Risk Factors for Preterm Birth among U.S. Hispanic Women in the U.S. - Mexico Border States

Xiaomei Ye

2017/08/23

Collaborators

- Dr. Gard (applied statistics)
- Dr. McDonald (public health)
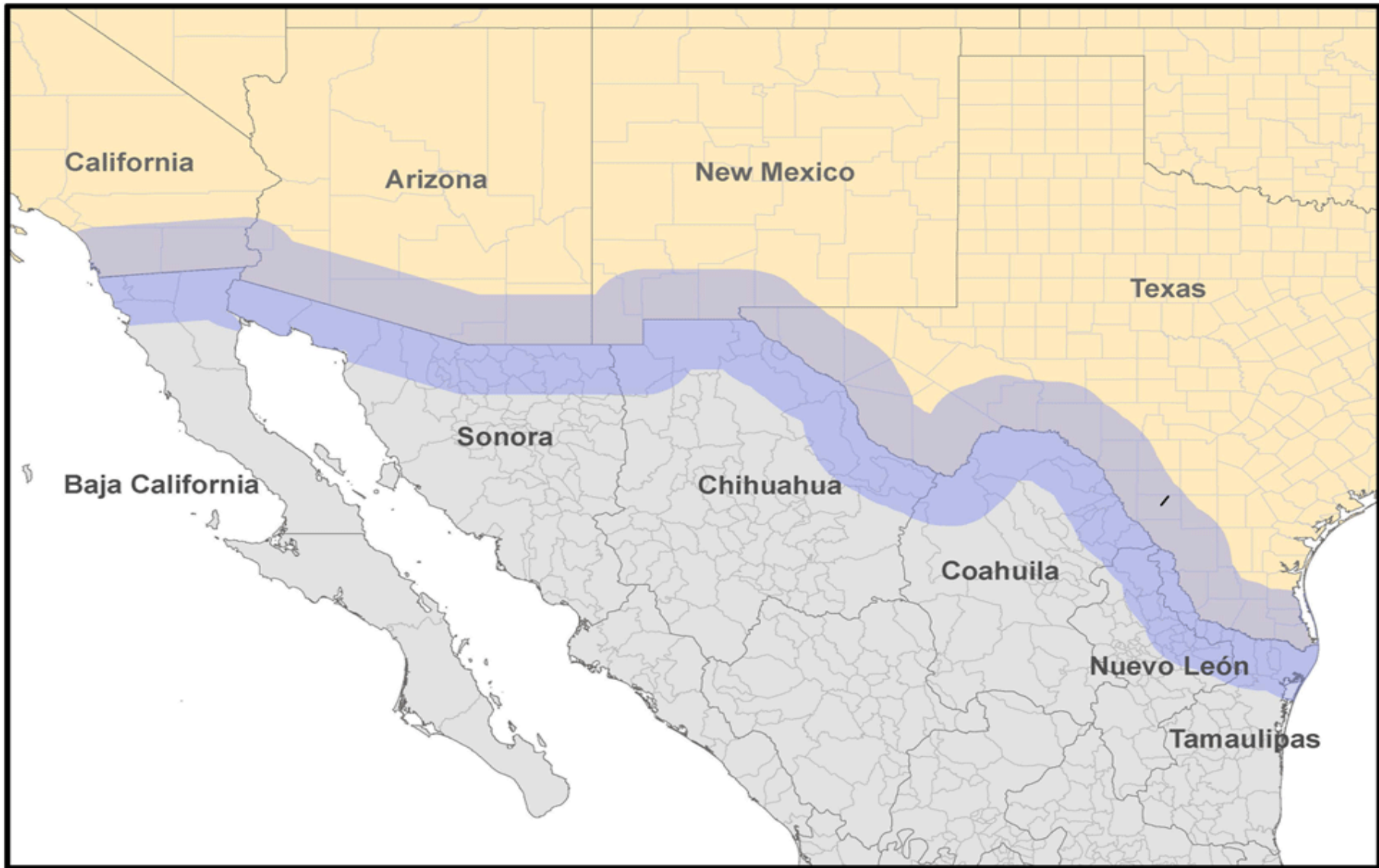- Dr. Amatya (public health)

Introduction

- **Preterm Birth**

- Definition: the delivery of a baby at a gestational age of less than 37 weeks.

