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APPENDIX A

ESTIMATED PROBIT COEFFICIENTS FOR MODELS OF INFANT MORTALITY, NEONATAL MORTALITY, AND POSTNEONATAL MORALITY AMONG MEDICAID NEWBORNS

TABLE A.1

ESTIMATED PROBIT COEFFICIENTS FOR A MODEL OF THE EFFECT OF PRENATAL WIC PARTICIPATION ON INFANT MORTALITY

(Standard Errors in Parentheses)

Explanatory Variables	Florida	Minnesota	North Carolina	South Carolina	Texas
Intercept	-2.723 **	-2.238 **	-2.192 **	-2.052 **	-2.314 **
	(.133)	(.172)	(.119)	(.173)	(.102)
Prenatal WIC Participation by 30 Weeks Gestation	-.140 **	-.036	-.205 **	-.587 **	-.169 **
	(.045)	(.067)	(.047)	(.062)	(.055)
Newborn Characteristics					
Male	.220 **	-.044	.075	.152 *	.049
	(.044)	(.064)	(.045)	(.061)	(.048)
Multiple Birth	.626 **	.446 **	.546 **	.669 **	.661 **
	(.089)	(.143)	(.095)	(.126)	(.093)
Mother Characteristics					
Age 18-19	.058	-.069	-.037	.059	-.016
	(.086)	(.127)	(.081)	(.108)	(.097)
Age 20-34	.031	-.200	-.091	.024	.063
	(.081)	(.123)	(.079)	(.098)	(.086)
Age 35 and over	.139	-.230	-.185	.054	.117
	(.144)	(.217)	(.179)	(.209)	(.151)
Black[a]	.253 **	.136	.046	-.077	-.154 *
	(.053)	(.102)	(.054)	(.075)	(.066)
Hispanic[a]	.098	--	--	--	-.139 *
	(.086)				(.057)
Native American	--	-.060	--	--	--
		(.128)			
Asian	--	-.294	--	--	--
		(.171)			
Other race/ethnicity[a]	--	--	--	--	-.195
					(.156)
Not married	.008	-.110	-.016	.097	-.080
	(.053)	(.075)	(.056)	(.075)	(.052)
Kessner Index inadequate	.244 **	.279 **	.344 **	.130	.158 *
	(.063)	(.105)	(.074)	(.084)	(.069)
Kessner Index intermediate	.034	.026	.147 **	-.036	.017
	(.052)	(.080)	(.050)	(.073)	(.061)
Kessner Index unknown	.283 **	.202 *	.301 **	-.042	.294 **
	(.106)	(.098)	(.107)	(.215)	(.084)
Previous live births (number)	.030	.019	.00009	--	-.007
	(.017)	(.028)	(.022)		(.019)
Pregnancy terminations weeks	--	.099 **	.108 **	--	.005
		(.034)	(.033)		(.101)

TABLE A.1 *(continued)*

Explanatory Variables	Florida	Minnesota	North Carolina	South Carolina	Texas
Mother Characteristics (continued)					
Education < 9 years	.200	.313	.018	.402 **	--
	(.107)	(.193)	(.113)	(.117)	
Education 9-11 years	.084	.122	.006	.164	--
	(.084)	(.122)	(.080)	(.117)	
Education 12 years	.085	.113	-.042	.092	--
	(.080)	(.111)	(.075)	(.114)	
Education missing	--	.369 **	--	--	--
		(.139)			
Urban	-.069	-.045	.055	-.113	--
	(.065)	(.073)	(.045)	(.061)	
Prenatal care from public health clinic	-.088	--	--	--	--
	(.071)				
Sample Size	31,747	11,564	20,687	11,773	25,746

SOURCE: WIC-Medicaid newborn database.

NOTE: The dependent variable is equal to one if the Medicaid newborn died within one year after birth, and equal to zero otherwise. In Texas, the dependent variable is equal to one if the Medicaid newborn died within six months after birth, and equal to zero otherwise.

*(**): Significant at the .05 (.01) level, two-tailed test.

[a]Racial/ethnicity groups varied across states. In North Carolina and South Carolina, a small number of women classified neither as white nor black are included with black women. In Texas, "black" means "black, nonspanish," "Hispanic" means "Mexican," and "Other race/ethnicity" means "other Hispanic." In Florida, "other race/ethnicity" means "Native American or Asian."

