INFANT AND CHILD MORTALITY

8

This chapter presents information on levels, trends, and differentials in neonatal, postneontal, infant, and child mortality and on the prevalence of high-risk fertility behavior. This information is central to an assessment of the demographic situation in Nepal. It is also crucial to the design of policies and programs targeted at the reduction of infant and child mortality and the avoidance of high-risk behavior.

Mortality estimates are computed from information collected in the pregnancy history section of the Women's Questionnaire administered in the 2001 Nepal Demographic and Health Survey (NDHS). Reproductive histories were obtained from ever-married women. Each woman was first asked about the number of her own sons and daughters living with her, the number living elsewhere and the number who had died, and the number of pregnancies that did not end in a live birth. She was then asked for a history of all her pregnancies, including the type of pregnancy outcome and the month and year the pregnancy ended. For each pregnancy ending in a live birth, the mother was asked the child's name, sex, age (if alive) or age at death (if dead), and whether the child was living with her.

The information on live births is used to directly estimate mortality rates. In this report, infant and child mortality are measured using the following five rates:

Neonatal mortality: the probability of dying within the first month of life
Postneonatal mortality: the difference between infant and neonatal mortality
Infant mortality: the probability of dying before the first birthday
Child mortality: the probability of dying between the first and fifth birthday
Under-five mortality: the probability of dying before the fifth birthday.

All rates are expressed per 1,000 live births, except child mortality, which is expressed per 1,000 children surviving to 12 months of age.

Information on pregnancies that did not end in a live birth and on children who died within seven days is used to estimate **perinatal mortality**, which is the number of stillbirths and early neonatal deaths per 1,000 stillbirths and live births.

8.1   DATA QUALITY

The reliability of mortality estimates depends on the sampling variability of the estimates and on nonsampling errors. Sampling errors are presented in Appendix B. Nonsampling errors arise from data collection problems and, in the case of mortality data, the most common types of problems are as follows: misreporting of age at death; misreporting of dates of birth and event underreporting (that is, both the birth and death of the child). The possible occurrence of these data problems in the 2001 NDHS will be discussed with reference to the data quality tables in Appendix C.

In the case of misreporting age at death, the most typical problem in survey data is the misreporting of infant deaths, which occur in the late postneonatal period, as deaths at 12 months or one year of age (digit preference in the reporting of age). Such misreporting results in underestimation of the infant mortality rates and overestimation of child mortality rates. A review of the reported age at death data (Table C.6) indicates that digit preferences in reported death at 12 months or one year is not a problem in the 2001 NDHS and that reporting errors did not arise from this source.

Misreporting of the date of birth of deceased children is common in many surveys that include both demographic and health information for children born since a specified date (that is, for children below age five). In the 2001 NDHS, the cutoff date for asking health questions was Baisakh 2052 in the Nepali calendar (corresponding to April 1995 in the Gregorian calendar). Table C.4 indicates that there is little misreporting of dates of birth for living children but that there is evidence of misreporting of dates for deceased children. The evidence for this is the 203 births in calendar year 2051 (1994) but only 128 births in calendar year 2052 (1995). The deficit in calendar year 2052 is believed to be the result of misreporting of date of birth by interviewers who want to avoid collecting the health data for deceased children. The transference of deceased children out of the five-year period preceding the survey strongly suggests that the estimated infant mortality rate for that period will be negatively biased and will understate the true level of infant mortality for the period of the late 1990s.

The problem of underreporting is usually most severe for deaths that occur very early in infancy. Table C.5 provides data for evaluating the occurrence of underreporting of early infant deaths. Selective underreporting of early neonatal deaths would result in an abnormally low ratio of deaths under seven days to all neonatal deaths. In the 2001 NDHS, this ratio is high (between 65 and 69) so that it can be concluded that there has not been selective omission of early infant deaths.[1]

While the evidence in Table C.5 does not indicate selective underreporting of early neonatal deaths, it is possible that there was a general tendency to underreport deceased children for the five-year period preceding the survey, the period for which health data are collected for each recorded birth. The motivation that interviewers have for omitting these events has already been indicated. The possibility that this occurred must be considered because of the sharp drop in infant and child mortality rates, a topic that is further discussed in the next section.

