Migration and health

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TEXAS A&M
U N I V E R S I T Y.

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Outline

- Hispanic paradox
  - Markides, Eschbach 2005

- Selective migration and Hispanic paradox
  - Bostean 2013

- Review of Hispanic paradox
  - Teruya, Bazargan-Hejazi 2013

- Obesity among young children of immigrants
  - Baker, Rendall, Weden 2015

Overview

- Migration may help reduce socioeconomic inequalities in population health (Markides, Coreil 1986; Markides, Eschbach 2005; Teruya, Bazargan-Hejazi 2013)

- There is evidence of migrants with healthy profiles even when they have low socioeconomic status

- However, acculturation appears to reduce immigrant health advantages

- Children of immigrants have emerged as uniquely susceptible to obesity, which is one of the most important population health issues currently facing the U.S. (Baker, Rendall, Weden 2015; Hamilton, Teitler, Reichman 2011)
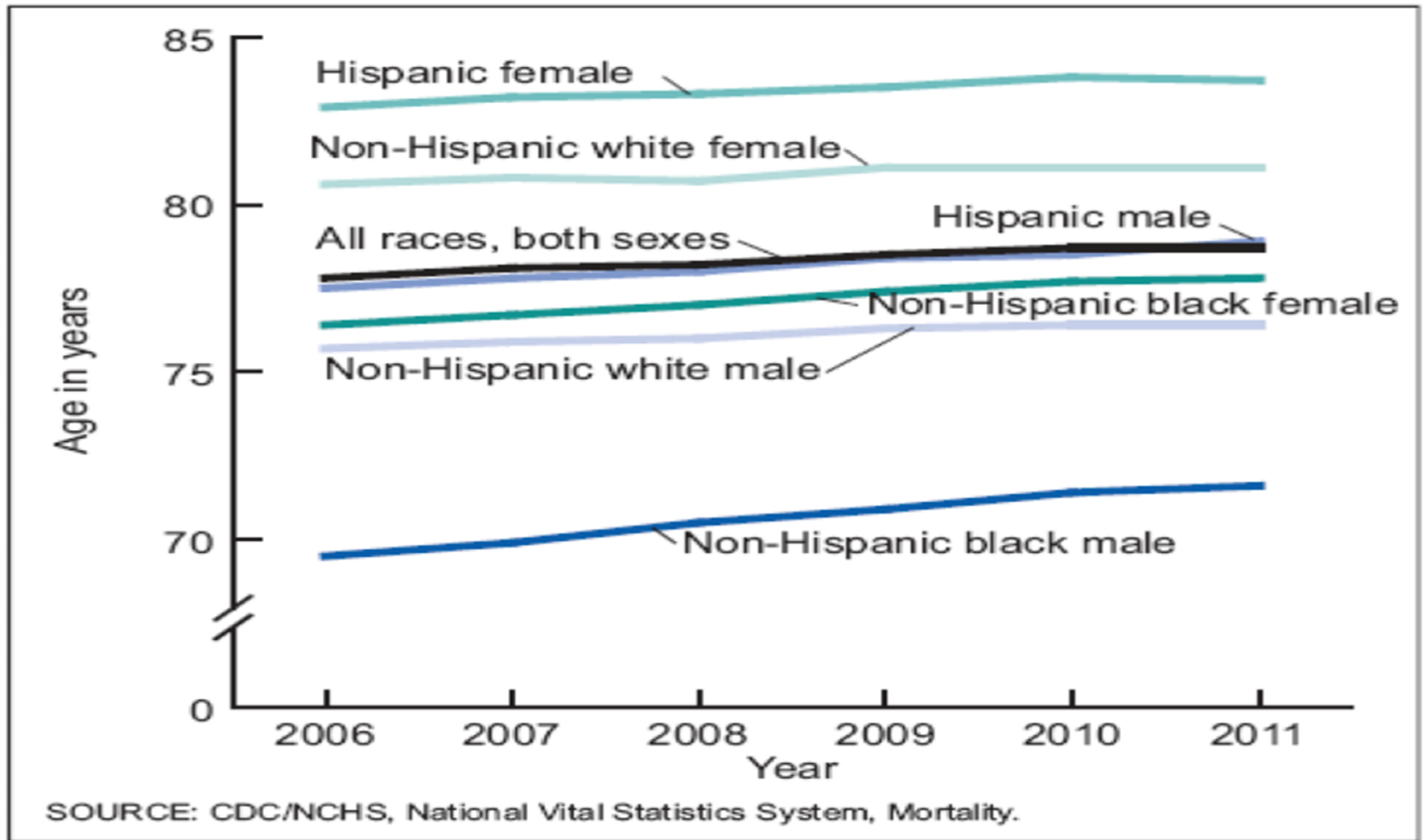
Hispanic paradox

- The Hispanic epidemiological paradox is the empirical finding that Hispanics have death rates of about the same magnitude as, and sometimes lower than, whites

- Also known as the Latino mortality paradox

- These findings are more evident for those of Mexican origin

Life expectancy at birth
by race/ethnicity: U.S., 2006–2011

SOURCE: CDC/NCHS, National Vital Statistics System, Mortality.

Why is this a paradox?

- Hispanic paradox: Hispanics have favorable health and mortality profiles relative to non-Hispanic White

  – Advantages have been mostly confined to mortality

  – Advantage appears to be greater in old age

- This is a paradox because

  – Most Hispanics in the U.S. are socioeconomically disadvantaged, compared to non-Hispanic Whites

  – Literature shows consistent association between low socioeconomic status and poor health outcomes

Explaining the Hispanic paradox

- Data artifacts
  - **Underreporting** of Hispanic-origin identification on death certificates
  - **Misstatement of age**, perhaps overstatement, at the older ages

- Migration effects
  - **Healthy migrant effect:** self-selection of immigrants in better physical and mental health
  - **Salmon bias:** Mexican Americans in poor health return to Mexico at old ages (return migrant effect)

- Cultural effects
  - **Better dietary** practices of Latinos and **stronger family** obligations and relationships

1st study: epidemiologic paradox

- In the Southwestern United States (Markides, Coreil 1986)
  - Health status of Hispanics was more comparable with health status of non-Hispanic Whites
  - Hispanics had better health status than African Americans
  - Even though Hispanics had more similar socioeconomic status to African Americans than to non-Hispanic Whites

- Data on
  - Infant mortality, overall life expectancy
  - Cardiovascular diseases, certain major cancers
  - Functional health

- Possible explanations
  - Certain cultural practices
  - Strong family supports
  - Selection: Immigrants have disproportionate good health
  - Salmon bias: Less healthy Hispanics return home where they die

– Data
Vital statistics (registered deaths) and 2000 Census population counts

– Problems with data
Hispanic identification on the death certificate is often made by a funeral director or other individual who may not know the decedent well

– Older ages
Black-White mortality crossover phenomenon...

Table 1. Death Rates for African Americans, Non-Hispanic Whites, and Hispanics, United States, 2000, by Age and Sex (per 100,000)

	African American	Non-Hispanic White	Hispanic	Rate Ratio: Hispanic/Non-Hispanic White
Men				
Under 1 y	1,567.6	658.7	637.1	0.97
1–4 y	54.5	32.4	31.5	0.97
5–14 y	28.2	20.0	17.9	0.90
15–24 y	181.4	103.5	107.7	1.04
25–34 y	261.0	123.0	120.2	0.98
35–44 y	453.0	233.9	211.0	0.90
45–54 y	1,017.7	497.7	439.0	0.88
55–64 y	2,080.1	1,170.9	965.7	0.82
65–74 y	4,253.5	2,930.5	2,287.9	0.78
75–84 y	8,486.0	6,977.8	5,395.3	0.77
85 y and older	16,791.0	17,853.2	13,086.2	0.73
Age-adjusted rate	1,403.5	1,035.4	818.1	0.79
Women				
Under 1 y	1,279.8	530.9	553.6	1.04
1–4 y	45.3	24.4	27.5	1.13
5–14 y	20.0	13.0	13.4	1.03
15–24 y	58.3	42.6	31.7	0.74
25–34 y	121.8	56.8	43.4	0.76
35–44 y	271.9	128.1	100.5	0.78
45–54 y	588.3	285.0	223.8	0.79
55–64 y	1,227.2	742.1	548.4	0.74
65–74 y	2,689.6	1,891.0	1,423.2	0.75
75–84 y	5,696.5	4,819.3	3,624.5	0.75
85 y and older	13,941.3	14,971.7	11,202.8	0.75
Age-adjusted rate	927.6	721.5	546.0	0.76

Note: From National Center for Health Statistics (2003).