- 36% of infant deaths (CDC, 2013).

- Immature brains can cause difficulties in physical development, feeding, and learning, etc.

- Premature lungs can cause respiratory distress syndrome and asthma, etc.

- Under-developed immune system can cause infections.

Introduction

- **Common risk factors for preterm birth**

- eclampsia, previous preterm birth, urinary tract infection, certain vaginal infections, diabetes, hypertension, and being underweight or obese before pregnancy.

- lack of education, young or older maternal age, smoking, insufficient or too much weight gain during pregnancy, depression, race and ethnicity, lifestyle, and other socioeconomic factors.
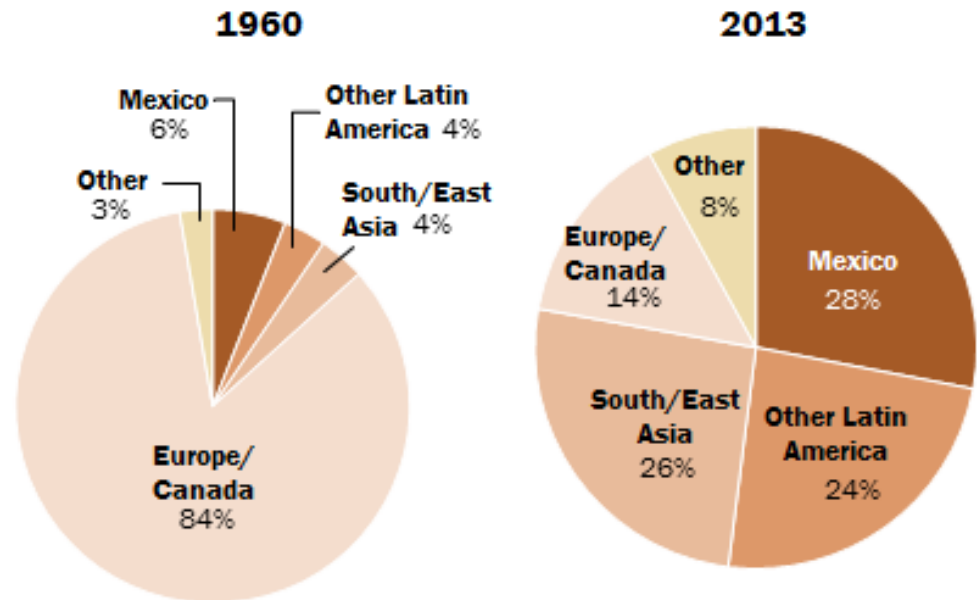
Introduction

Hispanic/Latino population in border states

Texas (39%),
New Mexico (48%),
Arizona (31%),
California (39%)

FIGURE 5.2

From Europe and Canada to Latin America and Asia: A Dramatic Shift in Immigrant Origins

% of U.S. immigrants born in …

1960

- Mexico 6%
- Other 3%
- Other Latin America 4%
- South/East Asia 4%
- Europe/Canada 84%

2013

- Other 8%
- Europe/Canada 14%
- Mexico 28%
- South/East Asia 26%
- Other Latin America 24%

Source: Pew Research Center tabulations of 1960 U.S. decennial census data and 2013 American Community Survey (IPUMS)

PEW RESEARCH CENTER

Introduction

Risk factors for preterm birth among Hispanics

- Diabetes, obesity, teen pregnancy, tobacco use, high poverty rates, low health insurance rates, and lack of access to health care

Hispanics:

- Are more likely to be obese
- Have higher adolescent birth rate
- Are more likely to live below poverty level and be uninsured

Purpose of this study

Texas is one of the states with highest percent born preterm and California is one of the states with lowest percent born preterm in the U.S. (NCHS, 2014).

- Studied the risk factors for preterm birth among Hispanic women in border states
- Updated the data that McDonald et al. (2013) used
- Further explored disparities in preterm birth between the border and non-border region in each of the four border states.

NM STATE

All About Discovery! ™
New Mexico State University
nmsu.edu

Methods

- **Study population**
- Hispanic moms with live, singleton births in border states in 2013 (n = 460,895)
- California (n = 197,951)
- New Mexico (n = 10,320)
- Texas (n = 162,372)

- **Data source**
- Centers for Disease Control (CDC) and Prevention's National Center for Health Statistics (NCHS)

Methods

- **17 potential risk factors**
- U,R: maternal age, mother's state of residence, mother's birth country, mother's marital status, live birth order, diabetes (pre-pregnancy and gestational combined), pregnancy hypertension, eclampsia, and population of residence county.

