

3 Bio-demographic Differentials in Childhood Mortality

This section examines the strength and consistency of associations between common bio-demographic variables and childhood mortality. The variables include: sex of the child, multiplicity of birth (singleton, twin, triplet, etc.), order of birth, age of the mother at birth, and length of the inter-birth interval. The impact of these five factors on the risk of early childhood death is thought to be manifest through both biological and behavioral mechanisms. It is also widely believed that with increasing age of the child behavioral factors take on greater importance while biological factors (e.g., constitution at birth) become less important.

The interpretation of these associations is facilitated by examination of the relative strength of the associations across age groups. In addition to under-five mortality and infant mortality, this analysis examines differences in covariate effects across three key under-five age segments: the *neonatal period*, when the effects of the bio-demographic variable on pregnancy outcome per se (low birth weight, birth trauma, intra-partum complications, and heritable defects) are thought to figure prominently; the *postneonatal period*, when children are increasingly exposed to changes in the nutritional regime and to disease agents in the environment; and the *12-59 month period* (i.e., child mortality), when environmental conditions and preventive and curative health interventions assume greater importance.

To minimize problems of truncation bias while at the same time including as many births as possible, the coverage period in this analysis is limited to the 10-year period preceding the survey. Even following this procedure, for certain covariate categories the number of observations for individual surveys is still quite small; therefore, rates based on less than 500 cases are flagged. Risk ratios are presented in addition to rates. *Risk ratio* (or relative risk) is defined as the ratio of the mortality rate in one risk category to the rate in a specified reference category.

3.1 SEX OF THE CHILD

Male children generally experience higher mortality than female children; exceptions to this pattern have been

observed where behavioral factors directly or indirectly favor the health and survival of male children (Hill and Upchurch, 1995). For instance, in settings where the bride's family is responsible for payment of the *bride wealth*, a female child may be viewed as a financial liability. Under such circumstances, patterns of child care and health interventions may be biased against girls.

Table 3.1 presents childhood mortality rates by sex of the child, with corresponding risk ratios. Taking all countries together, under-five mortality is 8 percent higher among males than females (i.e., an unweighted average of 8 percent excess mortality risk). Excess male mortality is most pronounced in the first month of life (24 percent), diminishes considerably during the postneonatal period (6 percent), and essentially disappears in the 12-59 month period.

During the neonatal period, excess male mortality exceeds 30 percent in six countries (Cameroon, Senegal, Zambia, Morocco, Indonesia, and the Dominican Republic), but is less than 10 percent in three countries (Malawi, Niger, and Colombia). In the postneonatal period, only two countries show excess male risk greater than 30 percent (Rwanda and the Philippines), while 13 countries have excess male risk less than 10 percent—four of these have slightly higher female risk.

During ages 12-59 months, only one country (Colombia) has notably high excess male risk (96 percent); most countries have very small or negligible sex differentials, and in five countries female risk exceeds male risk by more than 10 percent. In Pakistan, female child mortality is about one-third higher than male child mortality.

In sum, excess male mortality during the neonatal period is widespread and substantial in some countries. Sex differentials after the neonatal period are generally very small or negligible, with a few exceptions during the postneonatal period (where excess male mortality persists) and during the 12-59 month period (where there is excess female risk).

Table 3.1 Childhood mortality rates and the relative risk of dying by sex

Childhood mortality rates and the relative risk of dying by sex of child, for the ten-year period preceding the survey, Demographic and Health Surveys, 1990-1994

Country	Sex of child	Mortality rates (deaths per 1,000)					Relative risk of dying (reference: female)				
		Neonatal mortality	Post-neonatal mortality	Infant mortality	Child mortality	Under-five mortality	Neonatal mortality	Post-neonatal mortality	Infant mortality	Child mortality	Under-five mortality
Sub-Saharan Africa											
Namibia	M	39.2	27.4	66.6	30.3	94.9	1.24	1.10	1.18	0.88	1.07
	F	31.6	25.0	56.5	34.3	88.9	1.00	1.00	1.00	1.00	1.00
Kenya	M	28.7	37.8	66.6	32.8	97.1	1.14	1.14	1.14	1.01	1.09
	F	25.2	33.3	58.6	32.6	89.3	1.00	1.00	1.00	1.00	1.00
Ghana	M	51.8	27.4	79.2	63.4	137.5	1.29	0.92	1.13	1.02	1.08
	F	40.2	29.9	70.1	62.2	127.9	1.00	1.00	1.00	1.00	1.00
Cameroon	M	48.1	38.3	86.4	63.6	144.5	1.33	1.01	1.16	0.85	1.01
	F	36.3	37.9	74.3	74.8	143.5	1.00	1.00	1.00	1.00	1.00
Senegal	M	47.5	36.1	83.6	95.5	171.0	1.41	1.03	1.22	1.20	1.20
	F	33.6	35.1	68.7	79.5	142.7	1.00	1.00	1.00	1.00	1.00
Rwanda	M	49.1	49.3	98.4	86.9	176.7	1.10	1.33	1.20	1.20	1.19
	F	44.8	37.2	82.1	72.5	148.6	1.00	1.00	1.00	1.00	1.00
Madagascar	M	46.5	56.8	103.2	85.4	179.8	1.18	0.91	1.01	1.04	1.03
	F	39.5	62.3	101.8	81.9	175.3	1.00	1.00	1.00	1.00	1.00
Burkina Faso	M	56.9	57.6	114.5	107.1	209.3	1.25	1.05	1.14	0.97	1.05
	F	45.5	54.8	100.3	110.3	199.5	1.00	1.00	1.00	1.00	1.00
Zambia	M	46.3	59.9	106.2	91.7	188.1	1.37	1.06	1.17	1.08	1.12
	F	33.9	56.7	90.5	85.1	168.0	1.00	1.00	1.00	1.00	1.00
Nigeria	M	49.2	44.7	93.9	117.8	200.6	1.18	0.94	1.05	1.16	1.10
	F	41.8	47.5	89.3	101.6	181.8	1.00	1.00	1.00	1.00	1.00
Malawi	M	50.5	91.1	141.7	125.5	249.4	1.05	1.10	1.09	1.10	1.09
	F	47.9	82.5	130.4	114.4	229.8	1.00	1.00	1.00	1.00	1.00
Niger	M	52.2	83.6	135.8	211.5	318.6	1.02	1.02	1.02	0.91	0.95
	F	51.0	82.0	133.0	231.7	333.9	1.00	1.00	1.00	1.00	1.00
Asia/Near East											
North Africa											
Philippines	M	19.8	23.7	43.5	27.6	69.9	1.21	1.44	1.32	1.12	1.23
	F	16.4	16.5	32.9	24.7	56.8	1.00	1.00	1.00	1.00	1.00
Turkey	M	40.7	29.7	70.5	12.4	82.0	1.20	0.93	1.07	0.91	1.04
	F	34.0	32.0	66.0	13.6	78.7	1.00	1.00	1.00	1.00	1.00
Morocco	M	38.7	30.0	68.6	20.7	88.0	1.33	1.06	1.20	0.88	1.11
	F	29.1	28.3	57.4	23.6	79.6	1.00	1.00	1.00	1.00	1.00
Indonesia	M	38.2	35.4	73.5	29.9	101.2	1.45	1.09	1.25	1.13	1.21
	F	26.3	32.4	58.8	26.5	83.8	1.00	1.00	1.00	1.00	1.00
Pakistan	M	60.1	42.0	102.1	22.0	121.9	1.30	1.07	1.19	0.60	1.03
	F	46.1	39.3	85.5	36.5	118.9	1.00	1.00	1.00	1.00	1.00
Latin America/Caribbean											
Colombia	M	15.2	12.0	27.2	11.0	37.9	1.01	1.04	1.02	1.96	1.18
	F	15.1	11.5	26.6	5.6	32.0	1.00	1.00	1.00	1.00	1.00
Dominican Republic	M	31.4	21.8	53.3	17.5	69.9	1.86	1.21	1.53	0.86	1.28
	F	16.9	18.0	34.9	20.4	54.6	1.00	1.00	1.00	1.00	1.00
Peru	M	33.0	35.1	68.1	28.8	94.9	1.21	1.10	1.15	0.94	1.08
	F	27.2	32.0	59.2	30.6	88.0	1.00	1.00	1.00	1.00	1.00
Grand average	M	42.2	42.0	84.1	64.1	141.7	1.24	1.06	1.14	1.02	1.08
	F	34.1	39.7	73.8	63.1	131.1	1.00	1.00	1.00	1.00	1.00