Source: Markides, Eschbach 2005.

Racial crossover

- Life expectancy at birth is the lowest for blacks compared with Hispanics and whites

- For most of their lives, blacks have higher death rates than Hispanics and whites

- The situation changes at the very oldest ages

- By late life, death rates for blacks become lower than those for whites, and in some cases lower than those for Hispanics

Life expectancy at ages 70, 80, 90, and 100 by race/ethnicity and sex: United States, 2010

Age	Hispanics Males	Females	NH-Whites Males	Females	NH-Blacks Males	Females
70	15.4	18.0	14.2	16.4	12.8	15.7
80	9.0	10.8	8.1	9.6	7.8	9.6
90	4.5	5.4	4.0	4.8	4.4	5.2
100	2.3	2.6	2.0	2.3	2.5	2.8

Explaining the racial crossover

- Age misreporting on death certificates
  - Overstatement of age
  - But this would only postpone crossover to later ages, not eliminating it

- Population heterogeneity in frailty
  - The surviving elderly black population is a more robust group of disadvantaged individuals
  - The more frail blacks die before the age of 80 or 90
 - This produces a more robust group of blacks that live longer than the majority

Databases and findings

- Vital statistics data
  - Greatest mortality advantage compared with non-Hispanic Whites for all Hispanics combined
  - The advantage is greatest among older people

- National Community Surveys & National Death Index
  - Narrowing of the advantage
  - Mexican origin mortality advantage can be attributed to selective return migration of less healthy immigrants to Mexico
  - Immigrant residential concentration and lower all-cause mortality. Selective immigration? Which are the cultural mechanisms?

- Medicare & Social Security Administration NUDIMENT file
  - Advantage in mortality among Hispanic elders
  - This advantage is considerably lower than is found using the vital statistics method

Latinos Are More Likely To Be Obese And Have Diabetes

Annualized, age-adjusted prevalence of selected diseases and risk factors among adults aged 18–64 years
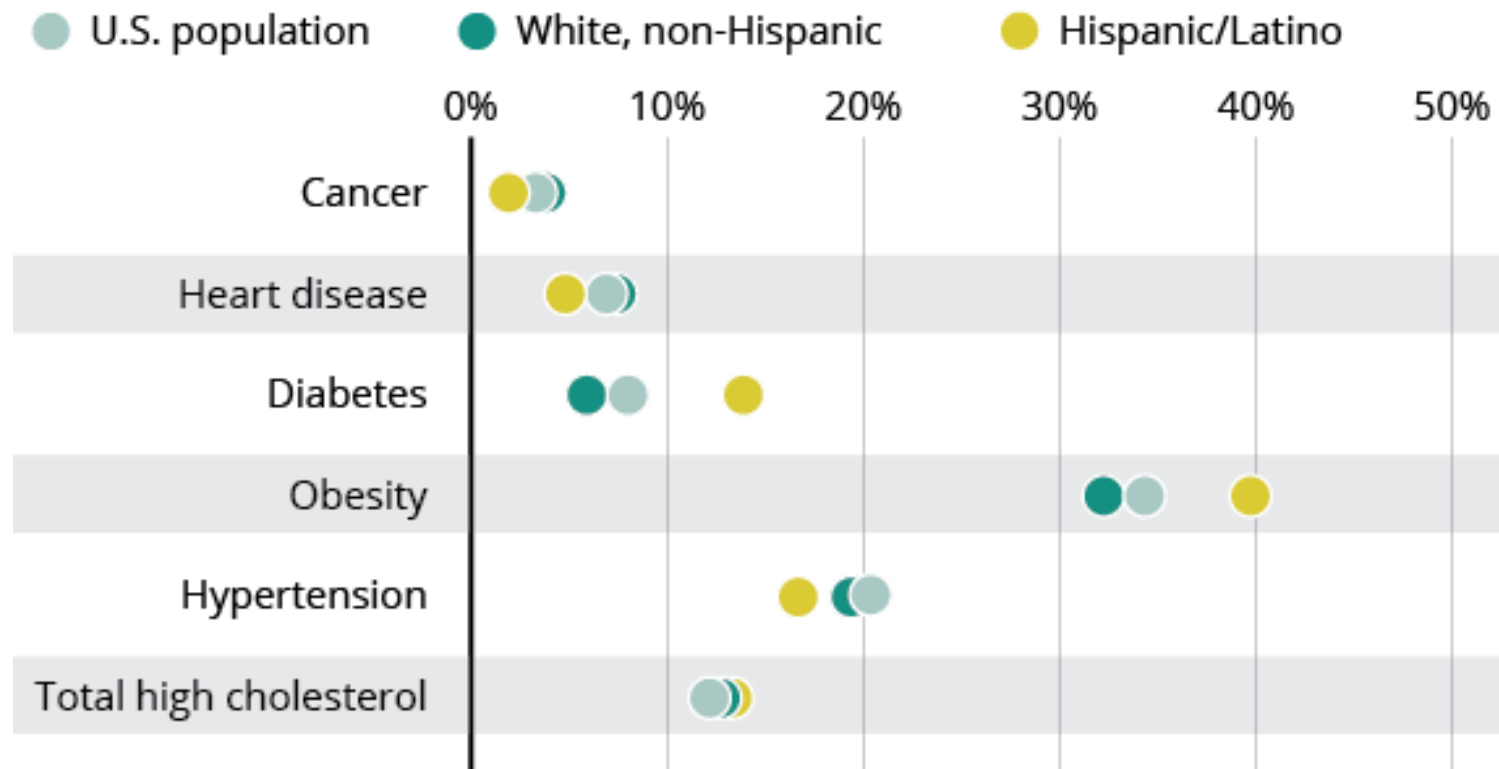
U.S. population — White, non-Hispanic — Hispanic/Latino