8.2 LEVELS AND TRENDS IN INFANT AND CHILD MORTALITY

Table 8.1 presents neonatal, postneonatal, infant, child, and under-five mortality rates for the three five-year periods preceding the survey. Under-five mortality in Nepal is 91 deaths per 1,000 births in the most recent five-year period (0-4 years preceding the survey). This means that about one in every 11 children born in the country dies before reaching age five. Slightly more than two in three under-five deaths occur in the first year of life—infant mortality is 64 deaths per 1,000 births

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[1]There are no model mortality patterns for the neonatal period. However, one review of data from several developing countries concluded that at levels of neonatal mortality of 20 per 1,000 or higher, approximately 70 percent of neonatal deaths occur within the first six day of life (Boerma, 1988).

Table 8.1 Early childhood mortality rates					
Neonatal, postneonatal, infant, child, and under-five mortality rates for five-year periods preceding the survey, Nepal 2001					
Years preceding the survey	Neonatal mortality (NN)	Postneonatal mortality (PNN)[1]	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
0-4	38.8	25.6	64.4	28.6	91.2
5-9	56.5	33.5	90.0	39.7	126.2
10-14	63.1	44.0	107.2	57.0	158.0
[1]Computed as the difference between the infant and neonatal mortality rates					

and child mortality is 29 deaths per 1,000 births. During infancy, the risk of neonatal death (39 per 1,000) is one and half times higher than the risk of postneonatal death (26 per 1,000).

According to data collected in the 2001 NDHS, mortality levels have declined rapidly in Nepal since the early 1980s (Table 8.1). However, as discussed in the earlier section on data quality, this decline could be overstated due to the misreporting of the dates of birth of deceased children and the underreporting of deceased children. Under-five mortality in the five years before the survey is 58 percent of what it was 10-14 years before the survey. Comparable data for child mortality (50 percent) and infant mortality (60 percent) indicate that the pace of decline is somewhat faster for child mortality than for infant mortality. The corresponding figures for neonatal and postneonatal mortality are 61 percent and 58 percent, respectively.

Mortality trends can also be examined by comparing data from the 2001 NDHS with data from other earlier sources. However, these comparisons should be interpreted with caution since the quality of data, method of analysis, time references, and sample coverage varies. Table 8.2 and Figure 8.1 show direct estimates of infant mortality from various sources. There is some indication that the infant mortality rate was underestimated in the 1986 and 1991 data, but this does not change the broad conclusion that there has been a substantial decline in infant mortality over the 30 years preceding the survey from about 150 in the late 1960s to about half this level in the late 1990s.

Table 8.2 Trends in infant mortality					
Trends in the infant mortality rate in Nepal, 1969-1998					
Approximate midpoint	NFS 1976	NFFS 1986	NFHS 1991	NFHS 1996	NDHS 2001
1969	156				
1974	140				
1979		90	123		
1984		103	115	127	
1988			80	108	107
1993				79	90
1998					64
Source: Ministry of Health, 1987:80; Ministry of Health, 1993:132; Pradhan et al., 1997: 102					

Figure 8.1 Trends in Infant Mortality
Nepal, 1969-2001
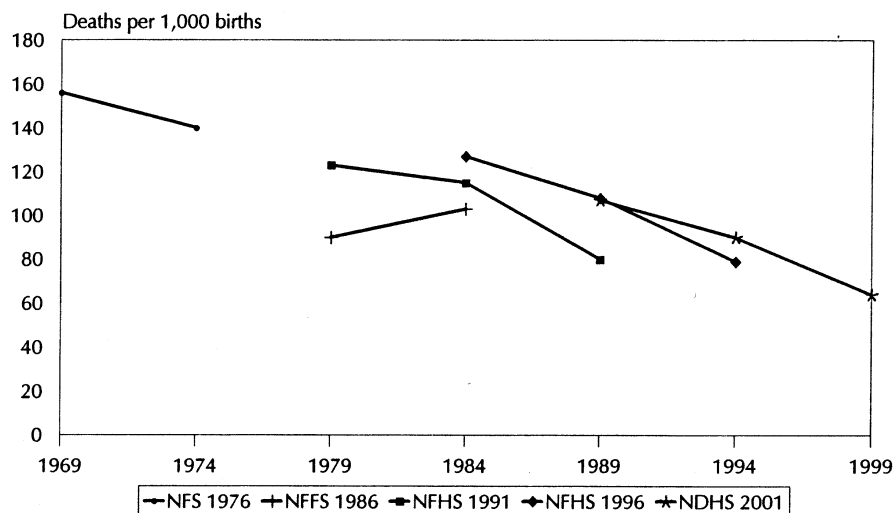
Note: Data for 1976 to 1996 surveys are from
Pradhan et al., 1997: Table 7.2, p. 102.