TABLE A.2

ESTIMATED PROBIT COEFFICIENTS FOR A MODEL OF THE EFFECT OF PRENATAL WIC PARTICIPATION ON NEONATAL MORTALITY

(Standard Errors in Parentheses)

Explanatory Variables	Florida	Minnesota	North Carolina	South Carolina	Texas
Intercept	-2.839 **	-2.543 **	-2.422 **	-2.253 **	-2.505 **
	(.162)	(.245)	(.150)	(.231)	(.133)
Prenatal WIC Participation by 30 Weeks Gestation	-.147 **	.019	-.315 **	-.720 **	-.208 **
	(.056)	(.094)	(.061)	(.081)	(.703)
Newborn Characteristics					
Male	.228 **	-.052	.090	.054	.028
	(.056)	(.088)	(.058)	(.077)	(.060)
Multiple Birth	.701 **	.686 **	.762 **	.841 **	.644 **
	(.100)	(.160)	(.103)	(.139)	(.111)
Mother Characteristics					
Age 18-19	-.025	-.079	-.118	-.063	.133
	(.107)	(.162)	(.109)	(.133)	(.127)
Age 20-34	.008	-.341 *	-.016	-.088	.163
	(.099)	(.161)	(.101)	(.118)	(.117)
Age 35 and over	-.035	-.141	-.035	-.460	.206
	(.197)	(.267)	(.225)	(.383)	(.195)
Black[a]	.264 **	.125	.110	-.039	-.180 *
	(.067)	(.137)	(.071)	(.101)	(.084)
Hispanic[a]	.107	--	--	--	-.136
	(.108)				(.071)
Native American	--	-.222	--	--	--
		(.207)			
Asian	--	-.383	--	--	--
		(.245)			
Other race/ethnicity[a]	--	--	--	--	-.119
					(.181)
Not married	.039	-.090	.083	.232 *	-.081
	(.067)	(.104)	(.076)	(.104)	(.064)
Kessner Index inadequate	.170 *	.242	.221 *	-.078	.061
	(.078)	(.142)	(.097)	(.109)	(.084)
Kessner Index intermediate	.005	-.155	.081	-.109	-.085
	(.064)	(.119)	(.066)	(.092)	(.074)
Kessner Index unknown	.234	.230	.309 *	-.038	.181
	(.132)	(.125)	(.130)	(.246)	(.104)
Previous live births (number)	.014	.002	-.047	--	-.025
	(.021)	(.041)	(.030)		(.025)
Pregnancy terminations weeks	--	.108 *	.104 *	--	.118
		(.045)	(.042)		(.095)

TABLE A.2 *(continued)*

Explanatory Variables	Florida	Minnesota	North Carolina	South Carolina	Texas
Mother Characteristics (continued)					
Education < 9 years	.106	.519	-.079	.506 **	--
	(.130)	(.269)	(.147)	(.190)	
Education 9-11 years	-.005	.184	-.042	.227	--
	(.099)	(.193)	(.098)	(.163)	
Education 12 years	-.001	.228	-.145	.200	--
	(.094)	(.178)	(.091)	(.157)	
Education missing	--	.574	--	--	--
		(.204)			
Urban	-.021	-.044	.050	-.140	--
	(.084)	(.102)	(.059)	(.079)	
Prenatal care from public health clinic	-.157	--	--	--	--
	(.094)				
Sample Size	31,747	11,564	20,687	11,773	25,746

SOURCE: WIC-Medicaid newborn database.

NOTE: The dependent variable is equal to one if the Medicaid newborn died within 28 days after birth, and equal to zero otherwise.

*(**): Significant at the .05 (.01) level, two-tailed test.

[a]Racial/ethnicity groups varied across states. In North Carolina and South Carolina, a small number of women classified neither as white nor black are included with black women. In Texas, "black" means "black, nonspanish," "Hispanic" means "Mexican," and "Other race/ethnicity" means "other Hispanic." In Florida, "other race/ethnicity" means "Native American or Asian."

TABLE A.3

ESTIMATED PROBIT COEFFICIENTS FOR A MODEL OF THE EFFECT OF PRENATAL WIC PARTICIPATION ON POSTNEONATAL MORTALITY

(Standard Errors in Parentheses)