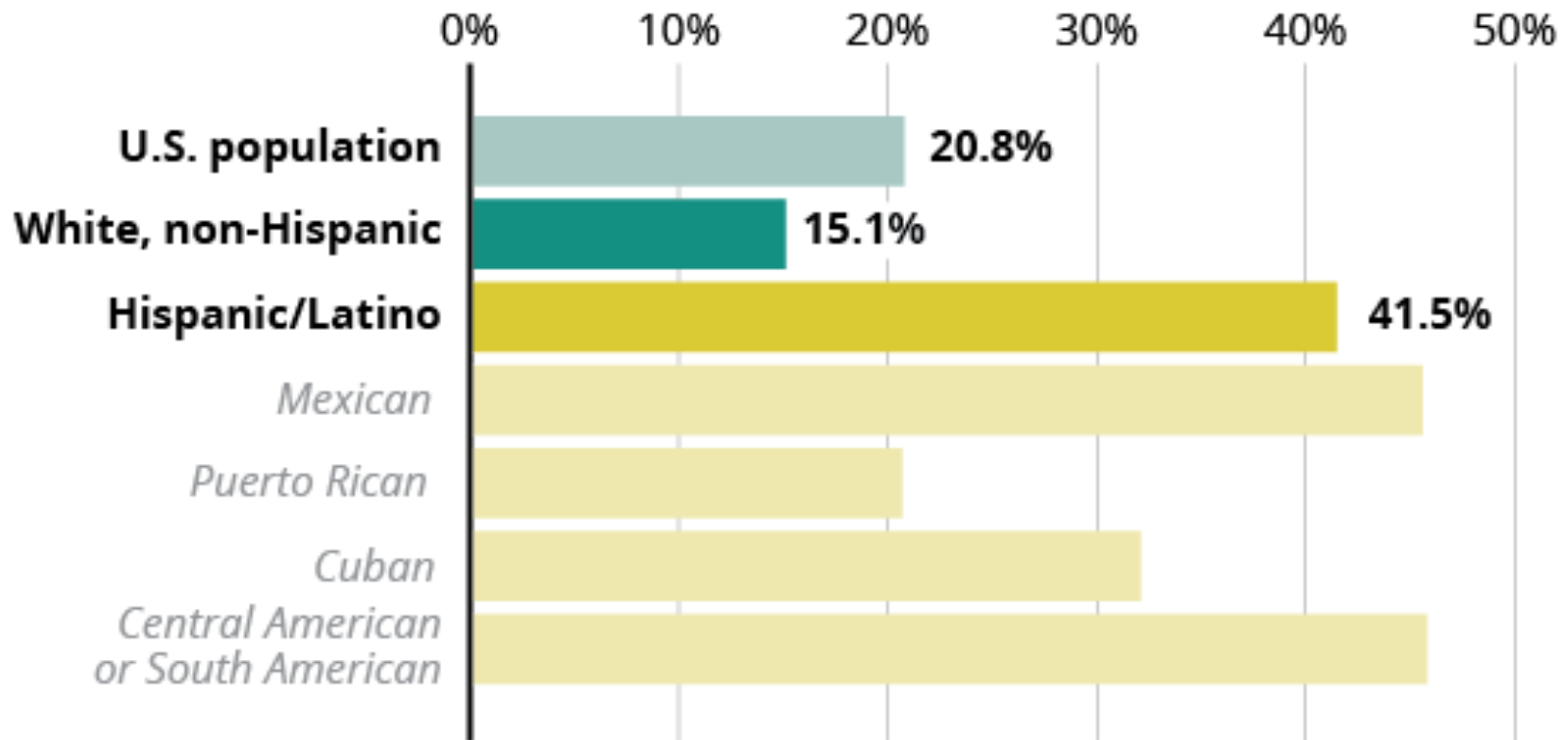Note: Persons of Hispanic/Latino ethnicity can be of any race or combination of races.

Source: CDC

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Source: Almendrala 2017.

Latinos Are Less Likely To Have Health Insurance

Percent uninsured (18–64 yrs, 2011–2013)

|	Percent
U.S. population	20.8%
White, non-Hispanic	15.1%
Hispanic/Latino	41.5%
Mexican	
Puerto Rican	
Cuban	
Central American or South American	

Note: Persons of Hispanic/Latino ethnicity can be of any race or combination of races.

Source: CDC

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Foreign-Born Latinos Are Healthier

Percent of increased prevalence of selected diseases and risk factors of U.S.-born Latinos compared to Latino immigrants
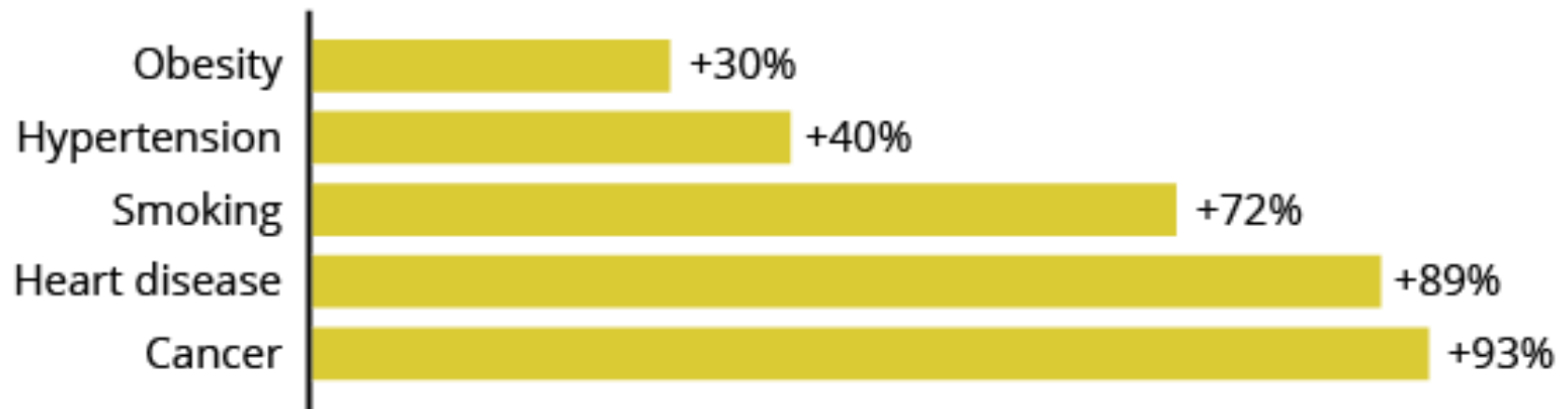
Obesity	+30%
Hypertension	+40%
Smoking	+72%
Heart disease	+89%
Cancer	+93%

Note: Persons of Hispanic/Latino ethnicity can be of any race or combination of races.

Source: CDC

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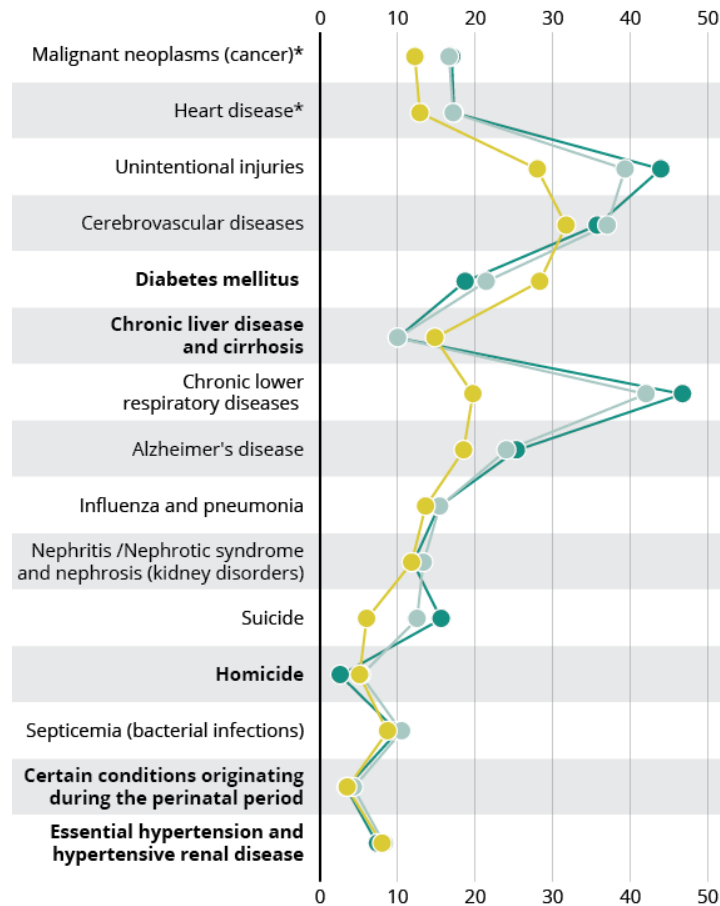Latinos Have Lower Death Rates Than Whites For Most Leading Causes Of Death In The U.S.