8.3 SOCIOECONOMIC DIFFERENTIALS IN MORTALITY

Table 8.3 presents differentials in childhood mortality in Nepal by place of residence and mother's education (Figure 8.2). To have a sufficient number of cases for statistical reliability, mortality rates are calculated for a ten-year period.

Mortality is consistently lower in urban than in rural areas. In the ten years preceding the survey, infant mortality was 37 percent lower and under-five mortality was 41 percent lower in urban areas than in rural areas. There is also considerable variation in mortality by ecological zone with children living in the mountains faring much worse than children living in the hills or *terai*. For example, one in six children living in the mountains dies before the fifth birthday, compared with one in nine children living in the *terai* and one in eleven children living in the hill zone. Settlements are scattered in the mountains and a health institution covers a much larger geographic area than in the hills and *terai*, thereby making them less accessible. Mortality is also much higher in the Far-western development region of Nepal than in the other regions.

Maternal education is strongly related to mortality. Children born to mothers with no education experience much higher levels of mortality than children born to mothers with some education; children born to the most highly educated mothers are least likely to die young. For example, under-five mortality for children of uneducated mothers is 121 per 1,000 births, 64 percent higher than for children of mothers who have some primary education and nearly double that of children of mothers who have some secondary education.

Table 8.3 Early childhood mortality rates by socioeconomic characteristics

Neonatal, postneonatal, infant, child, and under-five mortality rates for the 10-year period preceding the survey, by socioeconomic characteristic, Nepal 2001
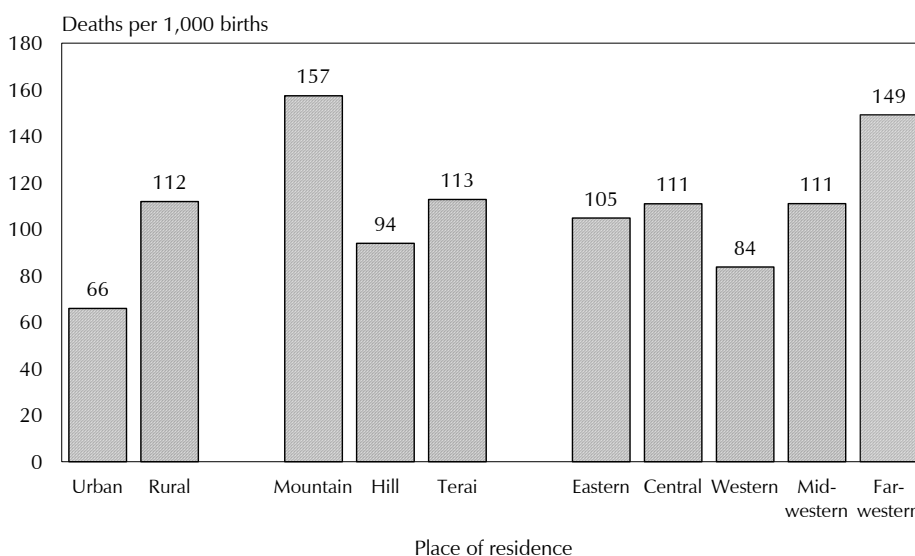
Socioeconomic characteristic	Neonatal mortality (NN)	Postneonatal mortality (PNN)[1]	Infant mortality $(_1q_0)$	Child mortality $(_4q_1)$	Under-five mortality $(_5q_0)$
Residence					
Urban	36.6	13.5	50.1	16.7	65.9
Rural	48.5	30.8	79.3	35.4	111.9
Ecological zone					
Mountain	64.9	47.1	112.0	51.2	157.4
Hill	41.9	24.3	66.2	29.7	93.9
Terai	49.7	31.1	80.8	34.8	112.8
Development region					
Eastern	50.5	27.0	77.5	29.6	104.8
Central	48.4	29.0	77.4	36.4	110.9
Western	39.1	21.0	60.1	25.1	83.7
Mid-western	40.5	32.3	72.9	41.2	111.0
Far-western	64.4	47.8	112.2	41.7	149.2
Mother's education					
No education	51.6	33.0	84.6	39.5	120.7
Primary	41.2	19.8	61.0	13.4	73.5
Some secondary	31.3	18.6	49.9	14.3	63.5
SLC and above	(8.8)	(2.3)	(11.2)	(3.7)	(14.9)