3.2 SINGLE AND MULTIPLE BIRTHS

Children from multiple births—twins, triplets, etc.—experience higher levels of mortality early in life than do children who are singleton births (Pison, van de Walle, and Sala-Diakanda, 1989). Mortality is especially high during the neonatal period. Important mediating factors include low birth weight, complications before and at birth, and competition for time, attention, and material resources after birth. Twinning is a relatively rare event—about 2 percent of births in the 10 years preceding the surveys occurred in a multiple-birth context. Consequently, only one survey (Indonesia) yielded as many as 500 "multiple-birth children" born during the specified time frame, making country-specific analysis of mortality differentials problematic. Nonetheless, the strength and consistency of the relationship are sufficiently compelling to warrant cautious interpretation of the survey findings.

Table 3.2 presents childhood mortality rates for single and multiple births. Taking all countries together, children of multiple births are almost five times more likely to die during the neonatal period than children who are single births, 2.5 times more likely to die during the postneonatal period, and 1.5 times more likely to die during the 12-59 month period. These findings are similar to those observed by Sullivan, Rutstein, and Bicego (1994) using earlier DHS survey data, and Rutstein (1984) using WFS data.

During infancy, the excess risk to children of multiple births exceeds 150 percent in every country, and in 12 of 20 countries exceeds 250 percent. After infancy, however, there is much more variability in the strength and even direction of the relationship between mortality and twinning. In three countries (Namibia, Kenya, and Ghana), twin deaths during the 12-59 month period are substantially less common than singleton deaths. However, this may be due, at least in part, to sampling fluctuation related to small numbers of observations.

3.3 BIRTH ORDER OF THE CHILD

Survival chances have been shown to vary with birth order (i.e., rank) of the child. In general, first births and births of very high order carry greater than average mortality risk. The factors that combine to produce this effect in the developing country setting are not well understood, nor does the typical U-shaped curve apply to birth order in all studies and in all settings. Certainly, there is a biological basis for

the poor survival experience of first births—namely, that many first births take place before a woman has reached full physical and reproductive maturity, leading to increased perinatal risk and more difficult delivery. Also, a first-time mother may be poorly prepared to handle new roles and responsibilities in her life. Operating as a mitigating factor, first-time young mothers in developing countries tend to be better educated than older, high parity women, and are more likely to use modern health services.

The causal mechanisms explaining heightened risk for high order births are not well understood. While older, high parity women are at increased risk of complications during and after childbirth and for delivery of a genetically impaired child, it appears that in many countries the poor survival experience of high order births is also related to adverse social and economic factors that are both the cause and consequence of high fertility. The degree of risk elevation associated with grand multiparity varies with the level of access to and use of high-quality antenatal and obstetrical services, which are dependent on the level of community development, the economic situation of the household, and the educational level of the mother. That the strength and consistency of the high birth order effect vary from survey to survey and country to country, lends support to this view. To further complicate analysis, however, the birth order-mortality relationship is confounded by the *birth interval effect* (see Section 3.5); and, grand multiparous women, especially those who are young will, by definition, have had a history of rapid childbearing with its associated maternal depletion.

Table 3.3 presents childhood mortality rates for children of birth order 1, 2-3, 4-6, and 7+. The reference category used for calculation of relative risks is birth order 2-3. When looking at the overall (average) influence of birth order on under-five mortality, the impression is one of minimal effects (Figure 3.1). Relative to birth order 2-3, under-five mortality is 5, 2, and 21 percent higher among children of birth orders 1, 4-6, and 7+, respectively. This aggregate statistic, however, "averages-away" notable country-specific patterns and masks underlying and offsetting age-specific effects.

In the majority of countries, first births are at greater risk of dying during the neonatal period. Combining all countries, first births carry 33 percent higher neonatal risk than births of rank 2-3. However, in four surveys—notably those in countries where good maternal health services are

Table 3.2 Childhood mortality rates and the relative risk of dying by status of birth

Childhood mortality rates and the relative risk of dying by status of birth (whether single or multiple birth), for the ten-year period preceding the survey, Demographic and Health Surveys, 1990-1994

