higher unemployment. Overall, Table 5 values confirm that Hispanic and Black minorities face disproportionately adverse environmental and socioeconomic conditions, as was noted by Grineski (2013) and Collins (2016).

Table 5: Differentiation among Floridian Hispanic groups

Region / County	Origin	Urban/Rural	WHITE	Environmental Pollution				Socio-Economic Status (SES)			
				DZL	HAZW	NPL	RPM	LINGO	UEMPL	PVRT	WHSD
Miami-Dade	Cuba	Highly Urban	4%	92	53	78	42	98	37	65	81
Osceola	Puerto Rico	Suburban	19%	94	19	31	52	89	57	70	68
Broward & Orange	S. America	Suburban	24%	88	32	65	69	93	64	63	63
Hardee & Hendry	Mexico	Rural	37%	18	10	15	10	87	61	81	91
Miami-Dade & Duval	Black	Urban	4%	87	59	94	88	61	87	85	81
US Average		Mix	50%	55	54	55	52	60	52	50	53
FL State Avg		Mostly Urban	56%	60	31	51	53	60	51	51	49

Health outcomes included a higher prevalence of three chronic diseases and a shorter than statistically expected lifetime. The diversity of asthma outcomes was much wider than expected based on environmental or socioeconomic factors: median values ranged from 4 for Cubans to 91 for the Black population, implying that racial and genetic factors played a disproportionately larger

role than the degree of environmental toxins exposure by itself. Diabetes prevalence was higher in all minority groups, consistent with previous findings (Schneiderman, 2014; Tessum, 2019). Mexicans and Blacks had higher rates of heart disease, and the Black community had a significantly lower life expectancy, in agreement with Daya (2019) and Liu (2021).

Table 6: Mean values of dependable variables for Floridian Hispanic sub-groups

Region/Country	Origin	Urban/Rural	Health Equity			
			ASTM	DBTS	HART	SHLF
Miami-Dade	Cuba	Highly Urban	4	89	57	18
Osceola	Puerto Rico	Suburban	29	85	53	43
Broward & Orange	S. America	Suburban	18	69	37	41
Hardee & Hendry	Mexico	Rural	45	85	81	46
Miami-Dade & Duval	Black	Urban	91	96	81	90
US Average		Mix	41	49	45	45
FL State Avg		Mostly Urban	29	62	62	49

Overall, the observed diversity of health outcomes exceeded the diversity of environmental pollution impacts, confirming the ecosystem’s complexity and the significant disadvantage faced by Florida’s majority Hispanic and Black communities.

The analysis of pair correlations among eight independent and four dependent variables revealed several interesting observations, as shown in Table 7. There is no correlation between the prevalence of Hispanics and unemployment – in contrast with many Western countries where recent immigrants have higher unemployment. However, there were positive correlations between Hispanic prevalence and lower income, along with lack of high school education. Environmental pollution factors correlated amongst themselves, indicating their prevalence in

the most heavily industrialized and densely populated regions. Furthermore, there was a significant positive correlation between diabetes and heart disease, implying that a portion of the population is in poor health and affected by both diseases. There was a significant positive correlation between diseases and socio-economic status (SES) and a positive correlation between unemployment and low SES. As expected, there was high inter-correlation among SES factors. Overall, Florida’s SES ranking is very similar to the US national average. Because all the data was expressed in percentile ranking within the United States, the results were very easy to interpret, as lower values for all environmental, SES or health variables corresponded to better outcomes for the impacted population group.

Table 7: Summary of factors’ pair correlations among variables for the entire state of Florida (%)

	Factor	1	2	3	4	5	6	7	8	9	10	11	12	13
HISP	1 % Hispanic	*	45	31	28	1	67	-5	20	37	-16	11	-29	-23
DZL	2 Diesel Particles		*	58	61	54	49	2	14	10	2	-5	-30	-12
HAZW	3 Hazard Waste Sites			*	47	39	30	4	23	15	15	-2	-17	7
NPL	4 Superfund (NPL)				*	41	32	7	15	11	11	-5	-28	0
RPM	5 RPM Facilities					*	20	9	18	11	21	0	-3	12
LINGO	6 Linguistic Isolation						*	7	30	39	4	14	-19	-7
UEMPL	7 Unemployment							*	43	37	48	31	18	37
PVRT	8 Poverty (<100%)								*	68	71	50	26	53
WHSD	9 Without High School									*	61	58	26	48
ASTM	10 Asthma										*	37	18	66
DBTS	11 Diabetes											*	80	35
HART	12 Heart disease												*	28
SHLF	13 Shorter Life Expectancy													*
	MAX	100%	97	98	99	99	99	99	99	99	99	99	99	99
	MIN	0	3	1	2	0	12	0	0	0	0	0	0	0