Note: Rates in parentheses are based on 250-499 exposed children
SLC = School Leaving Certificate
[1]Computed as the difference between the infant and neonatal mortality rates

Figure 8.2 Under-five Mortality Rates by Place of Residence

Deaths per 1,000 births

Urban 66, Rural 112, Mountain 157, Hill 94, Terai 113, Eastern 105, Central 111, Western 84, Mid-western 111, Far-western 149

Place of residence

Note: Rates are for the 10-year period preceding the survey.   Nepal 2001
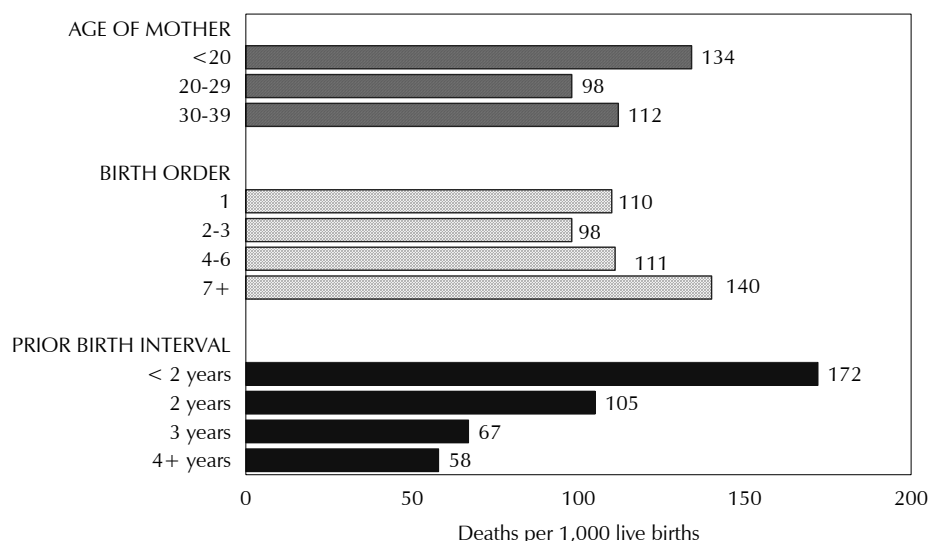
8.4   DEMOGRAPHIC DIFFERENTIALS IN MORTALITY

Besides socioeconomic characteristics, demographic characteristics of the child and the mother have been found to affect mortality risks. Some of these factors are the sex of the child, mother's age at birth, birth order, length of previous birth interval, and the mother's perception of the size of the child at birth. The relationship between these demographic characteristics and mortality is shown in Table 8.4 and Figure 8.3.

As expected, neonatal mortality is higher among males than among females. There is little variation in postneonatal mortality and infant mortality by sex of the child. However, child mortality is nearly one and a half times higher for females than for males. Since female mortality is typically lower than male mortality during childhood, this pattern suggests some gender-related differences in child-rearing practices and health care utilization.

