

# U.S. MODELS OF INFANT MORTALITY BY RACE/ETHNICITY: ONE SIZE FITS ALL?

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## Background & Significance

- Social Inequality & Stratification: United States
- U. S. Infant Mortality and Race/Ethnicity
- Recent Trends
- Perinatal Issues:
  - Epidemiologic Paradox
  - Health Care Technologies
  - Black/White crossover
  - Birth Outcome Standards
  - Proximate Determinants/Mediators:
    - Birth Weight
    - Gestational Age

## Present Research Aims

- Statistical Relationships: Birth Weight, Gestational Age & Infant Mortality
- Race/Ethnic-Specific Standards
- “Optimum” Zones of Infant Mortality
- Over Time Analyses: Survival Optimums by Race/Ethnicity

## Race/Ethnicity, Birth Outcomes & Infant Mortality

- Linear/Parametric Approaches:
- Dichotomous Approaches
  - Low Birth Weight (< 2,500 g)
  - Preterm Birth (< 37 weeks gestation)
- Conceptual/Methodological Advances
  - Very Low Birth Weight (< 1,500 g)
  - Early Preterm (< 32 weeks gestation)
  - Intrauterine Growth Retardation (IUGR):
    - ✓ Small-for-Gestational-Age (SGA)
    - ✓ Fetal Growth Ratio (FGR)

## Data

- U.S. Vital Statistics Linked Birth/Infant Death Files: 1989-1991 & 1995-1997
- Non-Hispanic White, Non-Hispanic Black & Mexican American Females Births

## Methods

- Race/Ethnic and Gestational Age-Specific Birth Weight Standardization
- Nonparametric Logistic Regression via Generalized Additive Models (GAM):

- $\log P(y) = \alpha + f_1(x_1) + f_2(x_2) + \dots + f_p(x_p)$
- SAS© PROC GAM

- Fitting Generalized Additive Models:

- ✓ Scatterplot Smoothers
- ✓ Backfitting
- ✓ Local-scoring

- *GAM Model: Infant Mortality* =  $\alpha + f_1(\text{Z-score Birth Weight})$
- *Logistic Model: Infant Mortality* =  $\alpha + \beta_1 \text{ Birth Weight} + \beta_2 \text{ Gestational Age}$

- Birth Weight Standardization

- Z-deviations from Optimum:

- Within 39-41 Weeks Gestation
- +? SD Gestational-Age-Specific Mean Birth Weight (GMB)
- Small = Z-score < +? SD GMB
- Heavy = Z-score > +? SD GMB

- Gestational Age Standardization

- Z-deviations from Optimum of 40 Weeks:

- Early = Z-score < 40 Weeks Gestational Age
- Late = Z-score > 40 Weeks Gestational Age

- Interactions E\*S, E\*H, L\*S, L\*H:

## Findings

- Tables 1 through 4 (model “0” equals unadjusted Odd Ratios)
- Infant Mortality Risk Differentials
- Race/Ethnicity
- Birth Weight vs. Gestational Age

Table 1. Logistic Regression Analysis of Infant Mortality: U.S. Females, 1989-1991

<i>OPTIMUM</i>	SPF (+1SD)					SPF (R/E+SD)				
<i>MODEL</i>	0	1	2	3	4	0	1	2	3	4
<b>Race/Ethnicity</b>										
Black	2.234	2.129	2.243	2.145	2.133	2.234	2.129	2.726	2.694	2.544
Mexican	1.042	1.040	1.042	1.033	1.016	1.042	1.040	0.800	0.762	0.799
<b>Gestational Age</b>										
Early Birth (E)	2.341	2.353	---	2.413	2.019	2.341	2.353	---	2.411	1.972
Late Birth (L)	1.400	1.517	---	1.529	1.508	1.400	1.517	---	1.529	1.437
<b>Birth Weight</b>										
Small Weight (S)	2.043	---	2.045	2.283	1.986	1.864	---	2.001	2.229	1.884
Heavy Weight (H)	1.238	---	1.237	1.105	1.807	1.629	---	1.560	1.421	1.877
E*S					1.136					1.149
E*H					0.846					0.921
L*S					1.028 <sup>†</sup>					1.052
L*H					0.925 <sup>†</sup>					1.127*
Intercept		-6.032	-6.045	-7.233	-7.054		-6.032	-6.370	-7.611	-7.281
AIC		314757	359989	299252	297895		314757	360051	299351	298177
-2LL		314747	359979	299238	297873		314747	360041	299337	298155

Table 2 Logistic Regression Analysis of Infant Mortality: U.S. Females, 1995-1997