Country	Single or multiple birth	Mortality rates (deaths per 1,000)					Relative risk of dying (reference: single birth)				
		Neonatal mortality	Post-neonatal mortality	Infant mortality	Child mortality	Under-five mortality	Neonatal mortality	Post-neonatal mortality	Infant mortality	Child mortality	Under-five mortality
Sub-Saharan Africa											
Namibia	S	32.4	24.1	56.6	32.7	87.4	1.00	1.00	1.00	1.00	1.00
	M	127.1	88.2	215.3	19.4	230.6	3.92	3.66	3.80	0.59	2.64
Kenya	S	23.1	35.2	58.3	32.9	89.3	1.00	1.00	1.00	1.00	1.00
	M	153.1	48.4	201.6	22.7	219.7	6.63	1.38	3.46	0.69	2.46
Ghana	S	39.8	27.6	67.4	63.4	126.6	1.00	1.00	1.00	1.00	1.00
	M	218.5	56.1	274.6	35.4	300.2	5.49	2.03	4.07	0.56	2.37
Cameroon	S	38.0	36.9	74.9	69.1	138.9	1.00	1.00	1.00	1.00	1.00
	M	155.5	70.4	226.0	71.8	281.5	4.09	1.91	3.02	1.04	2.03
Senegal	S	37.8	33.7	71.5	87.2	152.5	1.00	1.00	1.00	1.00	1.00
	M	145.9	108.3	254.2	94.9	325.0	3.86	3.21	3.56	1.09	2.13
Rwanda	S	41.8	42.5	84.3	79.4	157.0	1.00	1.00	1.00	1.00	1.00
	M	300.7	82.4	383.1	93.0	440.5	7.19	1.94	4.54	1.17	2.81
Madagascar	S	40.2	58.2	98.4	83.6	173.8	1.00	1.00	1.00	1.00	1.00
	M	166.6	113.7	280.3	89.0	344.4	4.14	1.95	2.85	1.06	1.98
Burkina Faso	S	47.8	53.4	101.2	106.4	196.8	1.00	1.00	1.00	1.00	1.00
	M	158.2	137.9	296.1	193.0	431.9	3.31	2.58	2.93	1.81	2.19
Zambia	S	33.5	55.7	89.3	86.9	168.4	1.00	1.00	1.00	1.00	1.00
	M	221.4	129.8	351.2	147.6	446.9	6.61	2.33	3.93	1.70	2.65
Nigeria	S	39.3	44.3	83.6	106.0	180.8	1.00	1.00	1.00	1.00	1.00
	M	211.5	96.4	307.9	237.7	472.4	5.38	2.18	3.68	2.24	2.61
Malawi	S	44.0	80.7	124.7	117.7	227.8	1.00	1.00	1.00	1.00	1.00
	M	156.1	211.1	367.2	177.5	479.5	3.55	2.62	2.94	1.51	2.10
Niger	S	45.4	80.9	126.3	218.3	317.0	1.00	1.00	1.00	1.00	1.00
	M	234.5	138.3	372.8	360.2	598.7	5.17	1.71	2.95	1.65	1.89
Asia/Near East/ North Africa											
Philippines	S	16.9	19.3	36.1	26.1	61.3	1.00	1.00	1.00	1.00	1.00
	M	111.6	90.4	202.0	30.5	226.4	6.60	4.68	5.60	1.17	3.69
Turkey	S	34.6	29.5	64.1	12.6	75.9	1.00	1.00	1.00	1.00	1.00
	M	183.3	98.3	281.6	38.6	309.3	5.30	3.33	4.39	3.06	4.08
Morocco	S	31.2	27.9	59.1	22.1	80.0	1.00	1.00	1.00	1.00	1.00
	M	165.1	90.2	255.3	21.7	271.5	5.29	3.23	4.32	0.98	3.39
Indonesia	S	32.4	39.5	71.8	35.2	104.5	1.00	1.00	1.00	1.00	1.00
	M	138.6	117.8	256.4	65.0	304.7	4.28	2.98	3.57	1.85	2.92
Pakistan	S	50.3	40.0	90.2	28.7	116.3	1.00	1.00	1.00	1.00	1.00
	M	220.0	85.1	305.1	73.0	355.8	4.37	2.13	3.38	2.54	3.06
Latin America/ Caribbean											
Colombia	S	12.7	11.2	23.9	8.4	32.1	1.00	1.00	1.00	1.00	1.00
	M	116.1	35.2	151.3	U	151.3	9.14	3.14	6.33	U	4.71
Dominican Republic	S	22.4	19.4	41.8	18.9	60.0	1.00	1.00	1.00	1.00	1.00
	M	131.2	54.4	185.6	19.3	201.2	5.86	2.80	4.44	1.02	3.35
Peru	S	29.1	32.4	61.5	29.1	88.8	1.00	1.00	1.00	1.00	1.00
	M	97.7	106.8	204.5	81.1	269.1	3.36	3.30	3.33	2.79	3.03
Grand average	S	34.6	39.6	74.3	63.2	131.8	1.00	1.00	1.00	1.00	1.00
	M	170.6	98.0	268.6	93.6	333.0	4.93	2.47	3.62	1.48	2.53

U = Unknown (no deaths reported in this age period)

Table 3.3 Childhood mortality rates and the relative risk of dying by birth order

Childhood mortality rates and the relative risk of dying by birth order of the child, for the ten-year period preceding the survey, Demographic and Health Surveys, 1990-1994

Country	Birth order of child	Mortality rates (deaths per 1,000)					Relative risk of dying (reference: birth order 2-3)				
		Neonatal mortality	Post-neonatal mortality	Infant mortality	Child mortality	Under-five mortality	Neonatal mortality	Post-neonatal mortality	Infant mortality	Child mortality	Under-five mortality
Sub-Saharan Africa											
Namibia	1	30.9	25.0	55.9	30.9	85.2	0.93	0.80	0.87	1.04	0.92
	2-3	33.1	31.4	64.5	29.7	92.3	1.00	1.00	1.00	1.00	1.00
	4-6	38.1	23.4	61.5	31.1	90.7	1.15	0.75	0.95	1.05	0.98
Kenya	7+	42.9	21.0	63.8	44.8	105.8	1.30	0.67	0.99	1.51	1.15
	1	33.6	36.2	69.8	26.3	94.2	1.58	1.03	1.24	0.81	1.09
	2-3	21.3	35.0	56.4	32.3	86.8	1.00	1.00	1.00	1.00	1.00
Ghana	4-6	22.9	34.5	57.3	37.6	92.7	1.08	0.99	1.02	1.16	1.07
	7+	36.1	37.5	73.6	32.1	103.3	1.69	1.07	1.30	0.99	1.19
	1	52.5	24.5	77.0	64.9	136.9	1.40	0.77	1.11	1.22	1.15
Cameroon	2-3	37.4	31.7	69.1	53.2	118.6	1.00	1.00	1.00	1.00	1.00
	4-6	41.5	22.3	63.8	72.9	132.0	1.11	0.70	0.92	1.37	1.11
	7+	72.1	43.2	115.3	63.1	171.1	1.93	1.36	1.67	1.19	1.44
Senegal	1	44.8	44.9	89.7	59.1	143.5	1.16	1.27	1.22	0.90	1.06
	2-3	38.5	35.3	73.8	66.0	135.0	1.00	1.00	1.00	1.00	1.00
	4-6	33.8	34.9	68.7	78.4	141.8	0.88	0.99	0.93	1.19	1.05
Rwanda	7+	61.6	41.4	103.0	69.9	165.7	1.60	1.17	1.40	1.06	1.23
	1	53.7	32.6	86.4	83.0	162.2	1.35	0.90	1.13	0.96	1.04
	2-3	39.8	36.4	76.2	86.4	156.2	1.00	1.00	1.00	1.00	1.00
Madagascar	4-6	32.0	32.9	64.9	85.4	144.7	0.80	0.90	0.85	0.99	0.93
	7+	44.4	41.3	85.8	96.8	174.2	1.12	1.13	1.13	1.12	1.12
	1	55.6	44.0	99.6	77.7	169.6	1.39	0.94	1.15	0.96	1.05
Burkina Faso	2-3	40.0	46.9	86.9	81.3	161.2	1.00	1.00	1.00	1.00	1.00
	4-6	41.4	41.6	83.0	76.6	153.2	1.04	0.89	0.96	0.94	0.95
	7+	58.5	40.0	98.6	83.6	173.9	1.46	0.85	1.13	1.03	1.08
Zambia	1	53.4	62.4	115.8	72.3	179.7	1.37	1.02	1.16	0.85	1.02
	2-3	38.9	61.3	100.1	84.9	176.5	1.00	1.00	1.00	1.00	1.00
	4-6	37.1	50.0	87.0	82.2	162.1	0.95	0.82	0.87	0.97	0.92
Nigeria	7+	47.7	67.1	114.8	94.8	198.7	1.23	1.09	1.15	1.12	1.13
	1	71.5	65.3	136.8	114.9	236.0	1.55	1.09	1.29	0.99	1.13
	2-3	46.1	59.9	106.0	115.6	209.4	1.00	1.00	1.00	1.00	1.00
Malawi	4-6	41.3	50.1	91.4	106.1	187.8	0.90	0.84	0.86	0.92	0.90
	7+	58.5	51.9	110.4	92.7	192.9	1.27	0.87	1.04	0.80	0.92
	1	50.8	70.8	121.5	105.1	213.9	1.44	1.16	1.26	1.13	1.19
Niger	2-3	35.2	60.9	96.2	92.6	179.8	1.00	1.00	1.00	1.00	1.00
	4-6	35.3	50.7	86.0	74.8	154.4	1.00	0.83	0.89	0.81	0.86
	7+	42.6	51.8	94.4	85.4	171.7	1.21	0.85	0.98	0.92	0.95
Nigeria	1	50.9	41.9	92.9	90.6	175.1	1.38	0.93	1.13	0.84	0.97
	2-3	37.0	44.9	81.9	108.0	181.1	1.00	1.00	1.00	1.00	1.00
	4-6	42.7	49.4	92.1	110.8	192.7	1.15	1.10	1.12	1.03	1.06
Malawi	7+	61.4	46.8	108.3	137.5	230.9	1.66	1.04	1.32	1.27	1.27
	1	76.8	98.3	175.1	126.8	279.7	1.60	1.13	1.30	0.96	1.12
	2-3	48.1	87.0	135.2	132.0	249.3	1.00	1.00	1.00	1.00	1.00
Niger	4-6	39.6	78.9	118.4	110.8	216.1	0.82	0.91	0.88	0.84	0.87
	7+	40.9	88.8	129.6	109.7	225.1	0.85	1.02	0.96	0.83	0.90
	1	77.9	87.0	164.9	207.1	337.9	1.75	1.14	1.37	0.92	1.06
Niger	2-3	44.6	76.1	120.6	224.8	318.3	1.00	1.00	1.00	1.00	1.00
	4-6	41.6	85.8	127.4	217.5	317.3	0.93	1.13	1.06	0.97	1.00
	7+	57.7	84.8	142.5	236.5	345.3	1.29	1.11	1.18	1.05	1.08