Palloni and Arias: Tests

- Palloni and Arias (2004) offer partial tests of four primary classes of explanations

  – **Poor data** quality with respect to ethnic classification, age report, or mortality ascertainment

  – Hypotheses that aspects of **Hispanic culture** (e.g., increased social support or superior health-related behaviors) reduce mortality risks

  – Health selective immigration: **healthy migrant effect**

  – Health selective return migration: **salmon bias hypothesis**

Palloni and Arias: Findings

- They find little support for

  – Data quality: irrelevant given data source (ethnic classification)

  – Cultural hypothesis: ethnic isolation does not improve health

  – Healthy migrant effect: does not attenuate with residence duration

- They find evidence that the salmon bias hypothesis may explain the Mexican American advantage

Main results

- Some studies have begun to question whether all Hispanic groups enjoy a mortality advantage

- However, majority of the evidence continues to support the Hispanic paradox
  - At least among people of Mexican origin
  - Especially in old age, at least among men

- Support for a selective return migration
  - Salmon bias effect
  - Need to explore existence of selective return migration effect
  - Need to expand data for various Hispanic origins

Need further explorations

- Studies of self-reports of health status do not support health advantage for Hispanics
  - Older Mexican Americans have been found to report their health as poorer than non-Hispanic Whites

- Older Mexican Americans might live longer than older non-Hispanic Whites
  - But do so with more disability and in poorer health

- High disability rates in older Mexican Americans is associated with
  - High rates of obesity and diabetes
  - Low rates of physical activity

Controversies

- Comparisons should not be between Hispanics and non-Hispanic Whites

- Hispanics should be compared to African Americans
  - Different mortality outcomes
  - Similar socioeconomic status

- If Hispanics are perceived as advantaged in health, they may receive diminished attention from policymakers
  - Hispanics experience disparities in health care access
  - They have higher rates of infectious diseases, diabetes, and disability
  - It is important to understand Hispanic paradox, as well as address health disparities concerning Hispanics

Selective migration

- Cultural theories have been used to explain the Hispanic paradox

- Need to study health selectivity in activity limitation, self-rated health, chronic conditions
  - Data from Mexico and U.S.
  - Mexican immigrants, 18+

- The analysis tested healthy migrant and salmon bias effect
  - Comparison of health of Mexican immigrants in the U.S. to non-migrants in Mexico, and to return migrants in Mexico

Source: Bostean 2013.

Table 1 Socio-demographic characteristics of sample adults ages 18+, Mexico

	Unweighted percentage				Weighted percentage			
	Whole sample	Non-migrant Mexican	Return migrant Mexican	p value	Whole sample	Non-migrant Mexican	Return migrant Mexican	p value
Age[a]	40.2	40.2	39.5		39.6	39.6	39.6	
	(39.9–40.39)	(39.9–40.4)	(37.9–41.1)		(39.3–39.9)	(39.3–39.9)	(37.6–41.5)	
Female	55.9	56.5	27.6	***	56.7	57.2	27.1	***
Marital status				*				*
Married/cohab	67.6	67.5	73.9		67.0	66.9	74.8	
Never married	22.1	22.2	16.4		22.7	22.9	15.5	
Div./sep./widowed[b]	10.4	10.4	9.7		10.3	10.3	9.7	
Education								*
Never attended/ kindergarten	9.8	9.8	7.3		9.5	9.5	7.3	
Elementary/junior high school	68.0	67.9	73.9		64.7	64.5	75.0	
High school or equivalent	13.0	13.0	10.9		14.2	14.3	8.8	
College+	9.3	9.3	7.9		11.7	11.7	9.0	
Employment status (last week)				***				***
Working for pay	52.5	52.2	65.5		54.1	53.8	67.4	
n	17,523	17,193	330					

Source: Mexican Family Life Survey 2002

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$ (two-tailed test), p value obtained from design-based F statistic from Pearson's χ^2 test

[a] Mean (95 % confidence intervals in parentheses). [b] Divorced, separated or widowed

Table 2 Socio-demographic characteristics of sample adults ages 18+, U.S.

	Whole sample	Mexican immigrant, <5 years.	Mexican immigrant, 5+ years	U.S.-born Mexican	U.S.-born White	p value
Unweighted percentage						
Age[a]	44.8 (44.7–44.8)	29.2 (28.7–29.5)	39.6 (39.3–39.8)	38.5 (38.1–38.7)	47.1 (46.9–47.2)	***
Female	53.0	46.1	49.8	52.9	52.3	***
Marital status						***
Married/cohab	64.2	62.6	75.9	56.1	67.7	
Never married	19.2	31.9	13.6	28.5	15.6	
Div./sep./widowed[b]	16.9	5.5	10.5	15.3	16.7	
Education						***
Never attended/kindergarten	0.7	3.3	3.9	1.2	0.2	
Elementary/junior high school	7.9	43.8	42.8	9.5	3.1	
High school or equivalent	42.0	43.5	39.5	52.8	40.9	
College+	49.4	9.3	13.9	36.5	55.8	
Employment status (last week)						***
Working for pay	61.6	62.2	62.9	62.9	61.7	
Language of Interview						***
English only	87.8	13.8	32.1	80.6	97.4	
Spanish or combination	9.0	83.6	65.6	15.6	0.1	
n	197,158	2,486	11,080	11,082	118,094	
Weighted percentage						
Age[a]	45.1 (44.8–45.2)	29.2 (28.7–29.6)	39.3 (38.9–39.7)	38.6 (38.1–39.0)	46.7 (46.3–46.8)	***
Female	52.0	44.8	47.8	51.9	51.7	***
Marital status						***
Married/cohab	64.3	61.5	76.9	56.8	66.9	
Never married	19.4	32.9	13.8	27.8	16.7	
Div./sep./widowed[b]	16.3	5.8	10.2	14.7	16.3	
Education						***
Never attended/kinder	0.5	3.2	3.9	1.0	0.2	
Elementary/junior high school	5.8	42.9	41.1	8.7	3.1	
High school or equivalent	41.1	44.1	40.2	51.1	40.7	
College+	52.7	9.9	14.9	39.2	56.1	
Employment status (last week)						***
Working for pay	61.8	63.3	64.2	63.9	61.8	
Language of Interview						***
English only	92.26	15.5	34.5	83.1	97.5	
Spanish or combination	4.7	82.2	63.4	13.4	0.1	

Source: National Health Interview Survey 2001–2003

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$ (two-tailed test), p value obtained from design-based F statistic from Pearson's χ^2 test. May not sum due to rounding error

[a] Mean (95 % confidence intervals in parentheses). [b] Divorced, separated or widowed

Source: Bostean 2013.