Explanatory Variables	Florida	Minnesota	North Carolina	South Carolina	Texas
Intercept	-3.119 **	-2.510	-2.555 **	2.487 **	-2.682 **
	(.196)	(.218)	(.165)	.229	(.139)
Prenatal WIC Participation by 30 Weeks Gestation	-.105	-.073	-.057	-.335 **	-.099
	(.063)	(.083)	(.062)	(.082)	(.075)
Newborn Characteristics					
Male	.176 **	-.027	.043	.229 **	.069
	(.061)	(.080)	(.058)	(.082)	(.067)
Multiple Birth	.353 **	-.258	.028	.158	.546 **
	(.139)	(.257)	(.171)	(.228)	(.128)
Mother Characteristics					
Age 18-19	.154	-.045	.024	.193	-.188
	(.121)	(.170)	(.102)	(.155)	(.132)
Age 20-34	.064	-.048	-.156	.154	-.043
	(.116)	(.162)	(.104)	(.144)	(.110)
Age 35 and over	.290	.293	-.350	.411	-.004
	(.186)	(.310)	(.248)	(.238)	(.203)
Black[a]	.200 **	.119	-.020	-.148	-.096
	(.073)	(.128)	(.069)	(.096)	(.091)
Hispanic[a]	.073	--	--	--	-.117
	(.119)				(.080)
Native American	--	.026	--	--	--
		(.148)			
Asian	--	-.183	--	--	--
		(.211)			
Other race/ethnicity[a]	--	--	--	--	-.266
					(.245)
Not married	-.033	-.110	-.102	-.042	-.068
	(.071)	(.094)	(.071)	(.094)	(.072)
Kessner Index inadequate	.292 **	.272 *	.409 **	.326 **	.274 **
	(.086)	(.131)	(.095)	(.111)	(.100)
Kessner Index intermediate	.069	.140	.190 **	.048	.160
	(.073)	(.098)	(.066)	(.100)	(.090)
Kessner Index unknown	.297	.120	.214	-.086	.400 **
	(.144)	(.132)	(.153)	(.349)	(.118)
Previous live births (number)	.041	.031	.044	--	.016
	(.022)	(.035)	(.027)		(.025)
Pregnancy terminations	--	.074	.094 *	--	-.396
		(.044)	(.042)		(.290)

TABLE A.3 *(continued)*

Explanatory Variables	Florida	Minnesota	North Carolina	South Carolina	Texas
Mother Characteristics (continued)					
Education < 9 years	.306	.137	.154	.198	--
	(.159)	(.242)	(.152)	(.184)	
Education 9-11 years	.208	.083	.095	.070	--
	(.131)	(.142)	(.118)	(.144)	
Education 12 years	.207	.036	.106	-.033	--
	(.127)	(.130)	(.112)	(.141)	
Education missing	--	.141	--	--	--
		(.178)			
Urban	-.113	-.033	.053	-.070	--
	(.085)	(.092)	(.058)	(.081)	
Prenatal care from public health clinic	.001	--	--	--	--
	(.091)				
Sample Size	31,747	11,564	20,687	11,773	25,746

SOURCE: WIC-Medicaid newborn database.

NOTE: The dependent variable is equal to one if the Medicaid newborn died between 28 days after birth and one year after birth, and equal to zero otherwise. In Texas, the dependent variable is equal to one if the Medicaid newborn died between 28 days after birth and 6 months after birth, and equal to zero otherwise.

*(**): Significant at the .05 (.01) level, two-tailed test.

[a]Racial/ethnicity groups varied across states. In North Carolina and South Carolina, a small number of women classified neither as white nor black are included with black women. In Texas, "black" means "black, nonspanish," "Hispanic" means "Mexican," and "Other race/ethnicity" means "other Hispanic." In Florida, "other race/ethnicity" means "Native American or Asian."

APPENDIX B

ESTIMATES FROM A STRUCTURAL MODEL OF INFANT MORTALITY AND LOW BIRTHWEIGHT

This appendix presents analysis results from estimating a structural model of infant mortality and low birthweight. Conceptually, birthweight depends on prenatal WIC participation (and other factors) and infant mortality depends on both birthweight and prenatal WIC participation (and other factors). Thus, the model specifies two effects of WIC participation on infant mortality--a direct effect, controlling for birthweight, and an indirect effect operating through WIC's effect on birthweight and birthweight's effect on infant mortality. A priori, we would expect most of the effect of WIC to be indirect. We expect this for two reasons: (1) since the main WIC benefit is food supplementation, we would expect the most primary effect of prenatal WIC participation to be higher newborn birthweight, and (2) the previous literature documents clearly that birthweight is the most important predictor of infant mortality.