	MEAN	23	60	31	52	54	60	51	51	49	29	62	62	49
	MEDIAN	14	62	27	54	56	63	52	51	49	20	67	67	50
	St. Dev	23	24	19	28	27	27	28	26	27	26	26	29	29
	St. Dev / Mean	1.02	0.40	0.62	0.54	0.50	0.45	0.56	0.51	0.56	0.9	0.41	0.47	0.59

Following the completion of the analysis of the entire state of Florida, it is beneficial to concentrate on areas with predominantly (>70%) Hispanic population and investigate pair correlations and median outcomes for that particular segment of the Florida population, as demonstrated in Table 8. A clear and significant correlation exists between the prevalence of Hispanics and higher exposure to sources of environmental pollution, as well as lower levels of education, higher diabetes, and heart disease, in agreement with Fernandez (2021) and Errisuriz (2024).

The lower half of the Table 7 contains important statistical

data for the entire Florida dataset. Because all data points have already been normalized on percentiles within the US total population, the expected mean and median points should be around 50 if all distributions were close normal and most US states were reasonably homogenous. Instead, in some aspects, Florida population is positioned well below (i.e. better) than the US average: 27th percentile in proximity hazardous waste sites, due to relatively low prevalence of industrial manufacturing in tourism-driven Florida. In other aspects Florida is meaningfully above (worse) than the US averages, in prevalence of diabetes and heart disease (both at 67th percentile).

Table 8: Summary of factors' pair correlations for Florida areas with majority-Hispanic populations

	Factor	1	2	3	4	5	6	7	8	9	10	11	12	13
HISP	1 % Hispanic	*	30	33	37	37	9	7	30	53	17	45	45	8
DZL	2 Diesel Particles		*	51	60	48	47	-1	39	35	7	41	46	16
HAZW	3 Hazard Waste Sites			*	75	60	28	18	52	41	38	33	46	34
NPL	4 Superfund (NPL)				*	81	27	12	47	36	35	26	44	32
RPM	5 RPM Facilities					*	14	4	41	35	28	28	46	28
LINGO	6 Linguistic Isolation						*	22	47	48	32	58	60	23
UEMPL	7 Unemployment							*	31	30	40	24	26	23
PVRT	8 Poverty (income <100% US threshold)								*	57	63	52	65	31
WHSD	9 Without High School Diploma									*	55	75	73	24
ASTM	10 Asthma										*	40	51	35
DBTS	11 Diabetes											*	88	20
HART	12 Heart disease												*	25
SHLF	13 Shorter Life Expect.													*
	MAX	100%	97	92	98	99	99	95	96	98	57	99	99	78
	MIN	81	57	22	40	11	12	0	0	0	0	14	1	0
	MEAN	91	88	53	75	48	96	40	62	76	7	83	53	24
	MEDIAN	92	92	53	78	42	98	37	65	81	4	89	57	18
	St. Dev	5	9	19	17	27	7	24	22	19	9	18	29	20
	St. Dev / Mean	0.06	0.10	0.37	0.23	0.55	0.07	0.61	0.35	0.25	1.27	0.22	0.53	0.84

When comparing the correlation of the two datasets (total Florida and majority Hispanic areas) in Tables 7 and 8, it is notable that the majority-Hispanic areas in Florida have significantly higher than US average exposure to environmental pollution, diabetes, proximity to disadvantaged neighborhoods, and somewhat lower SES. Prior medical research has shown a high prevalence of diabetes in the Hispanic community (Rodriguez, 2012; Shaw, 2017; Errisuriz, 2024).

A few highlighted datapoints in Table 8 show

disproportionately high exposure of Hispanic-majority areas of Florida to diesel particles (92th percentile) and yet very low asthma (4th percentile). This combination is counterintuitive, and could be a subject of further research. By the sample design of selecting majority-Hispanics areas, linguistic isolation is very high (98th percentile). However, in many Florida areas, Spanish has actually become the dominant local language, hence linguistic isolation is more acute for local English-speaking residents, not for Spanish-speaking majority in those areas.