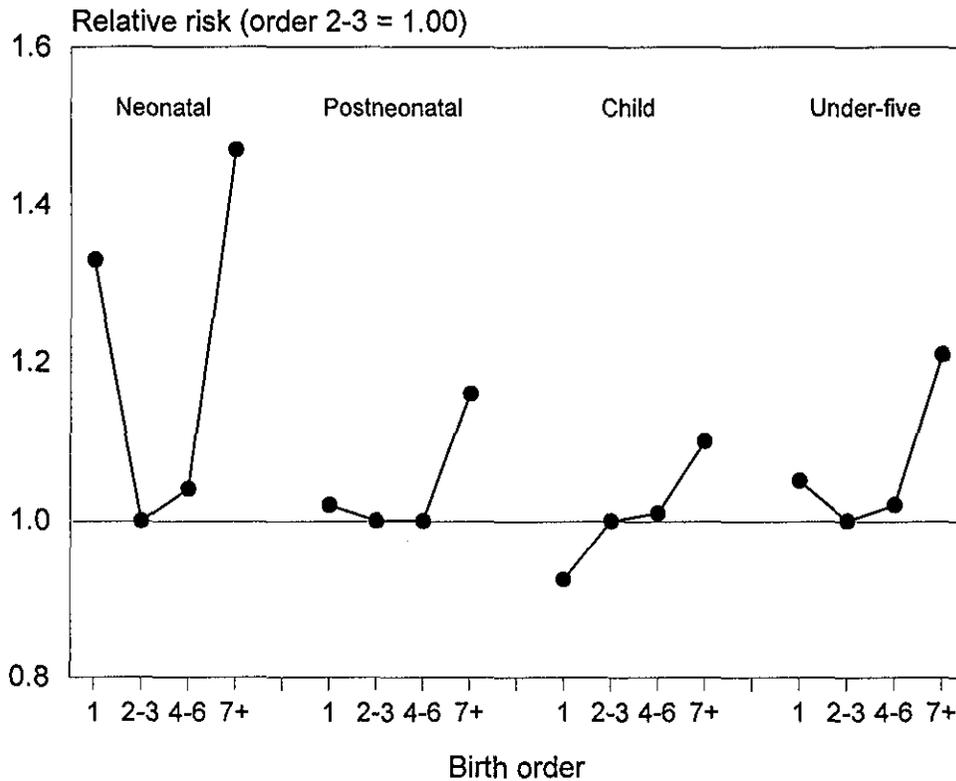
Table 3.3—Cont.

Country	Birth order of child	Mortality rates (deaths per 1,000)					Relative risk of dying (reference: birth order 2-3)				
		Neonatal mortality	Post-neonatal mortality	Infant mortality	Child mortality	Under-five mortality	Neonatal mortality	Post-neonatal mortality	Infant mortality	Child mortality	Under-five mortality
Asia/Near East/ North Africa											
Philippines	1	18.1	10.0	28.1	17.9	45.5	1.30	0.58	0.90	0.74	0.83
	2-3	13.9	17.3	31.2	24.3	54.8	1.00	1.00	1.00	1.00	1.00
	4-6	21.5	26.3	47.8	29.6	75.9	1.55	1.52	1.53	1.22	1.39
	7+	23.0	33.0	55.9	39.8	93.5	1.65	1.91	1.79	1.64	1.71
Turkey	1	37.4	26.6	64.0	8.8	72.2	1.43	1.09	1.26	0.80	1.18
	2-3	26.2	24.4	50.6	11.0	61.0	1.00	1.00	1.00	1.00	1.00
	4-6	41.1	39.3	80.3	20.0	98.7	1.57	1.61	1.59	1.82	1.62
Morocco	7+	75.4	49.7	125.1	16.5	139.5	2.88	2.04	2.47	1.50	2.29
	1	41.9	28.5	70.3	17.3	86.4	1.35	1.01	1.19	0.69	1.05
	2-3	31.0	28.1	59.0	25.1	82.6	1.00	1.00	1.00	1.00	1.00
Indonesia	4-6	27.7	24.7	52.5	23.5	74.7	0.89	0.88	0.89	0.94	0.90
	7+	41.2	38.5	79.8	19.3	97.6	1.33	1.37	1.35	0.77	1.18
	1	29.9	29.8	59.7	21.8	80.2	1.00	1.00	1.00	0.92	0.98
Pakistan	2-3	29.9	29.8	59.7	23.7	81.9	1.00	1.00	1.00	1.00	1.00
	4-6	34.1	38.6	72.7	33.4	103.7	1.14	1.30	1.22	1.41	1.27
	7+	46.9	52.1	98.9	54.1	147.6	1.57	1.75	1.66	2.28	1.80
	1	60.9	37.7	98.5	12.9	110.2	1.35	0.98	1.18	0.40	0.98
Latin America/ Caribbean	2-3	45.0	38.6	83.6	32.1	113.0	1.00	1.00	1.00	1.00	1.00
	4-6	51.8	43.0	94.8	33.6	125.2	1.15	1.11	1.13	1.05	1.11
	7+	63.4	43.5	106.9	32.3	135.7	1.41	1.13	1.28	1.01	1.20
	1	8.8	7.6	16.4	7.5	23.8	0.58	0.67	0.62	0.81	0.67
Colombia	2-3	15.2	11.3	26.5	9.3	35.5	1.00	1.00	1.00	1.00	1.00
	4-6	20.9	12.4	33.3	7.3	40.4	1.38	1.10	1.26	0.78	1.14
	7+	27.9	28.7	56.6	8.2	64.4	1.84	2.54	2.14	0.88	1.81
	1	22.5	21.0	43.6	11.9	54.9	0.95	1.27	1.08	0.71	0.97
Dominican Republic	2-3	23.6	16.6	40.3	16.8	56.4	1.00	1.00	1.00	1.00	1.00
	4-6	23.0	27.2	50.2	25.6	74.5	0.97	1.64	1.25	1.52	1.32
	7+	40.9	15.5	56.4	37.0	91.3	1.73	0.93	1.40	2.20	1.62
Peru	1	22.2	23.9	46.2	20.2	65.4	0.80	0.81	0.80	0.81	0.81
	2-3	27.9	29.6	57.5	25.0	81.1	1.00	1.00	1.00	1.00	1.00
	4-6	34.3	37.4	71.8	33.1	102.5	1.23	1.26	1.25	1.32	1.26
	7+	42.6	53.8	96.4	53.5	144.7	1.53	1.82	1.68	2.14	1.78
Grand average	1	44.7	40.9	85.6	58.9	137.6	1.33	1.02	1.16	0.92	1.05
	2-3	33.6	40.1	73.8	63.7	131.5	1.00	1.00	1.00	1.00	1.00
	4-6	35.1	40.2	75.2	64.5	134.1	1.04	1.00	1.02	1.01	1.02
	7+	49.3	46.5	95.8	70.4	158.6	1.47	1.16	1.30	1.10	1.21

relatively widespread (Namibia and the three Latin American countries)—first births are at lower risk. After the neonatal period, the risk of death associated with first births diminishes considerably so that by age 1-4 years, in 10 of 20 countries, first births experience mortality risk more than 10 percent lower than other children. Seven of these 10 countries are outside sub-Saharan Africa.