MODEL

For Medicaid birth i (i = 1, 2, ..., N), the structural equations are:

$$(1) \quad y_{1i}^{*} = \beta_1' X_{1i} + \alpha_1 WIC_i + u_{1i}$$

$$(2) \quad y_{2i}^{*} = \beta_2' X_{2i} + \alpha_2 WIC_i + \gamma_2 y_{1i}^{*} + u_{2i}$$

$$(3) \quad y_{1i} = \begin{cases} 1 \text{ if } y_{1i}^{*} > 0 \\ 0 \text{ otherwise} \end{cases}$$

$$(4) \quad y_{2i} = \begin{cases} 1 \text{ if } y_{2i}^{*} > 0 \\ 0 \text{ otherwise} \end{cases}$$

where y_{1i}^{*} and y_{2i}^{*} are continuous latent variables measuring the propensity for low birthweight and infant mortality, respectively, y_{1i} and y_{2i}--the observed realizations of the underlying latent variables--are binary endogenous variables denoting low birthweight and infant death, respectively, and X_{1i} and X_{2i} are column vectors of exogenous variables with K_1 and K_2 elements, respectively.[1] In this model, the latent variable

[1]In this model, the observed birthweight variable is specified as a dichotomous variable denoting whether the infant was low birthweight (birthweight less than 2,500 grams) or not. We also estimated a model of infant mortality and birthweight with a continuous variable for birthweight.

for the propensity for low birthweight is a determinant of infant mortality, but infant mortality does not determine low birthweight.

One important issue that arises in the estimation of the infant mortality and low birthweight equations is the extent to which the determinants of low birthweight (X_1 variables) are not identical to the determinants of infant mortality (X_2 variables). If the determinants of low birthweight and infant mortality are nearly or almost identical then it is extremely difficult to separate the effect of a given explanatory variable on low birthweight from its effect on infant mortality. In this case, the resulting parameter estimates have large standard errors and are very imprecise.

Table B.1 shows the exogenous variables included in the structural equations. In the infant mortality structural equation, the following variables were included (if they were available in the state's database): low birthweight, prenatal WIC participation by 30 weeks, male, multiple birth, race or ethnicity, Kessner Index variables denoting the adequacy of prenatal care, urban residence, and whether the source of prenatal care was a public health clinic. Variables for the mother's age and education, previous live births, and number of pregnancy terminations were not included in the structural equation for infant mortality, but were included as predictors of low birthweight.

The structural equations (1) and (2) can also be written in reduced form notation, which expresses each of the two endogenous variables (low birthweight and infant mortality) entirely in terms of the exogenous variables. The reduced form equations are:

---

but the results from those models were unrealistic and not robust. The most puzzling result was that birthweight had either a very small negative effect or, in two of the states, a positive effect on infant mortality. This finding made little sense in the context of the literature on infant mortality and led us to reconsider the model specification. Specifically, we favored a model in which some threshold value for birthweight (such as low birthweight or very low birthweight) is a predictor of infant mortality, in contrast to a model that specifies (implausibly) a linear effect of birthweight on infant mortality.

TABLE B.1

EXPLANATORY VARIABLES IN THE STRUCTURAL EQUATIONS FOR LOW BIRTHWEIGHT AND INFANT MORTALITY

Explanatory Variables	Low Birthweight	Infant Mortality
Intercept	X	X
Prenatal WIC Participation by 32 Weeks Gestation	X	X
Low Birthweight		X
Male Newborn	X	X
Multiple Birth	X	X
Mother Age 18-19	X	
Mother Age 20-34	X	
Mother Age 35 and over	X	
Black[a]	X	X
Hispanic[a]	X	X
Native American	X	X
Asian	X	X
Other race/ethnicity[a]	X	X
Not married	X	
Kessner Index inadequate	X	X
Kessner Index intermediate	X	X
Kessner Index unknown	X	X
Previous live births (number)	X	
Pregnancy terminations (number)	X	
Education < 9 years	X	
Education 9-11 years	X	
Education 12 years	X	
Education missing	X	
Urban		X
Prenatal care from public health clinic	X	X

[a]Racial/ethnicity groups varied across states. In North Carolina and South Carolina, a small number of women classified neither as white nor black are included with black women. In Texas, "black" means "black, nonspanish," "Hispanic" means "Mexican," and "Other race/ethnicity" means "other Hispanic."

$$(5) \quad y_{1i}^{*} = \beta_1' X_{1i} + \alpha_1 WIC_i + u_{1i}$$

$$(6) \quad y_{2i}^{*} = \beta_2' X_{2i} + (\alpha_2 + \gamma_2 \alpha_1) WIC_i + \gamma_2 \beta_i' X_{1i} + (u_{2i} + \gamma_2 u_{1i}),$$

where $(\alpha_2 + \gamma_2 \alpha_1)$ is the reduced-form coefficient of prenatal WIC participation in the infant mortality equation. This reduced-form coefficient is also interpreted as the total effect of WIC, which can be separated into an indirect and direct effect as follows:

Indirect effect: $\gamma_2 \alpha_1$

Direct effect: α_2

A two-stage limited information estimator was used to estimate this joint model of infant mortality and low birthweight. The first stage involves estimating the reduced form equations for low birthweight and infant mortality using probit, a maximum likelihood estimation procedure for binary dependent variables. The second stage involves estimating the structural coefficients using generalized least squares estimation.