Table 3 Age-standardized prevalence rates of chronic conditions and poor/fair self-rated health, U.S. and Mexico

| | Mexico | United States | | | |
	Whole population	Mexican immigrants, <5 years in U.S.	Mexican immigrants, ≥5 years in U.S.	U.S.-born Mexicans	U.S.-born Whites
Chronic conditions[a]					
Rate (95 % confidence interval)	15.76	14.89	20.32	26.33	26.03
	(15.02–16.50)	(11.56–18.22)	(19.21–21.43)	(25.03–27.63)	(25.59–26.47)
Poor/fair self-rated health[b]					
Rate (95 % confidence interval)	4.82	13.04	12.74	12.87	7.70
	(4.41–5.22)	(10.64–15.44)	(11.98–13.51)	(12.17–13.57)	(7.46–7.95)

Source: Author's calculations based on 2002 Mexican Family Life Survey, 2001–2003 National Health Interview Survey, and Mexican Census 2000. Crude rates estimated using weighted 2002 Mexican Family Life Survey (for Mexican sample) and 2001–2003 National Health Interview Survey (for U.S. sample). Age distribution data were obtained from Mexican Census 2000 (Censo General de Poblacion y Vivienda, 2000). Notes: Rates are per 100 and age-adjusted to the 2000 Mexican standard population. The Mexican population is not disaggregated because there were too few return migrants to standardize by age

[a] Diagnosed chronic conditions: have been told you have at least one of the following: diabetes, hypertension, cancer, and heart disease

[b] Ranking of own health as 4 or 5 on a scale of 1–5, where 1 is best health and 5 is worst health

Table 4 Selected health conditions: logistic regression odds ratios

	Activity limitation[a]	Poor self-rated health[b]	Chronic conditions[c]
Sample			
Non-migrant Mexican—MxFLS	Ref.	Ref.	Ref.
Return migrant—MxFLS	0.951	0.748	0.825
	(0.232)	(0.217)	(0.149)
U.S. Mexican imm, <5 years—NHIS	0.110***	2.635***	1.072
	(0.048)	(0.228)	(0.125)
U.S. Mexican imm, 5+ years—NHIS	0.372***	3.795***	1.450***
	(0.028)	(0.175)	(0.068)
U.S.-born Mexican—NHIS	0.598***	6.149***	2.371***
	(0.045)	(0.306)	(0.119)
U.S.-born White—NHIS	0.687***	4.366***	2.439***
	(0.037)	(0.192)	(0.093)
Socio-demographic controls			
Age	1.026***	1.023***	1.056***
	(0.001)	(0.001)	(0.001)
Sex			
Male	Ref.	Ref.	Ref.
Female	1.440***	0.857***	1.036*
	(0.035)	(0.015)	(0.018)
Marital status			
Married/cohab	Ref.	Ref.	Ref.
Divorced/separated/widowed	1.183***	1.329***	1.016
	(0.030)	(0.028)	(0.021)
Never married	1.193***	0.933*	0.817***
	(0.059)	(0.028)	(0.021)
Education			
Never attended/kindergarten	Ref.	Ref.	Ref.
Elementary/junior high school	0.702***	0.678***	1.726***
	(0.048)	(0.038)	(0.102)
High school	0.489***	0.343***	1.526***
	(0.039)	(0.020)	(0.099)
College+	0.390***	0.179***	1.356***
	(0.031)	(0.011)	(0.088)
Employment status last week			
Not working for pay	Ref.	Ref.	Ref.
Worked for pay	0.418***	0.318***	0.673***
	(0.011)	(0.006)	(0.012)
n	33,977	160,085	84,109

Source: Combined NHIS 2001–2003 and MxFLS 2002

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$ (two-tailed test). Standard errors in parentheses

[a] Activity limitation analysis restricted to those age 50+ (see text for detail). [b] Poor/fair self-rated health (coded 1 if respondent rated health as 4 or 5 on scale of 1–5). [c] Chronic conditions is coded 1 if the respondent has been told by health professional that he/she has at least one of the following: diabetes, heart disease, hypertension, cancer

Main findings

- Healthy migrant and salmon-bias effects in activity limitation, but not other health aspects

- Immigrants are negatively selected on self-rated health

- Future studies should

  – Investigate complexities of migrants' health profiles

  – Examine selection mechanisms, as well as other factors such as acculturation

Source: Bostean 2013.
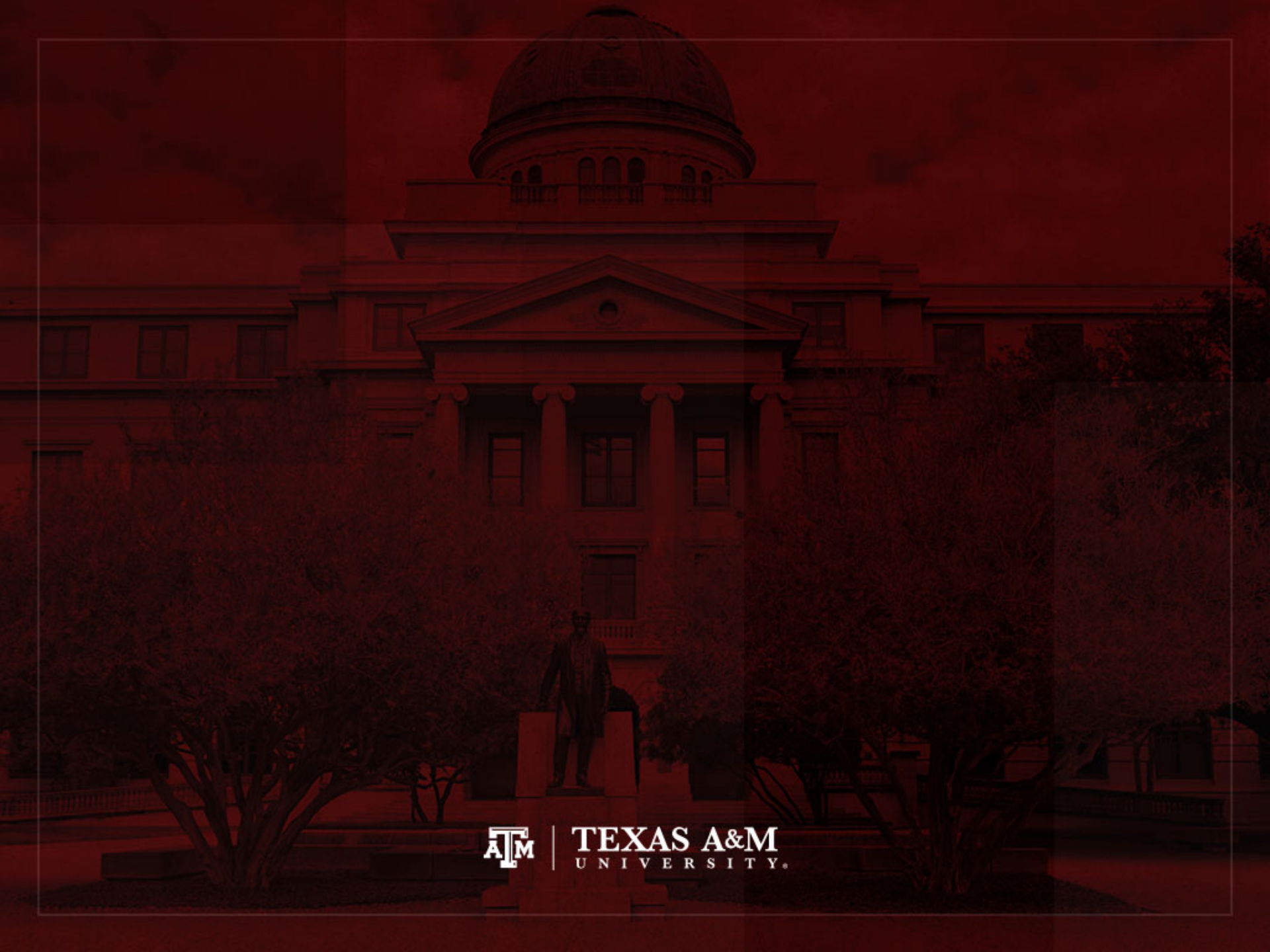
Review of Hispanic paradox

- Results about immigrant paradox and Hispanic paradox are inconsistent

- Issues pointed by the literature
  - Healthy migrant hypothesis indicates that studies are considering only healthy groups (self-selection)
  - Underreporting of deaths
  - Data usually investigated do not have important variables
  - Paradox is not generalizable across races, ethnicities, age groups and genders

- Factors predicting beneficial effects
  - Acculturation, health behaviors and diet, ethnicity, acculturative stress, adolescence, undocumented and uninsured status, age of arrival in the U.S., length of exposure, gender, age

Table 1. Factors and Commonalities in the Immigrant and Hispanic Paradoxes.