Regarding the association between very high birth order (7+) and mortality, an age-specific effect is observed. In every country except Malawi, the neonatal period poses increased risks for children of high birth order. Excess neonatal risk (i.e., relative to birth order 2-3) averages 47 percent across all countries, and ranges from 12 percent in Senegal to 188 percent in Turkey. The high mortality/high fertility countries of sub-Saharan Africa tend to exhibit the least amount of high birth order effect.

Figure 3.1 Relative risk of dying in childhood by birth order (averages for all countries combined), selected Demographic and Health Surveys, 1990-1994



After the neonatal period, the high birth order effect is generally much weaker and more variable. Excess postneonatal mortality risk averages 16 percent and child mortality risk is 10 percent. However, in 5 countries (all outside sub-Saharan Africa) excess postneonatal risk is greater than 75 percent; during the 1-4 year age period, 4 countries (again, all outside sub-Saharan Africa) show excess risk greater than 60 percent. In most countries of sub-Saharan Africa, mortality after the neonatal period shows only limited effects of high birth order. As discussed by Sullivan, Rutstein, and Bicego (1994), settings with persistently high fertility have maintained social systems that support and foster large families.

3.4 MOTHER'S AGE AT BIRTH

A mother's age at birth has important health and social ramifications. Many of these are the same as those discussed regarding birth order since birth order and mother's age at birth are highly correlated. The relationship between age at birth and birth order varies across sociocultural settings depending on levels and age patterns of fertility. Where age at marriage is rising, first births are often delayed

to a later (generally less risky) age, especially among those segments of the population that are in transition. Further, under patterns of lower, later fertility, older age at birth is less likely to be associated with grand multiparity, although this varies across social strata. While very young age at birth and older age at birth continue to be associated with heightened risk of dying in the first five years, there is substantial variation among countries. Part of the negative association between very young mother's age at birth and child survival may be attributed to the tendency for very young mothers to be socially and economically disadvantaged (Geronimus and Korenman, 1993). The age groups used in this analysis are: mother's age less than 20 years, 20-29 years, 30-39 years (reference group), and 40 or more years at the time of the birth.

Table 3.4 presents childhood mortality rates by mother's age at birth. For all countries combined, the average excess under-five risk associated with young age at birth (<20 years) is 26 percent (Figure 3.2). Births to women age 20-29 have essentially the same level of under-five risk as those in the reference 30-39 age category. Births to older women (age 40-49) carry 13 percent excess risk.

Table 3.4. Childhood mortality rates and the relative risk of dying by mother's age at birth

Childhood mortality rates and the relative risk of dying by age of mother at birth, for the ten-year period preceding the survey, Demographic and Health Surveys, 1990-1994

Country	Age of mother at birth	Mortality rates (deaths per 1,000)					Relative risk of dying (reference: age group 30-39 years)				
		Neonatal mortality	Post-neonatal mortality	Infant mortality	Child mortality	Under-five mortality	Neonatal mortality	Post-neonatal mortality	Infant mortality	Child mortality	Under-five mortality
Sub-Saharan Africa											
Namibia	< 20	38.9	27.7	66.6	36.2	100.4	1.17	1.31	1.23	1.05	1.16
	20-29	34.3	29.3	63.6	29.1	90.8	1.03	1.39	1.17	0.85	1.04
	30-39	33.2	21.1	54.3	34.4	86.9	1.00	1.00	1.00	1.00	1.00
	40-49	46.5	20.2	66.7	46.0	109.7	1.40	0.96	1.23	1.34	1.26
Kenya	< 20	31.3	43.9	75.1	35.7	108.1	1.13	1.33	1.24	1.34	1.26
	20-29	23.5	34.6	58.1	34.4	90.5	0.85	1.05	0.96	1.29	1.05
	30-39	27.8	32.9	60.7	26.7	85.8	1.00	1.00	1.00	1.00	1.00
	40-49	55.0	26.8	81.8	34.4	113.4	1.98	0.81	1.35	1.29	1.32
Ghana	< 20	59.3	32.0	91.3	76.6	160.9	1.32	1.25	1.30	1.32	1.30
	20-29	41.9	27.3	69.2	61.6	126.6	0.94	1.07	0.98	1.06	1.02
	30-39	44.8	25.5	70.3	57.9	124.1	1.00	1.00	1.00	1.00	1.00
	40-49	63.3	58.8	122.1	59.7	174.5	1.41	2.31	1.74	1.03	1.41
Cameroon	< 20	59.4	45.7	105.1	82.4	178.8	1.22	1.35	1.27	1.33	1.28
	20-29	30.9	37.0	67.8	64.2	127.7	0.63	1.09	0.82	1.04	0.92
	30-39	48.7	33.9	82.6	62.0	139.5	1.00	1.00	1.00	1.00	1.00
	40-49	42.5	23.3	65.8	123.0	181.2	0.87	0.69	0.80	1.98	1.30
Senegal	< 20	52.2	39.8	92.0	92.9	176.4	1.28	1.17	1.23	1.00	1.10
	20-29	37.0	34.5	71.5	82.9	148.5	0.91	1.02	0.96	0.89	0.93
	30-39	40.8	33.9	74.7	92.7	160.5	1.00	1.00	1.00	1.00	1.00
	40-49	29.2	44.1	73.3	80.8	148.2	0.72	1.30	0.98	0.87	0.92
Rwanda	< 20	64.5	56.6	121.2	131.5	236.8	1.35	1.43	1.39	1.94	1.59
	20-29	45.3	45.0	90.4	80.2	163.3	0.95	1.14	1.04	1.18	1.10
	30-39	47.7	39.5	87.2	67.7	148.9	1.00	1.00	1.00	1.00	1.00
	40-49	33.3	30.6	63.9	79.9	138.7	0.70	0.77	0.73	1.18	0.93
Madagascar	< 20	53.1	74.3	127.5	90.8	206.7	1.30	1.42	1.36	1.10	1.23
	20-29	40.8	58.7	99.5	81.9	173.2	1.00	1.12	1.06	0.99	1.03
	30-39	41.0	52.5	93.5	82.7	168.5	1.00	1.00	1.00	1.00	1.00
	40-49	37.8	34.1	71.9	71.1	137.8	0.92	0.65	0.77	0.86	0.82
Burkina Faso	< 20	80.5	65.4	145.9	128.0	255.2	1.59	1.31	1.45	1.22	1.31
	20-29	41.4	56.4	97.8	104.3	191.9	0.82	1.13	0.97	0.99	0.98
	30-39	50.6	50.0	100.6	104.9	195.0	1.00	1.00	1.00	1.00	1.00
	40-49	54.9	56.5	111.4	99.9	200.2	1.08	1.13	1.11	0.95	1.03
Zambia	< 20	53.3	69.8	123.2	110.1	219.7	1.55	1.32	1.41	1.44	1.40
	20-29	36.0	56.4	92.4	85.2	169.7	1.05	1.07	1.06	1.11	1.08
	30-39	34.4	52.7	87.1	76.6	157.0	1.00	1.00	1.00	1.00	1.00
	40-49	53.8	50.6	104.4	79.8	175.9	1.56	0.96	1.20	1.04	1.12
Nigeria	< 20	62.1	58.9	121.0	122.9	229.0	1.28	1.37	1.32	1.21	1.24
	20-29	36.7	42.3	79.0	107.0	177.5	0.76	0.98	0.86	1.05	0.96
	30-39	48.5	43.0	91.5	101.9	184.1	1.00	1.00	1.00	1.00	1.00
	40-49	70.6	57.5	128.1	144.4	254.0	1.46	1.34	1.40	1.42	1.38
Malawi	< 20	79.2	100.2	179.4	144.1	297.7	2.01	1.19	1.45	1.30	1.35
	20-29	43.6	82.3	125.8	116.8	228.0	1.10	0.98	1.02	1.05	1.03
	30-39	39.5	84.3	123.8	111.1	221.2	1.00	1.00	1.00	1.00	1.00
	40-49	38.2	91.4	129.6	92.1	209.7	0.97	1.08	1.05	0.83	0.95
Niger	< 20	71.4	84.8	156.2	222.4	343.9	1.33	1.06	1.17	1.02	1.06
	20-29	41.5	83.7	125.3	220.7	318.3	0.77	1.04	0.94	1.01	0.98
	30-39	53.8	80.1	134.0	218.7	323.4	1.00	1.00	1.00	1.00	1.00
	40-49	49.9	67.2	117.0	267.5	353.2	0.93	0.84	0.87	1.22	1.09