EMPIRICAL RESULTS

Reduced Form Coefficients. Tables B.2 and B.3 present estimates of the reduced form probit coefficients for the infant mortality and low birthweight equations.[2] With only one exception, prenatal WIC participation by 30 weeks gestation is associated with a significant reduction in the likelihood of both an infant death and low birthweight. The one exception is Minnesota, where the reduced-form coefficient of prenatal WIC participation is not statistically significant in the infant mortality equation.

Infant mortality and low birthweight among Medicaid newborns are also significantly related to the adequacy of prenatal care. In four of the five

[2]Probit coefficients do not have an intuitive interpretation except to show the direction of the effects of the independent variables on the likelihood of an infant death. In presenting the structural coefficient estimates below, the coefficients are used to calculate the probability of an infant death with and without prenatal WIC participation.

TABLE B.2

REDUCED FORM ESTIMATES OF A MODEL OF INFANT MORTALITY AMONG MEDICAID NEWBORNS
(Standard Errors in Parentheses)

Explanatory Variables	Florida	Minnesota	North Carolina	South Carolina	Texas
Intercept	-2.721 **	-2.213 **	-2.192 **	-2.050 **	-2.303 **
	(.145)	(.190)	(.119)	(.174)	(.102)
Prenatal WIC Participation by 30 Weeks Gestation	-.139 **	-.040	-.205 **	-.587 **	-.165 **
	(.047)	(.069)	(.049)	(.063)	(.057)
Newborn Characteristics					
Male	.220 **	-.035	.075	.153 *	.047
	(.046)	(.069)	(.045)	(.063)	(.050)
Multiple Birth	.628 **	.377 *	.545 **	.669 **	.665 **
	(.089)	(.158)	(.010)	(.132)	(.096)
Mother Characteristics					
Age 18-19	.062	-.102	-.036	.058	-.029
	(.090)	(.143)	(.082)	(.116)	(.099)
Age 20-34	.030	-.215	-.091	.023	.052
	(.083)	(.144)	(.081)	(.105)	(.087)
Age 35 and over	.139	-.311	-.185	.053	.102
	(.144)	(.222)	(.180)	(.209)	(.156)
Black[a]	.254 **	.124	.046	-.077	-.146 *
	(.055)	(.109)	(.056)	(.086)	(.067)
Hispanic[a]	.108	--	--	--	-.146 *
	(.089)				(.060)
Native American	--	-.124	--	--	--
		(.142)			
Asian	--	-.323	--	--	--
		(.175)			
Other race/ethnicity[a]	--	--	--	--	-.194
					(.159)
Not married	.003	-.139	-.016	.098	-.092
	(.053)	(.079)	(.057)	(.082)	(.053)
Kessner Index inadequate	.243 **	.291 **	.344 **	.129	.148 *
	(.064)	(.109)	(.076)	(.086)	(.071)
Kessner Index intermediate	.035	.027	.148 **	-.036	.014
	(.053)	(.087)	(.052)	(.077)	(.064)
Kessner Index unknown	.290 **	.199 **	.301 **	-.043	.296 *
	(.111)	(.099)	(.110)	(.207)	(.088)
Previous live births (number)	.030	.026	.0002	--	-.003
	(.017)	(.032)	(.022)		(.019)
Pregnancy terminations	--	.099 **	.109 **	--	.008
		(.037)	(.036)		(.118)
Education < 9 years	.174	.248	.018	.402 **	
	(.113)	(.229)	(.119)	(.146)	

TABLE B.2 *(continued)*

Explanatory Variables	Florida	Minnesota	North Carolina	South Carolina	Texas
Education 9-11 years	.084 (.086)	.115 (.128)	.006 (.086)	.163 (.123)	
Education 12 years	.083 (.083)	.111 (.115)	-.043 (.079)	.092 (.119)	--
Education missing	--	.323 * (.146)	--	--	--
Urban	-.073 (.066)	-.033 (.077)	.055 (.046)	-.113 (.064)	
Prenatal care from public health clinic	-.083 (.072)	--	--	--	--
Sample Size	31,732	11,547	20,687	11,773	25.710

SOURCE: WIC-Medicaid newborn database.

