

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

OPTIMUM MODEL	SPF (+1SD)					SPF (R/E+SD)				
	0	1	2	3	4	0	1	2	3	4
Race/Ethnicity										
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
Gestational Age										
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
Birth Weight										
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 [†]					1.052
L*H					0.925 [†]					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

OPTIMUM MODEL	SPF (+1SD)					SPF (R/E+SD)				
	0	1	2	3	4	0	1	2	3	4
Race/Ethnicity										
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
Gestational Age										
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
Birth Weight										
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 [†]					1.051
L*H					1.049 [†]					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 (+1SD)			SPF (+1SD)					
	0	1	2	0	1	2	0	1	2			
Gestational Age												
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
Birth Weight												
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 [†]	0.931 [†]	1.670	1.201	1.064 [†]	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 [†]			1.012 [†]			1.088*			1.104*
L*H			0.903 [†]			1.088 [†]			0.871 [†]			0.959 [†]
Intercept			-7.466			-7.814			-6.826			-6.473
AIC			184206			183828			87899			87164
-2LL			184196			183810			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 (+1SD)			SPF (+1SD)					
	0	1	2	0	1	2	0	1	2			
Gestational Age												
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
Birth Weight												
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 [†]	0.972 [†]	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 [†]			1.002 [†]			1.162			1.209
L*H			1.054 [†]			1.175*			1.001 [†]			1.178 [†]
Intercept			-7.738			-7.899			-7.051			-6.963
AIC			138779			138645			61108			60926
-2LL			138769			138627			61098			60908