Table 8.4 Early childhood mortality rates by demographic characteristics

Neonatal, postneonatal, infant, child, and under-five mortality rates for the 10-year period preceding the survey, by demographic characteristics, Nepal 2001

Demographic characteristic	Neonatal mortality (NN)	Postneonatal mortality (PNN)[1]	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
Child's sex					
Male	52.0	27.2	79.2	27.8	104.8
Female	43.3	31.9	75.2	40.2	112.4
Mother's age at birth[2]					
<20	71.2	37.1	108.2	28.5	133.6
20-29	40.3	27.3	67.6	32.6	98.0
30-39	42.8	30.1	72.9	42.5	112.3
Birth order					
1	56.8	32.0	88.8	22.9	109.7
2-3	44.1	27.5	71.6	28.6	98.1
4-6	39.7	29.7	69.4	44.8	111.1
7+	63.0	31.1	94.1	51.1	140.4
Previous birth interval[3]					
<2	79.9	44.5	124.4	54.8	172.4
2 years	39.7	28.0	67.8	40.0	105.1
3 years	26.5	18.8	45.2	22.4	66.6
4+ years	21.7	17.2	38.9	20.1	58.2
Birth size[4]					
Small/very small	58.1	32.2	90.3	na	na
Average or larger	32.4	24.0	56.4	na	na

na = Not applicable
[1] Computed as the difference between the infant and neonatal mortality rates
[2] Rates for age group 40-49 are not shown because they are based on fewer than 250 exposed children.
[3] Excludes first-order births
[4] Rates for the five-year period before the survey

Figure 8.3 Under-Five Mortality by
Selected Demographic Characteristics

AGE OF MOTHER
<20   134
20-29   98
30-39   112

BIRTH ORDER
1   110
2-3   98
4-6   111
7+   140

PRIOR BIRTH INTERVAL
< 2 years   172
2 years   105
3 years   67
4+ years   58

Deaths per 1,000 live births

Note: Rates are for the 10-year period preceding the survey

Nepal 2001

The relationship between maternal age (at birth) and neonatal, postneonatal, infant, and under-five mortality shows a U-shaped curve. These mortality measures are substantially higher among children born to mothers less than 20 or more than 30 years old.

As expected, first births and higher order births experience higher mortality, indicating a U-shaped relationship between birth order and mortality. For example, infant mortality for first births and births of order seven and higher is 89 per 1,000 births and 94 per 1,000 births, respectively, compared with about 70 per 1,000 births for second to sixth order births.

Mortality among children is negatively associated with the length of the previous birth interval. Under-five mortality decreases sharply from a high of 172 for children born less than two years after a previous birth to 58 per 1,000 live births for children born four or more years after a previous birth.

A child's size at birth has often been found to be an important determinant of the chances of survival in infancy. Since most births in Nepal take place outside of a health facility, few children are weighed at birth; as such, in the 2001 NDHS, mothers were asked to assess their child's size at birth. Even though this is a subjective assessment, it has been shown to closely correlate with actual birth weight in most countries. Due to small numbers, births have been grouped into small/very small and average/larger to give statistically reliable estimates. As expected, size of the baby at birth and mortality are negatively associated. For example, children who were regarded as very small or small have an infant mortality rate that is 60 percent higher than that for average/large children.

8.5   WOMEN'S STATUS AND CHILD MORTALITY

Since women are the primary caregivers, their status can impact the health status and survival of their children. Women who are empowered are in a better position to access information, make decisions, and act effectively to address their own and their children's health. Table 8.5 shows the relationship between mortality rates and the three indicators of women's empowerment measured in the 2001 NDHS. In general, the more decisionmaking power a woman has, the lower the level of childhood mortality, as observed with four of the five mortality rates (the exception being child mortality). There is no clear relationship between childhood mortality rates and women's attitudes toward a woman's right to refuse sex with her husband or toward wife beating.