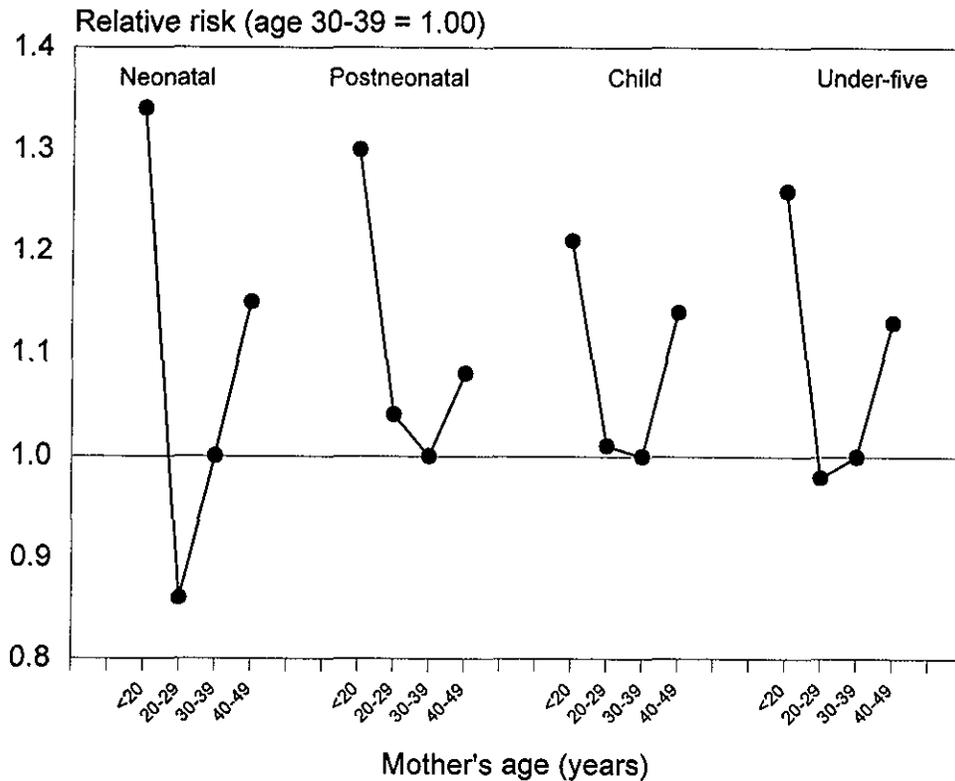
Table 3.4—Cont.

Country	Age of mother at birth	Mortality rates (deaths per 1,000)					Relative risk of dying (reference: age group 30-39 years)				
		Neonatal mortality	Post-neonatal mortality	Infant mortality	Child mortality	Under-five mortality	Neonatal mortality	Post-neonatal mortality	Infant mortality	Child mortality	Under-five mortality
Asia/Near East/ North Africa											
Philippines	< 20	18.9	22.7	41.6	40.5	80.4	0.93	0.96	0.95	1.74	1.21
	20-29	16.1	18.0	34.1	24.9	58.1	0.79	0.76	0.78	1.07	0.88
	30-39	20.4	23.6	44.0	23.3	66.3	1.00	1.00	1.00	1.00	1.00
	40-49	30.2	18.8	49.0	32.0	79.5	1.48	0.80	1.11	1.37	1.20
Turkey	< 20	52.0	40.8	92.8	11.9	103.5	0.93	1.27	1.06	0.94	1.04
	20-29	27.7	27.3	55.0	13.5	67.8	0.50	0.85	0.63	1.06	0.68
	30-39	55.8	32.1	87.9	12.7	99.5	1.00	1.00	1.00	1.00	1.00
	40-49	41.8	60.2	101.9	0.0	101.9	0.75	1.88	1.16	0.00	1.02
Morocco	< 20	65.2	42.1	107.3	19.8	125.0	2.23	1.44	1.83	0.86	1.56
	20-29	32.5	26.6	59.1	22.0	79.8	1.11	0.91	1.01	0.96	1.00
	30-39	29.2	29.3	58.5	22.9	80.0	1.00	1.00	1.00	1.00	1.00
	40-49	29.1	32.8	61.9	24.7	85.1	1.00	1.12	1.06	1.08	1.06
Indonesia	< 20	44.4	42.3	86.8	29.8	114.0	1.33	1.25	1.29	1.00	1.20
	20-29	28.4	31.8	60.2	27.3	85.8	0.85	0.94	0.90	0.91	0.90
	30-39	33.4	33.9	67.2	29.9	95.1	1.00	1.00	1.00	1.00	1.00
	40-49	42.1	30.3	72.4	25.9	96.4	1.26	0.89	1.08	0.87	1.01
Pakistan	< 20	70.1	51.2	121.3	26.7	144.8	1.45	1.45	1.45	0.84	1.28
	20-29	50.8	40.0	90.8	28.5	116.7	1.05	1.13	1.08	0.90	1.03
	30-39	48.5	35.4	83.8	31.8	113.0	1.00	1.00	1.00	1.00	1.00
	40-49	56.1	50.4	106.5	27.1	130.7	1.16	1.42	1.27	0.85	1.16
Latin America/ Caribbean											
Colombia	< 20	15.4	16.7	32.1	10.7	42.5	0.90	1.64	1.18	1.75	1.28
	20-29	13.6	11.3	24.9	7.3	32.0	0.80	1.11	0.91	1.20	0.96
	30-39	17.1	10.2	27.3	6.1	33.2	1.00	1.00	1.00	1.00	1.00
	40-49	32.5	2.0	34.5	31.8	65.2	1.90	0.20	1.26	5.21	1.96
Dominican Republic	< 20	36.0	30.5	66.5	21.5	86.6	1.37	1.88	1.56	0.87	1.31
	20-29	19.8	17.7	37.5	16.2	53.0	0.75	1.09	0.88	0.66	0.80
	30-39	26.3	16.2	42.6	24.7	66.2	1.00	1.00	1.00	1.00	1.00
	40-49	35.2	15.7	50.9	29.6	79.0	1.34	0.97	1.19	1.20	1.19
Peru	< 20	32.5	46.0	78.5	40.8	116.1	1.00	1.49	1.24	1.36	1.27
	20-29	27.2	30.7	58.0	26.3	82.7	0.84	0.99	0.91	0.88	0.90
	30-39	32.5	30.9	63.4	29.9	91.4	1.00	1.00	1.00	1.00	1.00
	40-49	47.9	52.6	100.5	43.3	139.5	1.47	1.70	1.59	1.45	1.53
Grand average	< 20	52.0	49.6	101.6	73.8	166.3	1.34	1.30	1.32	1.21	1.26
	20-29	33.5	39.5	73.0	61.7	129.1	0.86	1.04	0.95	1.01	0.98
	30-39	38.7	38.1	76.8	60.9	132.0	1.00	1.00	1.00	1.00	1.00
	40-49	44.5	41.2	85.7	69.7	148.7	1.15	1.08	1.12	1.14	1.13