NOTE: The dependent variable is equal to one if the Medicaid newborn died within one year after birth, and equal to zero otherwise. In Texas, the dependent variable is equal to one if the Medicaid newborn died within six months after birth, and equal to zero otherwise.

*(**): Significant at the .05 (.01) level, two-tailed test.

--: Variable not on the state database.

[a]Racial/ethnicity groups varied across states. In North Carolina and South Carolina, a small number of women classified neither as white nor black are included with black women. In Texas, "black" means "black, nonspanish," "Hispanic" means "Mexican," and "Other race/ethnicity" means "other Hispanic."

TABLE B.3

REDUCED-FORM ESTIMATES OF A MODEL OF LOW BIRTHWEIGHT AMONG MEDICAID NEWBORNS
(Standard Errors in Parentheses)

Explanatory Variable	Florida	Minnesota	North Carolina	South Carolina	Texas
Intercept	-1.440 **	-1.666 **	-1.431 **	-1.228 **	-1.203 **
	(.058)	(.097)	(.064)	(.090)	(.045)
Prenatal WIC Participation by 32 Weeks Gestation	-.172 **	-.104 **	-.196 **	-.255 **	-.104 **
	(.020)	(.067)	(.025)	(.033)	(.024)
Newborn Characteristics					
Male	-.120 **	-.122 **	-.082 **	-.094 **	-.089 **
	(.020)	(.036)	(.023)	(.031)	(.022)
Multiple Birth	1.709 **	1.703 **	1.683 **	1.657 **	1.635 **
	(.050)	(.078)	(.057)	(.081)	(.052)
Mother Characteristics					
Age 18-19	-.047	-.088	-.019	-.069	-.134 **
	(.039)	(.076)	(.044)	(.056)	(.040)
Age 20-34	.027	.014	.050	-.068	-.089 *
	(.036)	(.071)	(.042)	(.051)	(.036)
Age 35 and over	.264 **	.014	.178 **	.140	.018
	(.065)	(.119)	(.084)	(.104)	(.069)
Black[a]	.273 **	.371 **	.215 **	.174 **	.106 **
	(.023)	(.056)	(.028)	(.041)	(.030)
Hispanic[a]	-.083 *	--	--	--	-.119 **
	(.041)				(.028)
Native American	--	-.241 **	--	--	--
		(.078)			
Asian	--	-.081	--	--	--
		(.084)			
Other race/ethnicity[a]	--	--	--	--	-.216 **
					(.072)
Not married	.036	-.039	-.065 *	.065	.028
	(.024)	(.041)	(.029)	(.038)	(.024)
Kessner Index inadequate	.367 **	.512 **	.421 **	.310 **	.269 **
	(.029)	(.059)	(.042)	(.045)	(.031)
Kessner Index intermediate	.0006	.117 **	.279 **	.033	.005
	(.023)	(.044)	(.025)	(.037)	(.027)
Kessner Index unknown	.279 **	.375 **	.535 **	.441 **	.237 **
	(.053)	(.055)	(.058)	(.101)	(.041)
Previous live births (number)	-.014	-.063 **	-.061 **	--	-.033 **
	(.008)	(.015)	(.011)		(.009)
Pregnancy terminations		.099 **	.106 **	--	.168 **
		(.022)	(.019)		(.042)
Education < 9 years	.034	.320 **	.153 **	.091	--
	(.050)	(.110)	(.060)	(.077)	

TABLE B.3 *(continued)*

Explanatory Variable	Florida	Minnesota	North Carolina	South Carolina	Texas
Mother Characteristics (continued)					
Education 9-11 years	.080 *	.269 **	.114 **	.072	--
	(.036)	(.066)	(.042)	(.056)	
Education 12 years	.003	.194 **	.029	.030	--
	(.034)	(.060)	(.039)	(.054)	
Education missing	--	.254 **	--	--	--
		(.080)			
Urban	.030	-.012	.058 **	-.037	--
	(.031)	(.040)	(.023)	(.031)	
Prenatal care from public health clinic	-.097 **	--	--	--	--
	(.031)				
Sample Size	31,732	11,547	20,687	11,773	25,710

SOURCE: WIC-Medicaid newborn database.

NOTE: The dependent variable is equal to one if newborn birthweight was less than 2,500 grams and equal to zero otherwise.