	Commonalities			Differing factors and effects	
Immigrant paradox	Research methodology and epidemiological concerns, e. g. migrant health selectivity, underreporting of undocumented immigrant deaths, and the absence of legal status, ethnicity, in commonly used data sets appear to be significant factors/limitations in assessing true effect of both Paradoxes	Protection against drug use appears limited to adult immigrants	Not generalizable across all races and ethnicities	Beneficial effects uneven across races and ethnicities, with possible exception of protection against mental and substance disorders	Age, gender, and stress-inducing factors in acculturation are possible predictors of advantages or decline in beneficial effects
Hispanic paradox			Not generalizable across all "Hispanic," or Latino ethnicities	Mental and substance abuse protection appear limited to Mexican immigrants, not to Cubans, Puerto Ricans et al	Acculturation as a proxy for time spent in the United States appears especially significant for Mexican immigrants

Table 2. References Which Support and Do Not Support the Immigrant and Hispanic Paradox Construct.

|	Number and CCF of references which report statistical advantages	Number and CCF of studies which report specific negative mental and physical health outcomes in adults	Number and CCF of studies which express methodological concerns in data collection and approaches
Immigrant paradox	$n = 8$; CCF = 26	$n = 9$; CCF = 2.2	$n = 6$; CCF = 13
Hispanic paradox	$n = 4$; CCF = 21.8	$n = 9$; CCF = 4	

Note. CCF = cumulative citation factor.

Table 3. Factors in the Protective Effects of the Paradoxes, and in Their Erosion.

Factors in protective effects in immigrant and Hispanic paradoxes	Number of references and CCF	Rank (number of articles)	Rank (CCF)
"Acculturation"	$n = 10$; CCF = 10.4	1	2
Health behaviors and diet (Hispanic paradox)	$n = 6$; CCF = 22.5	2	1
Variations based on ethnicity (Hispanic paradox)	$n = 5$; CCF = 8.8	3	4
Acculturative stress	$n = 5$; CCF = 10.2	3	3
Adolescence	$n = 5$; CCF = 5.6	3	5
Undocumented and uninsured status (Hispanic paradox)	$n = 4$; CCF = 5	4	6
Age of arrival in the U.S. (Hispanic paradox)	$n = 4$; CCF = 3	4	7
Gender	$n = 3$; CCF = 5	5	6
Age	$n = 2$; CCF = 2.5	6	8

Note. CCF = cumulative citation factor.
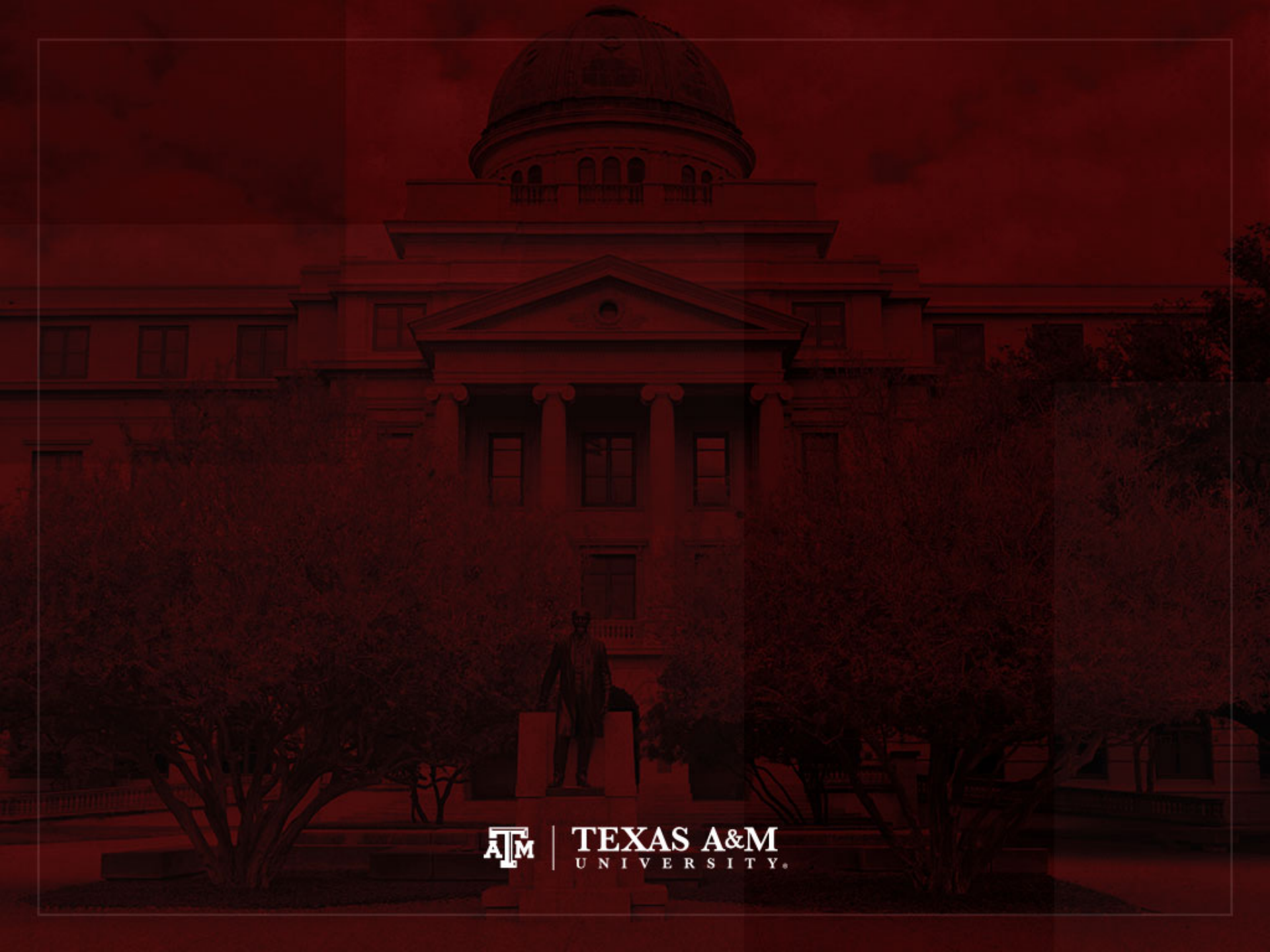
Immigrant children and obesity

- Immigrant epidemiological paradox

  - Immigrants and their children enjoy health advantages over their U.S.-born peers

  - Advantages diminish with greater acculturation

- Child obesity could be a potentially significant deviation from this paradox for 2nd generation immigrant children

Source: Baker, Rendall, Weden 2015.

Mother's acculturation measures

- Age at arrival in the United States
  - 1st generation: arrived in the U.S. at age 13 or older
  - 1.5th generation: arrived in the U.S. prior to age 13

- English language proficiency
  - Mother is asked to assess her ability to speak, read, write, and understand English on a four-point scale ranging from "very well" to "not well at all"
  - High English proficiency (HEP)
    - Answered "very well" on all measures or exclusively spoke English at home
  - Low English proficiency (LEP)
    - Otherwise

Data for 2nd generation children

- It is difficult to obtain sufficient sample size of 2nd generation immigrant children

- Strategy was to work with pooled samples of kindergartners from two nationally representative longitudinal surveys

- These samples assess children's early learning environments, health, and development

ECLS-B and ECLS-K

- Surveys directed by the National Center for Educational Statistics (NCES)

- Early Childhood Longitudinal Survey, Birth Cohort (ECLS-B)
  - Nationally representative sample of the cohort of children born in the United States in 2001

- Early Childhood Longitudinal Survey, Kindergarten Cohort (ECLS-K)
  - School-based sample that followed a nationally representative cohort of children attending kindergarten in the U.S. in 1998

Source: Baker, Rendall, Weden 2015.