Methods

- **17 potential risk factors**
- R: education, pre-pregnancy body mass index (BMI), prenatal care, interval since last pregnancy, previous preterm birth, the special supplemental nutrition program for women, infants, and children (WIC), and smoking during pregnancy.
- Weight gain per week and its square term

Methods

- **Descriptive statistics**
- Provide distributions for maternal demographics, maternal history, and pregnancy characteristics and outcomes.

Methods

- **Univariate chi-square tests of independence**

- Determine whether potential risk factors were associated with prematurity.

Methods

- **Two independent sample t-test**
- Determine whether weight gain per week was different between preterm birth and non-preterm birth groups.

Methods

- **For border states overall**: multivariable logistic regression with backward elimination.

- The same model was applied in the border counties and the non-border counties, as well as in each border state to facilitate comparison.

Methods

- Arizona was excluded.

- Unknown levels in each factor were excluded.

- SAS software version 9.4 (SAS Institute Inc., 2012).

- Significance level of 0.05.

Results

Table 1. Demographic and pregnancy characteristics of Hispanic mothers in border states with live, singleton births in 2013 overall, border counties and non-border counties.

	Overall		Preterm birth	Border counties		Preterm birth	Non-border counties		Preterm birth
	Total birth			Total birth			Total birth		
	N	Col %	%	N	Col %	%	N	Col %	%
Total	**460,895**		**9.46**	**76,297**		**10.62**	**384,598**		**9.23**
Mother's Residence State									
AZ	33,055	7.17	11.05	8,899	11.66	9.82	24,156	6.28	11.5
CA	232,846	50.52	7.78	20,197	26.47	6.62	212,649	55.29	7.89
NM	14,064	3.05	10.69	3,199	4.19	10.13	10,865	2.83	10.85
TX	180,930	39.26	11.26	44,002	57.67	12.67	136,928	35.60	10.81

- Most mothers resided in California and Texas.
- Texas accounted for most births in the border counties while California accounted for most in the non-border counties.
- Texas was the only state where preterm birth was more frequent in the border counties than non-border counties.

All About Discovery! ™
New Mexico State University
nmsu.edu

Results

Table 1. Demographic and pregnancy characteristics of Hispanic mothers in border states with live, singleton births in 2013 overall, border counties and non-border counties.

	Overall			Border counties			Non-border counties		
	Total birth		Preterm birth	Total birth		Preterm birth	Total birth		Preterm birth
	N	Col %	%	N	Col %	%	N	Col %	%
Total	**460,895**		**9.46**	**76,297**		**10.62**	**384,598**		**9.23**
Maternal Age (years)									
< 20	52,879	11.47	10.42	10,242	13.42	12.09	42,637	11.09	10.02
20-29	250,927	54.44	8.74	42,666	55.92	9.93	208,261	54.15	8.5
30-39	144,731	31.40	9.96	21,709	28.45	11.03	123,022	31.99	9.77
≥ 40	12,358	2.68	14.39	1,680	2.20	14.54	10,678	2.78	14.36

Results

Table 1. Demographic and pregnancy characteristics of Hispanic mothers in border states with live, singleton births in 2013 overall, border counties and non-border counties.

	Overall			Border counties			Non-border counties		
	Total birth		Preterm birth	Total birth		Preterm birth	Total birth		Preterm birth
	N	Col %	%	N	Col %	%	N	Col %	%
Total	460,895		9.46	76,297		10.62	384,598		9.23
Mother's Race/Hispanic Origin									
Mexican	345,061	74.87	9.22	58,815	77.09	10.14	286,246	74.43	9.03
Central or South American	31,295	6.79	9.6	1,150	1.51	9.48	30,145	7.84	9.61
Cuban	1,538	0.33	9.04	114	0.15	8.77	1,424	0.37	9.07
Puerto Rican	4,421	0.96	10.75	516	0.68	6.99	3,905	1.02	11.24
Other and unknown Hispanic	78,580	17.05	10.46	15,702	20.58	12.71	62,878	16.35	9.9

Results

Table 1. Demographic and pregnancy characteristics of Hispanic mothers in border states with live, singleton births in 2013 overall, border counties and non-border counties.