*(**): Significant at the .05 (.01) level, two-tailed test.

--: Variable not on the state database.

[a]Racial/ethnicity groups varied across states. In North Carolina and South Carolina, a small number of women classified neither as white nor black are included with black women. In Texas, "black" means "black, nonspanish," "Hispanic" means "Mexican," and "Other race/ethnicity" means "other Hispanic."

states, receiving inadequate versus adequate prenatal care is associated with a higher likelihood of an infant death and, in all five states, a higher likelihood of low birthweight. However, receiving intermediate versus adequate levels of prenatal care has no consistent relationship with infant mortality and low birthweight among Medicaid newborns in the five study states.

The reduced form coefficients of the race and ethnicity variables in the infant mortality equations varied across the study states. In Florida, the mortality rate for infants of black Medicaid mothers was significantly higher than the mortality rate for infants of white Medicaid mothers (the omitted category); in Minnesota, North Carolina, and South Carolina, the mortality rate for infants of white and black Medicaid mothers were roughly the same; and in Texas, the 6-month mortality rate for infants of black mothers was significantly less than the mortality rate for infants of white Medicaid mothers.

In contrast to their differential effects on infant mortality across the study states, race and ethnicity had remarkably similar impacts on the probability of low birthweight across the study states. In all five states, newborns born to black Medicaid mothers were significantly more likely to be low birthweight than newborns born to white Medicaid mothers. In Florida and Texas, newborns of Hispanic mothers were less likely to be low birthweight than newborns of white mothers, and in Minnesota, newborns of Native American Medicaid mothers were also less likely to be low birthweight than newborns of white Medicaid mothers.

Structural Coefficients. The structural coefficients for the infant mortality equations are presented in Table B.4. In principle, the structural coefficients enable us to determine whether the total (reduced-form) effects of WIC participation on infant mortality reflect only an indirect effect operating through reductions in the likelihood of low birthweight or whether there is an additional direct effect of prenatal WIC participation on infant mortality. The principal findings from the structural model estimates are the following:

- With the exception of Texas, the structural parameter estimates for prenatal WIC participation, which measure the direct effect of WIC, are not significantly different from zero.

TABLE B.4

STRUCTURAL EQUATION ESTIMATES OF A MODEL OF INFANT MORTALITY AMONG MEDICAID NEWBORNS
(Standard Errors in Parentheses)

Explanatory Variables	Florida	Minnesota	North Carolina	South Carolina	Texas
Intercept	-2.423 **	-1.252 **	-1.517 **	-.383	-2.441 **
	(.471)	(.364)	(.322)	(.694)	(.456)
Prenatal WIC Participation by 30 Weeks Gestation	-.118	.001	-.105	-.279	-.168 *
	(.074)	(.073)	(.066)	(.166)	(.070)
Low Birthweight	.113	.667 **	.524 *	1.190 *	-.094
	(.340)	(.235)	(.232)	(.569)	(.351)
Male Newborn	.234 **	.029	.107 *	.268 **	.058
	(.062)	(.075)	(.049)	(.090)	(.057)
Multiple Birth	.437	-.773	-.301	-1.318	.818
	(.576)	(.427)	(.396)	(.954)	(.571)
Black[a]	.246 *	-.049	-.046	-.306 *	-.170 *
	(.101)	(.136)	(.061)	(.145)	(.072)
Hispanic[a]	.163	--	--	--	-.151 *
	(.090)				(.077)
Native American	--	.113	--	--	-.151 *
		(.147)			(.077)
Asian	--	-.134	--	--	--
		(.163)			
Other race/ethnicity[a]	--	--	--	--	-.221
					(.176)
Kessner Index inadequate	.224	.019	.126	-.236	.172
	(.138)	(.152)	(.118)	(.204)	(.112)
Kessner Index intermediate	.038	-.023	.0002	-.071	.003
	(.052)	(.087)	(.078)	(.084)	(.063)
Kessner Index unknown	.292 *	-.017	.026	-.549	.336
	(.135)	(.124)	(.165)	(.320)	(.116)
Urban	-.082	-.011	.009	-.082	--
	(.067)	(.075)	(.047)	(.072)	
Prenatal care from public health clinic	-.057	--	--	--	--
	(.080)				
Sample Size	31,732	11,547	20,687	11,773	25,710

SOURCE: WIC-Medicaid newborn database.

NOTE: The dependent variable is equal to one if the Medicaid newborn died within one year after birth, and equal to zero otherwise. In Texas, the dependent variable is equal to one if the Medicaid newborn died within six months after birth, and equal to zero otherwise.