Strategies

- Authors included measured height and weight of kindergartners

  – Not parent-reported measures

- Models alternately included and excluded mother's pre-pregnancy weight status as a predictor

  – Higher mother's pre-pregnancy weight, higher chances of obesity among their children

  – Lower pre-pregnancy weight = Healthier

Table 3 Logistic regression models predicting obesity (BMI% ≥ 95) among kindergarteners using data from the Early Childhood Longitudinal Study, 1998 Kindergarten Cohort (ECLS-K) and 2001 Birth Cohort (ECLS-B) by Hispanic ethnicity: Odds ratios (OR) and 95 % confidence intervals (CI)

	Hispanic				Non-Hispanic[a]				All Children			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Mother's English Proficiency by Nativity												
(LEP second generation)												
HEP second generation	0.65	(0.43, 0.99)	0.62	(0.41, 0.94)	0.95	(0.61, 1.47)	0.86	(0.55, 1.35)	0.75	(0.56, 1.01)	0.71	(0.53, 0.95)
Third-plus generation	0.71	(0.53, 0.96)	0.61	(0.45, 0.83)	0.83	(0.53, 1.31)	0.70	(0.44, 1.12)	0.72	(0.58, 0.90)	0.62	(0.50, 0.78)
Mother's Race/Ethnicity (white)												
Hispanic	—	—	—	—	—	—	—	—	1.55	(1.28, 1.87)	1.39	(1.14, 1.70)
Black	—	—	—	—	1.44	(1.18, 1.76)	1.26	(1.03, 1.53)	1.40	(1.15, 1.69)	1.22	(1.00, 1.49)
Asian	—	—	—	—	0.99	(0.67, 1.46)	1.06	(0.72, 1.57)	0.94	(0.69, 1.27)	1.02	(0.75, 1.38)
Native American	—	—	—	—	1.44	(1.04, 2.00)	1.32	(0.95, 1.84)	1.41	(1.02, 1.95)	1.31	(0.94, 1.82)
Hawaiian/Pacific Islander	—	—	—	—	1.40	(0.85, 2.30)	1.30	(0.76, 2.20)	1.38	(0.86, 2.24)	1.24	(0.74, 2.06)
More than one race	—	—	—	—	1.59	(0.89, 2.83)	1.47	(0.81, 2.64)	1.56	(0.88, 2.79)	1.45	(0.80, 2.63)
Mother's Education (less than 9th grade)												
9th–12th grade	0.77	(0.49, 1.21)	0.73	(0.46, 1.15)	0.79	(0.41, 1.53)	0.79	(0.41, 1.53)	0.73	(0.52, 1.03)	0.73	(0.51, 1.03)
High school/GED	0.65	(0.45, 0.94)	0.67	(0.46, 0.97)	0.72	(0.38, 1.37)	0.71	(0.37, 1.35)	0.66	(0.49, 0.89)	0.66	(0.49, 0.90)
Some college	0.65	(0.42, 1.01)	0.66	(0.42, 1.03)	0.71	(0.38, 1.36)	0.68	(0.36, 1.30)	0.66	(0.49, 0.90)	0.64	(0.47, 0.88)
Bachelor's	0.59	(0.31, 1.10)	0.63	(0.32, 1.23)	0.46	(0.24, 0.89)	0.48	(0.25, 0.93)	0.43	(0.31, 0.61)	0.46	(0.32, 0.66)
Some grad. school	0.38	(0.16, 0.91)	0.45	(0.19, 1.07)	0.48	(0.24, 0.96)	0.52	(0.25, 1.05)	0.43	(0.29, 0.65)	0.48	(0.31, 0.72)
Log Household Income	0.95	(0.82, 1.09)	0.97	(0.84, 1.12)	0.89	(0.82, 0.97)	0.92	(0.84, 1.00)	0.91	(0.84, 0.97)	0.94	(0.87, 1.01)

Notes: All regressions are weighted using ECLS-K and ECLS-B normalized sample weights; confidence interval estimates adjust for stratification and clustering in the sample designs. Those 95% confidence intervals that do not span 1.00 imply that the odds ratio is statistically significantly different from 1 at $p < .05$.

[a] Includes white, black, Asian, Native American, Hawaiian/Pacific Islander, and multiracial who indicated that they were not Hispanic.

[b] Mother's pre-pregnancy BMI is calculated from reported height and weight for the ECLS-B sample and is imputed for the ECLS-K sample.

[c] All observations are rounded to comply with NCES disclosure guidelines.

Model 2 adds mother's pre-pregnancy BMI, which is calculated from reported height and weight for ECLS-B and is imputed for ECLS-K.

Table 3 (continued)

	Hispanic				Non-Hispanic[a]				All Children			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Mother's Marital Status (never married)												
Married	0.73	(0.52, 1.03)	0.72	(0.51, 1.02)	0.94	(0.74, 1.19)	0.91	(0.72, 1.16)	0.84	(0.69, 1.03)	0.82	(0.67, 1.01)
Formerly married	0.98	(0.64, 1.48)	0.98	(0.64, 1.49)	0.92	(0.70, 1.21)	0.92	(0.70, 1.21)	0.91	(0.73, 1.14)	0.91	(0.73, 1.13)
Birth Weight (average)												
Low	0.63	(0.38, 1.02)	0.64	(0.38, 1.05)	0.66	(0.52, 0.83)	0.66	(0.52, 0.83)	0.65	(0.53, 0.80)	0.66	(0.53, 0.81)
High	2.64	(1.85, 3.76)	2.42	(1.68, 3.48)	1.84	(1.50, 2.26)	1.55	(1.25, 1.93)	2.01	(1.68, 2.40)	1.74	(1.44, 2.10)
Mother's Age at Birth	1.02	(1.00, 1.04)	1.01	(0.99, 1.03)	1.01	(1.00, 1.03)	1.00	(0.99, 1.02)	1.02	(1.01, 1.03)	1.01	(1.00, 1.02)
Singleton	1.07	(0.58, 1.98)	1.13	(0.58, 2.19)	1.10	(0.78, 1.55)	1.20	(0.85, 1.71)	1.09	(0.81, 1.48)	1.19	(0.87, 1.63)
Child Is Female	0.77	(0.61, 0.98)	0.78	(0.61, 1.00)	1.05	(0.91, 1.20)	1.02	(0.89, 1.17)	0.96	(0.86, 1.08)	0.95	(0.85, 1.07)
Child's Age	0.98	(0.95, 1.00)	0.97	(0.94, 1.00)	1.01	(0.99, 1.02)	1.01	(0.99, 1.02)	1.00	(0.98, 1.01)	1.00	(0.98, 1.01)
Number of Siblings	0.86	(0.75, 0.98)	0.84	(0.74, 0.97)	0.78	(0.73, 0.83)	0.76	(0.72, 0.82)	0.80	(0.76, 0.85)	0.79	(0.74, 0.84)
Maternal Pre-Pregnancy BMI[b]	—	—	1.07	(1.04, 1.09)	—	—	1.07	(1.06, 1.09)	—	—	1.07	(1.06, 1.09)
Survey Sample Control ECLS-B (vs. ECLS-K)	1.61	(1.21, 2.14)	1.61	(1.21, 2.15)	1.47	(1.24, 1.76)	1.45	(1.21, 1.73)	1.51	(1.30, 1.75)	1.49	(1.28, 1.73)
Observations[c]	3,100				14,500				17,600			

Notes: All regressions are weighted using ECLS-K and ECLS-B normalized sample weights; confidence interval estimates adjust for stratification and clustering in the sample designs. Those 95% confidence intervals that do not span 1.00 imply that the odds ratio is statistically significantly different from 1 at $p < .05$.