The most pronounced effects of young mother's age at birth on child survival occur during the first month of life, although the excess risk persists throughout the five-year period. Average excess risk associated with young age of the mother falls from 34 percent in the neonatal period, to 30 percent in the postneonatal period, to 21 percent during ages 1-4 years. Excess neonatal risk related to young moth-

er's age ranges from -10 percent (i.e., lower risk is associated with young mother's age) in Colombia to 123 percent excess risk in Morocco. In the postneonatal period, excess risk ranges from -4 percent in the Philippines to 88 percent excess risk in the Dominican Republic. Excess child mortality risk ranges from -16 percent in Pakistan to 94 percent in Rwanda.

Figure 3.2 Relative risk of dying in childhood by mother's age at birth (averages for all countries combined), selected Demographic and Health Surveys, 1990-1994



The influence of older mother's age at birth (40-49 years) on mortality risk varies widely among countries. Excess under-five risk ranges from -18 percent in Madagascar to 96 percent in Colombia. Taking all countries together, excess mortality risk changes little with age of the child from an average of 15 percent excess neonatal risk to 8 percent average excess postneonatal risk, to 14 percent average excess child mortality risk. However, underlying these averages, widely different patterns define the relationship between older mother's age and childhood mortality. For example, comparing Ghana and Cameroon, overall excess under-five risk is roughly the same among mothers age 40-49 (41 vs 30 percent). Closer examination reveals that, in Ghana, excess risk is substantial during infancy (74 percent) but almost nonexistent during ages 1-4 years; while in Cameroon, risk to children of older women is actually lower than the reference group, but is two times higher during the age period 1-4 years.

3.5 LENGTH OF PRECEDING BIRTH INTERVAL

In a 1984 study of data from the World Fertility Survey (WFS), Shea Rutstein was the first to show decisively that the pace of childbearing is closely linked to survival chances of children. Subsequent research has refined our understanding of the relationship between short birth intervals and heightened mortality risk. Part of the observed bivariate association appears to be due to common cause household factors mediated by replacement of the dead child (Hobcraft, McDonald, and Rutstein, 1985), while part is due to the bias introduced by using interbirth (rather than interpregnancy) intervals (Miller, 1989). Still, even after accounting for these factors, the short birth interval defines mortality risk better than any other demographic variable, especially mortality during infancy (0-11 months). Using DHS data from 17 countries, Boerma and Bicego (1992) point to antenatal factors, particularly those involving maternal nutrition/depletion, to explain the relationship between short birth intervals and high early childhood mortality.

The following presentation focuses on the simple bivariate relationship between birth interval lengths of <24 months, 24-47 months, and 48+ months and childhood mortality. The <24 month category includes all intervals of this length—i.e., it is not restricted to those intervals in which the preceding sibling survived for at least two years before the birth of the index child, as is presented in Sullivan, Rutstein, and Bicego (1994). It should be emphasized that previous studies using both DHS and WFS data indicate that such a restriction has the effect of attenuating the birth interval-mortality relationship in most countries, especially during the neonatal and postneonatal periods.

Table 3.5 indicates that, without exception, children born after a short interval (<24 months) are at increased risk of dying during the first five years and, with the exception of the Dominican Republic, children born after a long interval (48+ months) are at lower risk relative to the 24-47 month interval. Figure 3.3 shows that, for all countries together, short preceding birth intervals are associated with 58 percent higher risk of dying before the age of five while long birth intervals are associated with 28 percent lower risk of dying, compared with intervals 24-47 months in length.

Table 3.5 Childhood mortality rates and the relative risk of dying by length of preceding birth interval

Childhood mortality rates and the relative risk of dying by length of preceding birth interval, for the ten-year period preceding the survey, Demographic and Health Surveys, 1990-1994

Country	Length of preceding birth interval (years)	Mortality rates (deaths per 1,000)					Relative risk of dying (reference: birth interval 2-3 years)				
		Neonatal mortality	Post-neonatal mortality	Infant mortality	Child mortality	Under-five mortality	Neonatal mortality	Post-neonatal mortality	Infant mortality	Child mortality	Under-five mortality
Sub-Saharan Africa											
Namibia	< 2	63.9	33.5	97.5	42.5	135.8	2.32	1.32	1.84	1.36	1.65
	2 - 3	27.5	25.4	52.9	31.3	82.5	1.00	1.00	1.00	1.00	1.00
	4+	26.2	21.9	48.1	25.2	72.1	0.95	0.86	0.91	0.81	0.87
Kenya	< 2	32.2	49.2	81.4	38.1	116.4	1.53	1.60	1.57	1.09	1.37
	2 - 3	21.1	30.8	51.9	34.8	84.8	1.00	1.00	1.00	1.00	1.00
	4+	21.1	23.4	44.5	20.8	64.4	1.00	0.76	0.86	0.60	0.76
Ghana	< 2	80.7	36.6	117.3	90.8	197.4	2.18	1.18	1.73	1.53	1.60
	2 - 3	37.1	30.9	67.9	59.4	123.3	1.00	1.00	1.00	1.00	1.00
	4+	30.5	20.2	50.7	39.3	88.0	0.82	0.65	0.75	0.66	0.71
Cameroon	< 2	76.8	61.2	138.0	110.2	233.1	2.87	2.34	2.60	1.82	2.11
	2 - 3	26.8	26.2	53.1	60.7	110.5	1.00	1.00	1.00	1.00	1.00
	4+	32.3	28.1	60.5	34.7	93.0	1.21	1.07	1.14	0.57	0.84
Senegal	< 2	65.1	46.5	111.6	89.2	190.9	2.19	1.36	1.74	0.96	1.26
	2 - 3	29.7	34.3	64.0	93.2	151.3	1.00	1.00	1.00	1.00	1.00
	4+	18.3	23.9	42.2	63.2	102.7	0.62	0.70	0.66	0.68	0.68
Rwanda	< 2	87.9	70.9	158.8	100.4	243.2	3.30	2.14	2.66	1.33	1.86
	2 - 3	26.6	33.2	59.8	75.7	131.0	1.00	1.00	1.00	1.00	1.00
	4+	33.2	23.9	57.0	45.0	99.5	1.25	0.72	0.95	0.59	0.76
Madagascar	< 2	63.2	81.8	145.0	111.6	240.4	2.16	1.61	1.81	1.52	1.63
	2 - 3	29.2	50.8	80.0	73.2	147.3	1.00	1.00	1.00	1.00	1.00
	4+	24.9	26.6	51.5	68.8	116.8	0.85	0.52	0.64	0.94	0.79
Burkina Faso	< 2	93.0	85.2	178.2	165.3	314.0	2.56	1.75	2.10	1.77	1.84
	2 - 3	36.3	48.6	84.9	93.2	170.2	1.00	1.00	1.00	1.00	1.00
	4+	20.3	26.3	46.7	65.7	109.3	0.56	0.54	0.55	0.70	0.64
Zambia	< 2	70.0	86.4	156.3	104.5	244.5	2.47	1.79	2.04	1.30	1.62
	2 - 3	28.3	48.2	76.5	80.1	150.5	1.00	1.00	1.00	1.00	1.00
	4+	20.1	36.0	56.1	70.3	122.5	0.71	0.75	0.73	0.88	0.81
Nigeria	< 2	69.9	64.3	134.2	123.9	241.5	2.04	1.57	1.78	1.05	1.31
	2 - 3	34.2	41.0	75.2	118.0	184.3	1.00	1.00	1.00	1.00	1.00
	4+	21.2	25.1	46.3	69.8	112.8	0.62	0.61	0.62	0.59	0.61
Malawi	< 2	66.7	116.0	182.6	161.5	314.6	1.88	1.54	1.65	1.50	1.52
	2 - 3	35.5	75.4	110.9	108.0	206.9	1.00	1.00	1.00	1.00	1.00
	4+	31.2	65.1	96.2	76.7	165.6	0.88	0.86	0.87	0.71	0.80
Niger	< 2	61.5	97.1	158.6	222.7	346.0	1.50	1.25	1.34	0.94	1.06
	2 - 3	41.1	77.4	118.5	236.3	326.8	1.00	1.00	1.00	1.00	1.00
	4+	21.6	52.1	73.8	157.2	219.4	0.53	0.67	0.62	0.67	0.67