	Overall			Border counties			Non-border counties		
	Total birth		Preterm birth	Total birth		Preterm birth	Total birth		Preterm birth
	N	Col %	%	N	Col %	%	N	Col %	%
Total	**460,895**		**9.46**	**76,297**		**10.62**	**384,598**		**9.23**
Eclampsia									
Yes	642	0.14	35.67	118	0.15	33.05	524	0.14	36.26
No	460,251	99.86	9.43	76,179	99.85	10.6	384,072	99.86	9.2
Not on certificate	2	0.00	0	0	0.00	none	2	0.00	0
Pregnancy Hypertension									
Yes	17,089	3.71	23.83	2,198	2.88	25.61	14,891	3.87	23.56
No	443,804	96.29	8.92	74,099	97.12	10.19	369,705	96.13	8.66
Unknown or not stated	2	0.00	0	0	0.00	none	2	0.00	0
Interval since Last Pregnancy (*R)									
0 to 11 months	9,873	2.14	17.09	1,747	2.29	20.32	8,126	2.11	16.39
12 to 23 months	63,491	13.78	10.04	11,105	14.55	12.19	52,386	13.62	9.59
>= 24 months	194,902	42.29	8.83	29,995	39.31	10.21	164,907	42.88	8.58
N/A (no previous pregnancy)	130,677	28.35	8.84	21,497	28.18	9.6	109,180	28.39	8.69
Unknown or not stated	28,920	6.27	10.99	3,045	3.99	13.12	25,875	6.73	10.74
Not on certificate	33,032	7.17	11.03	8,908	11.68	9.84	24,124	6.27	11.47

Results

Table 1. Demographic and pregnancy characteristics of Hispanic mothers in border states with live, singleton births in 2013 overall, border counties and non-border counties.									
	Overall			Border counties			Non-border counties		
	Total birth		Preterm birth	Total birth		Preterm birth	Total birth		Preterm birth
	N	Col %	%	N	Col %	%	N	Col %	%
Total	460,895		9.46	76,297		10.62	384,598		9.23
Previous preterm birth (*R)									
Yes	6,163	1.34	26.29	842	1.10	17.7	5,321	1.38	27.66
No	421,698	91.50	9.1	66,547	87.22	10.65	355,151	92.34	8.81
Unknown or not stated	2	0.00	0	0	0.00	none	2	0.00	0
Not on certificate	33,032	7.17	11.03	8,908	11.68	9.84	24,124	6.27	11.47
Diabetes (any)									
Yes	26,479	5.75	13.76	3,781	4.96	16.05	22,698	5.90	13.38
No	434,414	94.25	9.21	72,516	95.04	10.35	361,898	94.10	8.98
Unknown	2	0.00	0	0	0.00	none	2	0.00	0

Results

- All Table 1 characteristics were significantly associated with preterm birth in univariate analyses, with p-values of less than 0.001.