Women's status indicators	Neonatal mortality (NN)	Postneonatal mortality (PNN)[1]	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
Table 8.5 Early childhood mortality rates by women's status					
Neonatal, postneonatal, infant, child, and under-five mortality rates for the 10-year period preceding the survey, by women's status indicators, Nepal 2001					
Number of decisions in which woman has final say[2]					
0	57.2	33.6	90.8	24.8	113.3
1-2	49.7	34.3	84.0	35.1	116.2
3-4	38.8	24.9	63.7	33.9	95.4
5	47.1	21.5	68.6	34.5	100.8
Number of reasons to refuse sex with husband					
1-2	49.7	32.9	82.5	(33.2)	(113.0)
3-4	47.6	29.6	77.1	34.0	108.5
Number of reasons wife beating is justified					
0	48.9	29.5	78.4	34.5	110.1
1-2	41.7	28.4	70.1	36.4	103.9
3-4	54.5	35.1	89.7	16.1	104.3

Note: Rates in parentheses are based on 250-499 exposed children. Rates for 0 reasons to refuse sex with husband and 5 reasons wife beating is justified are not shown because they are based on fewer than 250 exposed children.
[1] Computed as the difference between the infant and neonatal mortality rates
[2] Either by herself or jointly with others

8.6   PERINATAL MORTALITY

Perinatal mortality reflects an adverse outcome for pregnancies of at least seven months gestation. The perinatal mortality rate is obtained by summing all stillbirths and deaths to children within the first week of life (early neonatal deaths) and dividing by the sum of all stillbirths and live births. The perinatal mortality rate captures stillbirths and early neonatal deaths, two seemingly different outcomes that result from similar conditions.

In the 2001 NDHS, women were asked to report on all the pregnancies that they had in their lifetime. The pregnancy history provides information on all the respondent's children born alive or dead, whether or not still living, and all the pregnancies that did not end in a live birth.

Information on perinatal mortality is obtained from reports of pregnancy losses and pregnancy duration (which defines stillbirths) and deaths to children within the first week of life. These events are highly susceptible to omission and misreporting. Nevertheless, retrospective surveys provide more representative and complete enumeration of perinatal deaths than most vital registration systems and hospital-based studies in developing countries.

Data obtained from this survey have been summarized in Table 8.6. The perinatal mortality rate for the five years prior to the survey is 47 deaths per 1,000 pregnancies, a decline from 61 deaths in the ten years preceding the 1996 NFHS.

As expected, mothers' age has a U-shaped relationship with perinatal mortality. For example, perinatal mortality is higher among women in the youngest and oldest age groups. Perinatal mortality is about twice as high if the length of the previous birth interval is shorter than 15 months than if the birth interval is 15 months or longer.

Perinatal mortality is lower in urban areas than in rural areas and among mothers living in the hill region than among those living in the mountains or *terai*. Perinatal mortality is also lowest in the Western development region. There is an inverse relationship between perinatal mortality and mother's education.

| Table 8.6 Perinatal mortality |

Number of stillbirths and early neonatal deaths, and the perinatal mortality rate for the five-year period preceding the survey, by background characteristics, Nepal 2001

Background characteristic	Number of stillbirths[1]	Number of early neonatal deaths[2]	Perinatal mortality rate[3]	Number of pregnancies of 7+ months duration
Mother's age at birth				
<20	32	61	69.9	1,322
20-29	86	80	39.5	4,194
30-39	33	31	44.7	1,425
40-49	5	11	82.7	193
Previous pregnancy interval in months				
<15	16	22	109.7	351
15-26	42	39	45.0	1,804
27-38	27	35	34.9	1,781
39+	71	85	48.8	3,198
Residence				
Urban	8	8	36.6	458
Rural	148	173	48.1	6,676
Ecological zone				
Mountain	19	18	66.1	554
Hill	66	59	42.4	2,939
Terai	72	105	48.6	3,641
Development region				
Eastern	39	53	55.7	1,649
Central	52	58	46.5	2,362
Western	20	27	37.0	1,282
Mid-western	28	17	41.9	1,076
Far-western	17	27	57.1	766
Mother's education				
No education	125	142	50.2	5,301
Primary	21	24	45.1	991
Some secondary	10	17	45.1	597
SLC and above	0	0	0.0	244
Total	156	182	47.4	7,134

SLC = School Leaving Certificate
[1] A still birth is a fetal death that occurs in a pregnancy lasting seven or more months.
[2] An early neonatal death is the death of a live-born child at age 0 to 6 days.
[3] The perinatal mortality rate is the sum of the number of stillbirths and early neonatal deaths divided by the number of pregnancies of seven or more months duration.