*(**): Significant at the .05 (.01) level, two-tailed test.

--: Variable not on the state database.

[a]Racial/ethnicity groups varied across states. In North Carolina and South Carolina, a small number of women classified neither as white nor black are included with black women. In Texas, "black" means "black, nonspanish," "Hispanic" means "Mexican," and "Other race/ethnicity" means "other Hispanic." In Florida, "other race/ethnicity" means "Native American or Asian."

- For Florida, North Carolina, and South Carolina, the structural coefficients of prenatal WIC participation are not statistically significant, while the reduced-form coefficients are statistically significant. In other words, although the total effects of prenatal WIC participation are statistically significant, the direct effects are not.

- In Minnesota, North Carolina, and South Carolina, whether the newborn is low birthweight is one of at most two or three significant predictors of infant mortality. However, in Florida and Texas, low birthweight is ***not*** a significant predictor of infant mortality, which is very surprising. In Texas, low birthweight has a small (but not statistically significant) ***negative*** effect on infant mortality, implying the implausible result that low birthweight babies have lower infant mortality.

Table B.5 provides additional information on the total, direct, and indirect effects of prenatal WIC participation. In this table, the coefficients from both the reduced form and structural equations have been used to calculate predicted infant mortality rates with and without prenatal WIC participation. Using the reduced form infant mortality equation, the difference in the predicted infant mortality rates with and without WIC give an estimate of the total effect of prenatal WIC participation. Using the structural infant mortality equation, the difference in the predicted infant mortality rates with and without WIC give an estimate of the direct effect of prenatal WIC participation. Our principal findings are:

- ***The total effects of WIC participation on infant mortality are very large.*** Although the reduction in infant mortality associated with WIC participation is 9 percent for Minnesota, the reduction in infant mortality is at least 30 percent in each of the other four states, reaching as high as 76 percent for South Carolina.

- ***Relative to the total effects, the direct effects of WIC participation on infant mortality are large from a substantive point of view.*** Except for Minnesota where we estimate a small (and negative but not significant) direct effect, the direct effect is more than half the total effect in each state. Such direct effects seem implausibly large. Because the main WIC benefit is food

TABLE B.5

TOTAL, DIRECT, AND INDIRECT EFFECTS OF PRENATAL WIC PARTICIPATION ON INFANT MORTALITY

	Florida	Minnesota	North Carolina	South Carolina	Texas
Total Effects of WIC					
Infant mortality rate with WIC	8.2	12.5	12.9	8.8	7.1
Infant mortality rate without WIC	11.7	13.8	21.3	36.0	11.0
Difference	-3.5 **	-1.3	-8.4 **	-27.2 **	-3.9 **
Direct Effect of WIC					
Infant mortality rate with WIC	8.7	14.8	16.8	19.1	7.0
Infant mortality rate without WIC	11.8	14.8	21.6	36.0	11.0
Difference	-3.1	0.0	-4.8	-16.9	-4.0 *
Direct Effect as a Proportion of the Total Effect of WIC	.89	--	.57	.62	1.03
Indirect Effect as a Proportion of the Total Effect of WIC	.11	--	.43	.38	-.03

SOURCE: WIC-Medicaid newborn database.

NOTE: The infant mortality rates are the predicted number of infant deaths per 1,000 live births and are based on the reduced form and structural parameter estimates presented in Tables 4-6.

*(**): Significant at the .05 (.01) level, two-tailed test.

supplementation, we expect WIC participation to lower infant mortality mainly indirectly by raising birthweight.

The main conclusion to draw from Tables B.4 and B.5 is that the direct effects of WIC participation on infant mortality cannot be estimated precisely with available data. Even though the estimated direct effects seem large for four of the five states (Table B.5), only the direct effect for Texas can be statistically differentiated from zero (Table B.4). The problem is that the observed variables that most strongly influence the likelihood of low birthweight also strongly influence the likelihood of an infant death, and, thus, we are unable to separate the effects of the explanatory variables on low birthweight from their effects on infant morality. This explains the large standard errors in the infant mortality equation, resulting in the insignificant direct effects of WIC participation on infant mortality, the insignificant effects of low birthweight in Florida and Texas, and the insignificant direct effects of the adequacy of prenatal care in all the study states. To identify more precisely the structural determinants of infant mortality and to separate the direct from indirect effects, we would need variables that are strong determinants of birthweight but have only *indirect* effects on infant mortality operating through birthweight. As it turns out, such variables are either not available or not available in the WIC-Medicaid database.