- Weight gain per week was different between preterm birth and non-preterm birth groups, with p-values of less than 0.001.
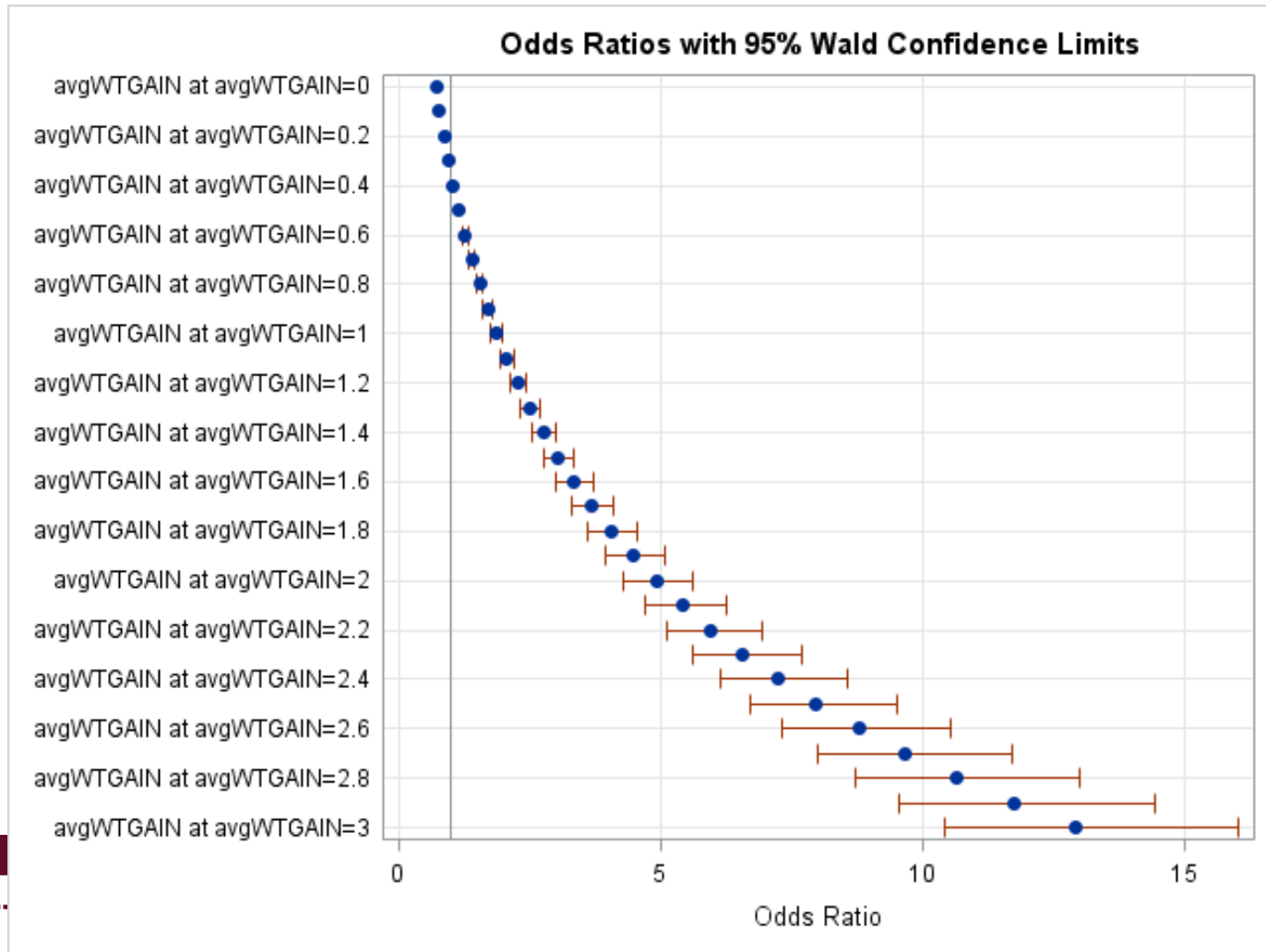
Results for border states

- **Applying backward elimination selection in border states overall, all factors stayed in the model.**

Factors	Adjusted OR	95% CI
Eclampsia vs No eclampsia	4.49	3.53 to 5.71
A previous preterm birth vs No previous preterm birth	3.05	2.86 to 3.26
Pregnancy hypertension vs No pregnancy hypertension	2.97	2.84 to 3.10
No prenatal care vs Received prenatal care	1.98	1.87 to 2.10
Short interpregnancy interval (0-11 months) vs No previous pregnancy	1.87	1.73 to 2.02

Results for border states

- Other risk factors: age younger than 20 or 30 years and older (vs 20-29),

New Mexico or Texas residence (vs California residence),

less than high school education (vs high school),

pre-pregnancy BMI of underweight (vs normal),

Puerto Rican or other and unknown Hispanic origin (vs Mexican origin),

live birth order of four or greater (vs one),

diabetes,

smoked during pregnancy,

- Protective factors: education of more than high school, born in Mexico (vs U.S.), married.

Weight gain per week (pounds/week) was quadratically associated with preterm birth

All About Discovery! ™
New Mexico State University
nmsu.edu

Results for overall border and non-border counties

- Mothers with diabetes and Texas residence had higher ORs in the border counties than in the non-border counties.

Table3. Adjusted odds ratios (ORs) for preterm birth among live, singleton births to Hispanic women in border states overall, border counties and non-border counties.