8.7   HIGH-RISK FERTILITY BEHAVIOR

Research has shown that there is a strong relationship between certain characteristics associated with fertility behavior and children's survival chances. Typically, the probability of dying in infancy is much greater for children born to mothers who are too young or too old, children born after a short birth interval, and children born to mothers with high parity. For analysis purposes, a mother is classified as "too young" if she is less than 18 years old and "too old" if she is over 34 at the time of delivery. A "short birth interval" is defined as a birth occurring less than 24 months after the previous birth, and a mother is of "high parity" if she has given birth to three or more living children, that is, if the child is of birth order four or higher.

Table 8.7 shows the percent distribution of children born in the five years preceding the survey and of currently married women by these risk factors. The table also displays the risk ratio of mortality for children by comparing the proportion of deceased children in each high-risk category with the proportion of deceased children not in any high-risk category.

Fifty-three percent of Nepalese children born in the five years preceding the survey fall into a high-risk category, with 37 percent in a single high-risk category and 16 percent in a multiple high-risk category. Three in ten births in Nepal are not in any risk category, and 18 percent are in an unavoidable risk category (first order births to women age 18-34).

The relationship between risk factors and mortality is given by the risk ratios displayed in column 2 of Table 8.7. In general, risk ratios are higher for children in a multiple high-risk category than in a single high-risk category. The most vulnerable births are those to women who are age 35 or older, with a birth interval less than 24 months and birth order three or higher. These children are nearly 2.4 times more likely to die than children not in any high-risk category. Fortunately, only 1 percent of births are in this category. It is also worthwhile to note that 7 percent of births occur to mothers who have three or more children and a short previous birth interval. These children are more than twice as likely to die as children who are not in any high-risk category. Another 7 percent of births occur to women under age 18; these babies are also subject to twice the risk of dying than children who are not in any high-risk category.

Table 8.7 High-risk fertility behavior

Percent distribution of children born in the five years preceding the survey by category of elevated risk of mortality, risk ratio, and percent distribution of currently married women by category of risk if they were to conceive a child at the time of the survey, Nepal 2001

Risk category	Births in the 5 years preceding the survey		Percentage of currently married women[1]
	Percentage of births	Risk ratio	
Not in any high-risk category	29.8	1.00	32.3[a]
Unavoidable risk category			
First order births between age 18 and 34 years	17.5	1.30	8.3
Single high-risk category			
Mother's age <18	6.6	2.24	2.3
Mother's age >34	0.4	1.62	2.9
Birth interval <24 months	9.1	1.34	8.9
Birth order >3	20.5	1.17	13.3
Subtotal	36.6	1.41	27.4
Multiple high-risk category			
Age <18 & birth interval <24 months [2]	0.4	2.01	0.3
Age >34 & birth interval <24 months	0.0	0.00	0.1
Age >34 & birth order >3	7.8	1.08	21.4
Age >34 & birth interval <24 months & birth order >3	1.0	2.38	2.3
Birth interval <24 months & birth order >3	6.8	2.18	7.9
Subtotal	16.1	1.65	32.1
In any avoidable high-risk category	52.7	1.48	59.4
Total	100.0	na	100.0
Number of births	6,978	na	8,342

Note: Risk ratio is the ratio of the proportion dead among births in a specific high-risk category to the proportion dead among births *not in any high-risk category.*
na = Not applicable
[1] Women are assigned to risk categories according to the status they would have at the birth of a child if they were to conceive at the time of the survey: current age less than 17 years and 3 months or older than 34 years and 2 months, latest birth less than 15 months ago, or latest birth being of order 3 or higher.
[2] Includes the category *age <18* and *birth order >3*
[a] Includes sterilized women

The final column of Table 8.7 addresses the question of what percentage of currently married women have the potential for having a high-risk birth. This was obtained by simulating the distribution of currently married women by the risk category in which a birth would fall if a woman were to conceive at the time of the survey.

Overall, 59 percent of currently married women have the potential to give birth to a child with an elevated risk of mortality. Twenty-one percent of these women are or would be too old and have or would have too many children. A slightly higher proportion of women exhibit the potential for having a birth in a multiple high-risk category than in a single high-risk category.