<i>OPTIMUM</i>	SPF (+1SD)					SPF (R/E+SD)				
<i>MODEL</i>	0	1	2	3	4	0	1	2	3	4
<b>Race/Ethnicity</b>										
Black	2.043	2.011	2.051	2.031	2.028	2.043	2.011	1.822	1.766	1.798
Mexican	1.007	1.022	1.007	1.018	1.009	1.007	1.022	1.480	1.622	1.487
<b>Gestational Age</b>										
Early Birth (E)	2.227	2.286	---	2.341	2.113	2.227	2.286	---	2.338	2.065
Late Birth (L)	1.455	1.540	---	1.547	1.510	1.455	1.540	---	1.546	1.435
<b>Birth Weight</b>										
Small Weight (S)	2.023	---	2.025	2.291	2.109	1.989	---	1.982	2.230	1.998
Heavy Weight (H)	1.290	---	1.287	1.141	1.823	1.571	---	1.520	1.321	1.827
E*S					1.081					1.093
E*H					0.869					0.930
L*S					1.025 <sup>†</sup>					1.051
L*H					1.049 <sup>†</sup>					1.183
Intercept		-6.306	-6.281	-7.511	-7.416		-6.306	-6.428	-7.678	-7.499
AIC		239055	274589	228253	227693		239055	274661	228382	227929
-2LL		239045	274579	228239	227671		239045	274651	228368	227907

Table 3 Logistic Regression Analysis of Infant Mortality by Race/Ethnicity: U.S. Females, 1989-1991

RACE/ETHNICITY OPTIMUM	WHITE			BLACK			MEXICAN					
	SPF (+1SD)			SPF (+1.51SD)			SPF (+1SD)			SPF (+1.90SD)		
	0	1	2	0	1	2	0	1	2	0	1	2
<b>Gestational Age</b>												
Early Birth (E)	2.290	2.347	2.090	2.290	2.345	2.047	2.566	2.635	1.920	2.566	2.634	1.895
Late Birth (L)	1.453	1.464	1.536	1.453	1.463	1.463	1.778	1.796	1.642	1.778	1.795	1.597
<b>Birth Weight</b>												
Small Weight (S)	2.076	2.320	2.142	2.021	2.252	2.020	1.927	2.162	1.634	1.912	2.143	1.590
Heavy Weight (H)	1.313	1.154	1.889	1.783	1.598	2.086	1.057 <sup>†</sup>	0.931 <sup>†</sup>	1.670	1.201	1.064 <sup>†</sup>	1.711
E*S		1.091			1.102			1.244			1.252	
E*H		0.847			0.920			0.821			0.863	
L*S		0.988 <sup>†</sup>			1.012 <sup>†</sup>			1.088*			1.104*	
L*H		0.903 <sup>†</sup>			1.088 <sup>†</sup>			0.871 <sup>†</sup>			0.959 <sup>†</sup>	
Intercept		-7.466	-7.376		-7.814	-7.605		-6.826	-6.432		-6.966	-6.473
AIC		184206	183623		184284	183828		87899	87137		87899	87164
-2LL		184196	183605		184274	183810		87889	87119		87889	87146

Table 4 Logistic Regression Analysis of Infant Mortality by Race/Ethnicity: U.S. Females, 1995-1997

RACE/ETHNICITY OPTIMUM	WHITE			BLACK			MEXICAN					
	SPF (+1SD)			SPF (+1.42SD)			SPF (+1SD)			SPF (+0.79)		
	0	1	2	0	1	2	0	1	2	0	1	2
<b>Gestational Age</b>												
Early Birth (E)	2.233	2.289	2.137	2.233	2.285	2.104	2.460	2.513	2.073	2.460	2.509	2.011
Late Birth (L)	1.477	1.482	1.545	1.477	1.482	1.492	1.788	1.799	1.442	1.788	1.797	1.339
<b>Birth Weight</b>												
Small Weight (S)	2.072	2.345	2.238	2.025	2.278	2.126	1.848	2.089	1.746	1.803	2.024	1.627
Heavy Weight (H)	1.315	1.150	1.873	1.738	1.422	2.073	1.113 <sup>†</sup>	0.972 <sup>†</sup>	1.638	1.549	1.297	1.750
E*S		1.056			1.063			1.150			1.168	
E*H		0.860			0.911			0.873			0.951*	
L*S		0.985 <sup>†</sup>			1.002 <sup>†</sup>			1.162			1.209	
L*H		1.054 <sup>†</sup>			1.175*			1.001 <sup>†</sup>			1.178 <sup>†</sup>	
Intercept		-7.738	-7.698		-8.019	-7.899		-7.051	-6.811		-7.407	-6.963
AIC		138779	138495		138866	138645		61108	60872		61131	60926
-2LL		138769	138477		138856	138627		61098	60854		61121	60908