	Overall (370643)			Border counties (61641)			Non-border counties (309002)		
	OR	95% CI		OR	95% CI		OR	95% CI	
Diabetes (any)									
Yes	1.322	1.265	1.382	1.537	1.378	1.713	1.295	1.233	1.359
No	1			1			1		
Mothers Residence State									
CA	1			1			1		
NM	1.196	1.111	1.287	1.584	1.224	2.05	1.326	1.22	1.441
TX	1.464	1.428	1.501	2.517	2.019	3.137	1.341	1.304	1.379

Results for overall border and non-border counties

- Mothers who did not receive prenatal care and had previous preterm birth had higher ORs in the non-border counties than in the border counties.

Table3. Adjusted odds ratios (ORs) for preterm birth among live, singleton births to Hispanic women in border states overall, border counties and non-border counties.

	Overall (370643)			Border counties (61641)			Non-border counties (309002)		
	OR	95% CI		OR	95% CI		OR	95% CI	
Prenatal care (*R)									
No prenatal care	1.98	1.87	2.10	1.49	1.32	1.67	2.20	2.05	2.35
Had prenatal care	1			1			1		
Previous preterm birth (*R)									
Yes	3.05	2.86	3.26	1.88	1.52	2.33	3.40	3.17	3.65
No	1			1			1		

Disparities of risk factors in border states

	Border states	Border counties	Non-border counties
Adjusted OR and 95% confidence interval			
A previous preterm birth vs no previous preterm birth			
Overall	3.05, (2.86 - 3.26)	1.88, (1.52 - 2.33)	3.40, (3.17 - 3.65)
CA	4.82, (4.35 - 5.34)	5.64, (3.33 - 9.56)	4.78, (4.30 - 5.31)
NM	1.09, (0.82 - 1.46)	0.72, (0.48 - 1.07)	2.06, (1.28 - 3.30)
TX	2.61, (2.38 - 2.86)	3.31, (2.45 - 4.48)	2.67, (2.42 - 2.94)
Pregnancy hypertension vs no pregnancy hypertension			
Overall	2.97, (2.84 - 3.10)	2.98, (2.65 - 3.36)	3.01, (2.87 - 3.15)
CA	3.54, (3.32 - 3.78)	4.4, (3.47 - 5.58)	3.48, (3.25 - 3.72)
NM	2.61, (1.95 - 3.48)	1.26, (0.59 - 2.70)	3.16, (2.30 - 4.36)
TX	2.61, (2.46 - 2.76)	2.70, (2.35 - 3.10)	2.64, (2.48 - 2.82)
No prenatal care vs had prenatal care			
Overall	1.98, (1.87 - 2.10)	1.49, (1.32 - 1.67)	2.20, (2.05 - 2.35)
CA	3.20, (2.75 - 3.73)	1.37, (0.82 - 2.29)	3.70, (3.15 - 4.35)
NM	1.61, (1.07 - 2.42)	1.68, (0.95 - 2.95)	1.64, (0.89 - 3.01)
TX	1.85, (1.73 - 1.98)	1.50, (1.32 - 1.7)	1.97, (1.82 - 2.13)

Disparities of risk factors in border states

Adjusted OR and 95% confidence interval			
	Border states	**Border counties**	**Non-border counties**
	Other and Unknown Hispanic origin vs Mexican origin		
Overall	1.12, (1.08 - 1.15)	1.04, (0.97 - 1.11)	1.09, (1.05 - 1.13)
CA	1.14, (1.09 - 1.20)	1.09, (0.69 - 1.71)	1.14, (1.08 - 1.20)
NM	0.81, (0.68 - 0.96)	0.60, (0.43 - 0.82)	0.92, (0.75 - 1.14)
TX	1.11, (1.06 - 1.15)	1.08, (1.01 - 1.17)	1.06, (1.00 - 1.11)

- Compared to Mexican origin, other and unknown Hispanics were protective in NM while identified as a risk factor in CA and TX in general.

  -- Explained why mother's Hispanic origin was not a risk factor in the border counties.

- CA border counties were doing worse in previous preterm birth and pregnancy hypertension than TX border counties.
- What factors could be associated with the following percentages in the border counties (12.67 vs 6.62)?

Table 1. Demographic and pregnancy characteristics of Hispanic mothers in border states with live, singleton births in 2013 overall, border counties and non-border counties.