Table 3.5—Cont.

Country	Length of preceding birth interval (years)	Mortality rates (deaths per 1,000)					Relative risk of dying (reference: birth interval 2-3 years)				
		Post-					Post-				
		Neonatal mortality	neonatal mortality	Infant mortality	Child mortality	Under-five mortality	Neonatal mortality	neonatal mortality	Infant mortality	Child mortality	Under-five mortality
Asia/Near East/ North Africa											
Philippines	< 2	20.6	33.5	54.0	38.3	90.3	1.37	1.86	1.64	1.53	1.58
	2 - 3	15.0	18.0	33.0	25.0	57.2	1.00	1.00	1.00	1.00	1.00
	4+	19.3	13.9	33.2	15.1	47.8	1.29	0.77	1.01	0.60	0.84
Turkey	< 2	63.3	50.1	113.4	24.5	135.1	2.73	1.84	2.25	2.13	2.20
	2 - 3	23.2	27.3	50.4	11.5	61.3	1.00	1.00	1.00	1.00	1.00
	4+	20.4	15.0	35.4	3.9	39.1	0.88	0.55	0.70	0.34	0.64
Morocco	< 2	56.6	47.2	103.8	31.0	131.6	2.53	1.96	2.23	1.46	1.97
	2 - 3	22.4	24.1	46.5	21.3	66.8	1.00	1.00	1.00	1.00	1.00
	4+	19.3	12.3	31.6	14.0	45.1	0.86	0.51	0.68	0.66	0.68
Indonesia	< 2	57.2	60.4	117.7	46.2	158.4	2.06	1.71	1.87	1.45	1.70
	2 - 3	27.8	35.3	63.1	31.9	93.0	1.00	1.00	1.00	1.00	1.00
	4+	24.2	18.4	42.6	15.6	57.5	0.87	0.52	0.68	0.49	0.62
Pakistan	< 2	75.0	59.6	134.6	43.5	172.2	2.06	2.18	2.11	1.71	1.97
	2 - 3	36.4	27.4	63.8	25.4	87.6	1.00	1.00	1.00	1.00	1.00
	4+	13.7	18.3	32.0	13.6	45.2	0.38	0.67	0.50	0.54	0.52
Latin America/ Caribbean											
Colombia	< 2	16.9	22.4	39.3	15.4	54.1	0.92	1.95	1.32	2.26	1.49
	2 - 3	18.3	11.5	29.8	6.8	36.3	1.00	1.00	1.00	1.00	1.00
	4+	18.5	6.7	25.3	2.5	27.7	1.01	0.58	0.85	0.37	0.76
Dominican Republic	< 2	35.8	27.1	62.9	25.9	87.2	2.27	1.73	2.00	1.27	1.70
	2 - 3	15.8	15.7	31.5	20.4	51.2	1.00	1.00	1.00	1.00	1.00
	4+	22.4	13.9	36.3	17.0	52.6	1.42	0.89	1.15	0.83	1.03
Peru	< 2	49.4	61.8	111.2	46.2	152.2	1.86	2.09	1.99	1.41	1.75
	2 - 3	26.6	29.5	56.0	32.7	86.8	1.00	1.00	1.00	1.00	1.00
	4+	19.7	12.8	32.5	12.2	44.3	0.74	0.43	0.58	0.37	0.51
Grand average	< 2	60.3	59.5	119.8	81.6	189.9	2.16	1.67	1.89	1.32	1.58
	2 - 3	27.9	35.6	63.5	61.9	120.5	1.00	1.00	1.00	1.00	1.00
	4+	22.9	24.2	47.1	41.5	86.3	0.82	0.68	0.74	0.67	0.72

Generally, the most pronounced effect of short birth intervals on childhood mortality occurs during the neonatal period, and the weakest effect during the period 1-4 years. This is consistent with the hypothesis that antenatal and maternal health factors mediate the relationship. Taking all countries together, excess mortality risk is 116 percent during the neonatal period, 67 percent during the postneonatal period, and 32 percent during the period 1-4 years. There are exceptions to this pattern. For example, in the Philippines, postneonatal risk is more sensitive to the *interval effect* than neonatal risk; however, this may be due to misreporting of age at death (i.e., neonatal deaths reported at "1 month"). More strikingly, in Colombia excess risk associated with short birth intervals is much greater during ages 1-4 years (126 percent) than during infancy (32 percent). In

this case, the minimal birth interval effect during infancy is probably due to a combination of age at death misreporting (e.g., heaping of deaths at age 12 months) and selective underreporting of neonatal deaths. (Note that essentially no interval-related differentials are observed in the neonatal period.)

Children born after long intervals (48+ months) generally have better survival chances in every age category than children in the reference group 24-47 months, especially after the neonatal period. In four countries, however—Cameroon, Rwanda, Philippines, and the Dominican Republic—long intervals are associated with relatively high neonatal risk. This suggests that some long intervals may be "long" due to poor maternal health, pregnancy loss (unre-

ported in DHS surveys), or omitted births leading to neonatal deaths during the reference interval. In the latter case, the "long" reference interval may in fact be composed of two or more short intervals. Overall, however, intervals of 48+ months are associated with lower (often substantially

lower) rates of childhood mortality. Taking all countries together, long birth intervals are associated with averages of 18 percent (neonatal), 32 percent (postneonatal), and 33 percent (age 1-4 years) lower risk of dying during the first five years (Figure 3.3).

Figure 3.3 Relative risk of dying in childhood by length of preceding birth interval (averages for all countries combined), selected Demographic and Health Surveys, 1990-1994