As shown in Table 9, linear multi-variable regression analysis was conducted to supplement the pairs' correlation analysis using all four environmental pollution factors and two socioeconomic factors: absence of high school diploma (WHSD) and unemployment (UEMPL). This approach is conceptually similar to analysis of CO2 emissions and economic factors (Sabroso, 2023) and in determining the effect of unemployment (Nojeem, 2023).

The dependent variable is the Health Equity Index (HEI), an equally weighted three diseases (asthma, diabetes, and coronary disease). The higher value of HEI is detrimental to the population. The HEI shows a positive correlation with the lack of high school education (WHSD) and unemployment (UEMPL) with a high level of statistical significance ($p < 0.01$). These results agree with findings by Hipp (2010) and Grineski (2013).

Table 9: Linear multi-variable regression analysis of environmental hazards and health outcomes

Independent Variables	Abbrev.	Coeff.	t Stat	P-value	P-Signif.
Intercept		30.9578			
Diesel Particles	DZL	-0.2146	-14.01	0.0000	***
Hazardous Waste	HAZW	0.0202	1.23	0.2169	not signif.
Superfund	NPL	-0.0679	-6.03	0.0000	***
RPM Facilities	RPM	0.1237	11.01	0.0000	***
Without High School Diploma	WHSD	0.4258	42.85	0.0000	***
Unemployment	UEMPL	0.1587	16.68	0.0000	***

*Dependent variable is Health Equity Index = Equally weighted 3 diseases (Asthma, Diabetes and Coronary Disease). Note that P-values are marked as the following: * $p < 0.1$, ** $p < 0.05$, and *** $p < 0.01$.*

A significant negative correlation between the HEI, diesel and Superfund factors could indicate that rural areas are less efficient in providing healthcare than urban areas, as suggested by Mikati (2018). Earlier in this report Figure 1 illustrates this phenomenon, which was observed by Branch (2022) and Liu (2021).

It is impossible to know how long people affected by pollution have lived in a particularly polluted area, which is a natural limitation of both our study and the majority of other “point of time” studies. Such information is not gathered by the United States Census, which is conducted once every ten years across the country. This unidentified longevity of residence factor is of utmost significance because it is obvious that environmental pollution has a cumulative impact, albeit non-linear, on the length of time an individual is exposed to toxic substances (Morello-Frosch, 2011; Tessum, 2019; Josey, 2023).

CONCLUSION

As a country of (relatively) recent immigrants, the United States is a true “melting pot” of various nationalities. As a result, one significant limitation of using this nationality-specific approach is identifying local areas with a sufficiently high percentage of residents with heritage of a given country or region. It is still possible, but it requires careful consideration of the research topic and robust granular databases.

This study discovered that the diversity of Hispanic origin leads to very different socioeconomic and health outcomes. A more nuanced understanding of intra-Hispanic group differences is required to develop more tailored and effective strategies in research methodologies, service allocation, and policymaking in general.

The results of pair correlation tests revealed significant relationships among a number of different factors, particularly among socioeconomic and health equity groups. The interdependence of factors that influence health equity in Florida was highlighted by the findings of a multivariable regression analysis, which revealed significant associations among groups of factors: environmental pollutants, socioeconomic characteristics, and health outcomes.

The results demonstrate that the overall Hispanic communities in Florida are disproportionately affected by pollution and socioeconomic challenges and that these communities also experience significantly worse health equity outcomes: a higher disease prevalence and a shorter life span. Within Hispanic communities, South Americans and Cuban cohorts have better health and SES outcomes despite exposure to higher environmental pollution in their highly urban areas. Mexican descendants have cleaner air environments in rural Florida areas, but not as favorable health and SES outcomes. A comparison with the African-American majority community in Miami-Dade County (adjacent to Cuban-majority communities in the same country) shows that African Americans in south Florida have the most challenging outcomes across all twelve researched factors. This study may encourage researchers to focus on intra-segmentation within large US ethnic and racial minority groups. This should help in identifying critical aspects of diversity among Hispanics and African-American communities that were previously overlooked by many environmental economists. Thus, a new more granular approach should allow to see many distinct vibrant colors when demographics are viewed via the prism of the environmental justice.

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