	Overall			Border counties			Non-border counties		
	Total birth		Preterm birth	Total birth		Preterm birth	Total birth		Preterm birth
	N	Col %	%	N	Col %	%	N	Col %	%
Total	460,895		9.46	76,297		10.62	384,598		9.23
Mother's Residence State									
AZ	33,055	7.17	11.05	8,899	11.66	9.82	24,156	6.28	11.5
CA	232,846	50.52	7.78	20,197	26.47	6.62	212,649	55.29	7.89
NM	14,064	3.05	10.69	3,199	4.19	10.13	10,865	2.83	10.85
TX	180,930	39.26	11.26	44,002	57.67	12.67	136,928	35.60	10.81

Adjusted OR and 95% confidence interval	
	Border counties
	Eclampsia vs no eclampsia
Overall	4.25, (2.59 - 6.96)
CA	3.04, (0.67 - 13.76)
TX	4.47, (2.43 - 8.24)
	No prenatal care vs had prenatal care
Overall	1.49, (1.32 - 1.67)
CA	1.37, (0.82 - 2.29)
TX	1.50, (1.32 - 1.70)
	Education of less than high school vs high school
Overall	1.07, (1.00 - 1.15)
CA	0.93, (0.78 - 1.10)
TX	1.12, (1.04 - 1.21)
	Other and Unknown Hispanic origin vs Mexican origin
Overall	1.04, (0.97 - 1.11)
CA	1.09, (0.69 - 1.71)
TX	1.08, (1.01 - 1.17)

- In the border counties, some factors were significant in TX but not (less significant) in CA.
- Or some factors were protective in CA but not (or less protective) in TX (none).

	Border counties
	Maternal age <20 vs 20-29
Overall	1.12, (1.03 - 1.23)
CA	1.14, (0.91 - 1.43)
TX	1.11, (1.01 - 1.23)
	Maternal age 30-39 vs 20-29
Overall	1.17, (1.10 - 1.25)
CA	1.15, (0.99 - 1.33)
TX	1.17, (1.09 - 1.27)
	Maternal age >=40 vs 20-29
Overall	1.51, (1.28 - 1.79)
CA	1.26, (0.87 - 1.83)
TX	1.56, (1.29 - 1.89)

Results for Texas

- TX was the only state where preterm birth was more prevalent in the border counties than non-border counties. Why?

Adjusted OR and 95% confidence interval			
	Border counties	**Non-border counties**	**Reason**
Interval since last pregnancy of 12-23 months vs no previous pregnancy	1.22, (1.03 - 1.45)	1.07, (0.96 - 1.19)	Significant vs non-significant
Diabetes (any) ?	1.50, (1.31 - 1.71)	1.30, (1.21 - 1.39)	Significant vs less significant
Previous preterm birth ?	3.31, (2.45 - 4.48)	2.67, (2.42 - 2.94)	Significant vs less significant
WIC	1.07, (0.99 – 1.15)	0.91, (0.87 – 0.95)	Not protective vs protective

Comparisons between 2009 and 2013 preterm birth proportions

	Border states		Border counties		Non-border counties	
	2009	2013	2009	2013	2009	2013
U.S. border	11.6	9.46	12.8	10.62	11.4	9.23
TX	13.1	11.26	14.7	12.67	12.6	10.81
CA	10.3	7.78	9.3	6.6	10.4	7.89
NM	12.6	10.69	13.6	10.13	12.3	10.85
AZ	12.8	11.05	11.2	9.82	13.3	11.5

Summary

Comparisons of risk factors between overall border counties and non-border counties

ORs in the border counties		ORs in the non-border counties
Diabetes (CA, TX)	>	Diabetes
TX residents (interpregnancy of 12-23 months)	>	TX residents (WIC is protective)
No prenatal care	<	No prenatal care (CA, TX)
Smoked during pregnancy: not significant (not a risk factor in every state)	≠	Smoked during pregnancy: significant in every state

Summary

- **Risk factors across border states**: eclampsia, pregnancy hypertension, no prenatal care, short interpregnancy interval (vs no previous birth), maternal age <20 (vs 20-29), smoked during pregnancy, diabetes, too much average weight gain.

- **Risk factors in CA and TX but not in NM**: a previous preterm birth, maternal age >=30 (vs 20-29), pre-pregnancy BMI of underweight (vs normal), other and unknown Hispanic origin (vs Mexican), parity of 4 or greater, county of population 500k to 1000k (vs 100k to 250k).