[a] Includes white, black, Asian, Native American, Hawaiian/Pacific Islander, and multiracial who indicated that they were not Hispanic.

[b] Mother's pre-pregnancy BMI is calculated from reported height and weight for the ECLS-B sample and is imputed for the ECLS-K sample.

[c] All observations are rounded to comply with NCES disclosure guidelines.

Table 4 Alternative maternal nativity and acculturation specifications for logistic regression models predicting obesity (BMI% $\geq$ 95) among kindergarteners using data from the Early Childhood Longitudinal Study, 1998 Kindergarten Cohort (ECLS-K) and 2001 Birth Cohort (ECLS-B): Odds ratios (OR) and 95 % confidence intervals (CI)[a]

| | Hispanic | | | | Non-Hispanic | | | | All Children | | | |
| | Model 1 | | Model 2[b] | | Model 1 | | Model 2[b] | | Model 1 | | Model 2[b] | |
	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Mother's English Proficiency by Nativity (LEP second generation)												
HEP second generation	0.65	(0.43, 0.99)	0.62	(0.41, 0.94)	0.95	(0.61, 1.47)	0.86	(0.55, 1.35)	0.75	(0.56, 1.01)	0.71	(0.53, 0.95)
Third-plus generation	0.71	(0.53, 0.96)	0.61	(0.45, 0.83)	0.83	(0.53, 1.31)	0.70	(0.44, 1.12)	0.72	(0.58, 0.90)	0.62	(0.50, 0.78)
Mother's Generation[c] (generation 1.0)												
Generation 1.5	0.99	(0.69, 1.43)	0.90	(0.62, 1.29)	1.00	(0.60, 1.68)	0.91	(0.54, 1.52)	0.97	(0.72, 1.32)	0.87	(0.64, 1.17)
Third-plus generation	0.80	(0.58, 1.09)	0.67	(0.48, 0.92)	0.86	(0.58, 1.28)	0.74	(0.50, 1.11)	0.81	(0.64, 1.01)	0.66	(0.52, 0.82)
Mother's Nativity (immigrant)												
Native-born	0.80	(0.60, 1.05)	0.69	(0.52, 0.92)	0.86	(0.62, 1.20)	0.77	(0.55, 1.07)	0.81	(0.69, 0.96)	0.68	(0.56, 0.83)
Observations[d]	3,100				14,500				17,600			

Notes: Analyses are weighted using normalized sample weights; confidence interval estimates adjust for stratification and clustering in the sample designs. Those 95% confidence intervals that do not span 1.00 imply that the odds ratio is statistically significantly different from 1 at $p < .05$.

[a] All models control for race/ethnicity, mother's education, log of household income, mother's marital status, mother's age at birth, child's age, gender, birth weight, number of siblings, and singleton status.

[b] Model 2 adds mother's pre-pregnancy BMI, which is calculated from reported height and weight for ECLS-B and is imputed for ECLS-K.

[c] Generation 1.0 is defined as arriving in the United States at age 13 or older; generation 1.5 is defined as arriving in the United States prior to age 13.

[d] All observations are rounded to comply with NCES disclosure guidelines.

Main findings

- Findings are opposite to those predicted by the immigrant epidemiological paradox

- Children of U.S.-born mothers were less likely to be obese than children of foreign-born mothers

- Children of the least-acculturated immigrant mothers (low English language proficiency) were the most likely to be obese
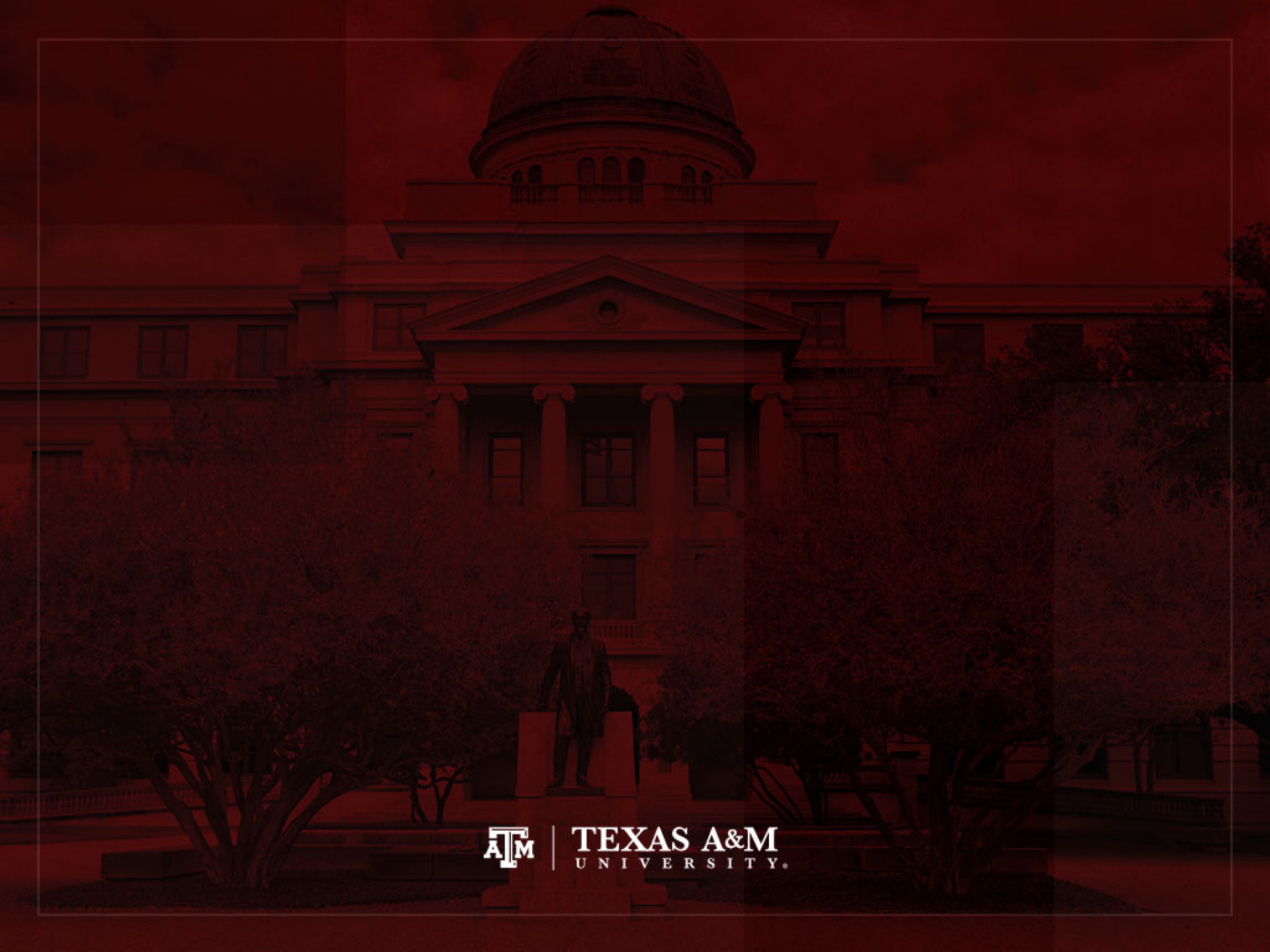
Pre-pregnancy weight

- Foreign-born mothers had lower (healthier) pre-pregnancy weight than U.S.-born mothers

  – This was protective against their second-generation children's obesity

- However, this protection was not sufficiently strong to outweigh factors associated with

  – Mothers' linguistic isolation

  – Marginal status as immigrants

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