- **Protective factors across border states**: Education of more than high school (vs high school) and mother's birth country of Mexico (vs U.S.).

- **Protective factors in CA and TX but not in NM**: married.

Summary

- Even though California is one of the states with lowest preterm birth rate, serious issues in California (higher OR than border states overall) need to be brought into attention if a mom:

- **has a previous preterm birth** (both in border and non-border counties),

- **is diagnosed with pregnancy hypertension** (both in border and non-border counties),

- **does not receive prenatal care** (in non-border counties).

Next steps

- Re-run with 2015 data

- What happened to TX?
- What happened to CA?
- ......

Thank you!

Results

Table 1. Demographic and pregnancy characteristics of Hispanic mothers in border states with live, singleton births in 2013 overall, border counties and non-border counties.

	Overall			Border counties			Non-border counties		
	Total birth		Preterm birth	Total birth		Preterm birth	Total birth		Preterm birth
	N	Col %	%	N	Col %	%	N	Col %	%
Total	**460,895**		**9.46**	**76,297**		**10.62**	**384,598**		**9.23**
Population of Residence County									
County of 1,000,000 or more	256,672	55.69	9.13	17,470	22.90	6.74	239,202	62.20	9.3
County of 500,000 to 1,000,000	79,398	17.23	9.88	31,585	41.40	12.21	47,813	12.43	8.35
County of 250,000 to 500,000	43,325	9.40	9.09	6,831	8.95	12.4	36,494	9.49	8.47
County of 100,000 to 250,000	44,874	9.74	9.72	13,149	17.23	10.02	31,725	8.25	9.6
County of 50,000 to 100,000	13,924	3.02	10.82	1,712	2.24	14.19	12,212	3.18	10.35
County of 25,000 to 50,000	12,319	2.67	10.62	3,179	4.17	9.78	9,140	2.38	10.91
County of 10,000 to 25,000	7,647	1.66	11.86	1,659	2.17	15.25	5,988	1.56	10.92
County less than 10,000	2,736	0.59	12.43	712	0.93	15.03	2,024	0.53	11.52

Results

	Overall (370643)			Border counties (61641)			Non-border counties (309002)		
	OR	95% CI		OR	95% CI		OR	95% CI	
Mother's Residenc State									
CA	1			1			1		
TX	1.568	1.533	1.604	2.12	1.984	2.267	1.47	1.433	1.508
Live Birth Order (Parity)									
1	1			1			1		
≥ 4	1.337	1.294	1.38	1.547	1.437	1.666	1.296	1.251	1.343
Population of Residence County									
County of 100,000 to 250,000	1			1			1		
County of 25,000 or less	1.273	1.184	1.368	1.533	1.338	1.757	1.19	1.092	1.296
Prenatal Care (*R)									
Had prenatal care	1			1			1		
No prenatal care	2.386	2.252	2.527	1.684	1.506	1.883	2.654	2.482	2.839
Previous Preterm Birth (*R)									
Yes	3.585	3.366	3.818	1.843	1.529	2.223	4.011	3.751	4.29
No	1			1			1		
Population of Residence County									
County of 100,000 to 250,000	1			1			1		
County of 1,000,000 or more	0.896	0.862	0.932	0.603	0.549	0.662	0.947	0.906	0.991

Table2. Crude odds ratios (ORs) for preterm birth among live, singleton births to Hispanic women in border states overall, border counties and non-border counties.

Results

Table2. Crude odds ratios (ORs) for preterm birth among live, singleton births to Hispanic women in border states overall, border counties and non-border counties.

	Overall (370643)			Border counties (61641)			Non-border counties (309002)		
	OR	95% CI		OR	95% CI		OR	95% CI	
Mother's Race/Hispanic Origin									
Mexican	1			1			1		
Puerto Rican	1.202	1.078	1.34	0.636	0.427	0.948	1.304	1.164	1.461
Live Birth Order (Parity)									
1	1			1			1		
2,3	0.98	0.956	1.005	1.063	1.003	1.126	0.963	0.936	0.99
Population of Residence County									
County of 100,000 to 250,000	1			1			1		
County of 500,000 to 1,000,000	1.016	0.972	1.062	1.233	1.139	1.334	0.846	0.801	0.894
County of 250,000 to 500,000	0.922	0.877	0.969	1.18	1.065	1.308	0.882	0.832	0.934