8 INFANT AND CHILD MORTALITY

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This chapter presents information on mortality among children less than five years of age. The estimated mortality rates provide information on levels and trends in mortality as well as differentials between population subgroups. The rates of mortality presented in this chapter are defined as follows:

- Neonatal mortality (NN): the probability of dying within the first month of life
- Postneonatal mortality (PNN): the difference between infant and neonatal mortality
- Infant mortality ($_1q_0$): the probability of dying between birth and the first birthday
- Child mortality ($_4q_1$) the probability of dying between exact ages one and five
- Under-five mortality ($_5q_0$): the probability of dying between birth and the fifth birthday.

All rates are expressed as deaths per 1,000 live births, except child mortality, which is expressed as deaths per 1,000 children surviving to age one.

8.1 BACKGROUND AND ASSESSMENT OF DATA QUALITY

In the 2002 Uzbekistan Health Examination Survey (UHES), survey respondents were asked to report reproductive events in terms of the internationally recognized definitions of the World Health Organization (WHO, 1993). The definition of a live birth is a birth, irrespective of the duration of pregnancy, which after separation from the mother breathes or shows any other signs of life, such as beating of the heart or movement of voluntary muscles. Infant deaths are deaths of live-born infants under one year of age.

The mortality estimates were calculated from information in the reproductive section of the Women's Questionnaire. This section of the questionnaire includes a pregnancy history in which specific questions are asked about each pregnancy that a woman has had. For each live birth reported in the pregnancy history, questions are asked about the month and year of birth, sex of the child, survivorship status, and age (current age for surviving children and age at death for deceased children).

The accuracy of mortality estimates calculated from survey data depends on the sampling variability of the estimates and on nonsampling error (i.e., the completeness and accuracy with which births and deaths are reported and recorded). Sampling variability is discussed in section 8.2. This section considers nonsampling error.

The most serious source of nonsampling error in mortality data collected by a retrospective survey is underreporting of the births and deaths of children who did not survive (United Nations, 1982). Such underreporting results in underestimation of mortality rates. When there is underreporting of deceased children in a survey, it is usually most severe for deaths that occurred in early infancy (i.e., in the neonatal period). If there were underreporting of early neonatal deaths, this would result in an abnormally low ratio of neonatal mortality to infant mortality. In retrospective surveys, underreporting of early infant deaths is usually more common for births that occurred further back in time than for births that occurred close to the time of the survey. Thus, when considering nonsampling error, the ratio of neonatal mortality to infant mortality is examined for various periods preceding the survey.

Neonatal and infant mortality rates from the UHES are shown in Table 8.1 for three five-year periods preceding the survey (1988-1992, 1993-1997, and 1998-2002). Also shown are the neonatal mortal-

ity/infant mortality (NNM/IM) ratios for those periods. In countries known for having complete and accurate mortality data at a level of infant mortality of approximately 50 to 60 per 1,000 (i.e., the level of infant mortality estimated by the 2002 UHES), the value of this ratio is typically between 0.50 and 0.60.[1] Based on these statistics, a value for the NNM/IM ratio of less than 0.50 would suggest underreporting of neonatal deaths (and underestimation of the infant mortality rate). The values of the NNM/IM ratios in Table 8.1 (0.51, 0.53, and 0.55) all exceed 0.50. Accordingly, there is no evidence of substantial underreporting of neonatal deaths in the 2002 survey.

It should be noted that the NNM/IM ratios from the 2002 UHES and especially the values for 1993-1997 and 1998-2002 (0.53 and 0.55) are greater than the ratio (0.46) corresponding to the infant mortality estimate of 49 per 1,000 from the 1996 UDHS (Institute of Obstetrics and Gynecology and Macro International Inc., 1997). This suggests less complete reporting of neonatal deaths in the 1996 survey and that 49 per 1,000 was an underestimate of the infant mortality rate.

Table 8.1 Early childhood mortality rates

Neonatal, postneonatal, infant, child, and under-five mortality rates for five-year periods preceding the survey, Uzbekistan 2002

Years preceding the survey	Approximate calendar period	Neonatal mortality (NN)	Postneonatal mortality[1] (PNN)	Infant mortality ($_1q_0$)	Ratio neonatal mortality/ infant mortality	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
0-4	1998-2002	33.9	27.8	61.7	0.55	12.3	73.3
5-9	1993-1997	33.8	30.3	64.1	0.53	13.4	76.6
10-14	1988-1992	26.5	25.2	51.7	0.51	10.7	61.9

[1] Computed as the difference between the infant and the neonatal mortality rates

8.2 LEVELS AND TRENDS IN EARLY CHILDHOOD MORTALITY

The most recent childhood mortality estimates reference the five-year calendar period 1998-2002 (Table 8.1). For that period, infant mortality is estimated at 62 per 1,000, with estimates of neonatal and postneonatal mortality of 34 per 1,000 and 28 per 1,000, respectively. Child mortality (age 1-4) is estimated at 11 per 1,000, and under-five mortality is 73 per 1,000.

The trend in infant mortality for the three periods preceding the survey is from 52 per 1,000 (1988-1992) to 64 per 1,000 (1993-1997) to 62 per 1,000 (1998-2002), suggesting that there has been relatively little change in infant mortality over the past ten years.

The estimates of infant mortality for the two most recent periods are higher than the estimate for the earliest period, which could reflect a recent increase in infant mortality. However, all three estimates are within sampling error of each other (i.e., variability arising because the estimates are based on a sample of births rather than all births occurring in the specified periods), so it is just as likely that the difference represents the presence of sampling error rather than an actual increase in infant mortality.[2] Additionally, the earliest estimate is for a retrospective period 10-14 years preceding the survey, and respon-

[1] For example, see the neonatal and infant mortality rates for Hungary (1955), Italy (1955), and Puerto Rico (1957) (United Nations, 1961) and for Portugal (1968) (United Nations, 1975).

[2] The mortality estimates of the UHES are based on data provided by a sample of 5,463 women and are subject to sampling variability. Of interest here is the 95-percent confidence interval for the estimated infant mortality rates. The confidence intervals are very broad, extending about 12 points per 1,000 plus and minus of infant mortality estimate (Appendix B, Sampling Errors). Thus, the point estimates of infant mortality (52, 64, and 62 per 1,000) cannot be considered exact, and the true rate in each time period could be higher or lower by 12 points.

dent reporting error is typically more prevalent for periods more distant from the survey than for those closer to the survey. Bearing this in mind, it is appropriate to focus on the rates for the ten-year period preceding the survey, and the conclusion is that the infant mortality rate has remained basically unchanged over the past ten years at about 62 per 1,000.

8.3 RECENT IMR ESTIMATES FROM VARIOUS SOURCES

Recent infant mortality estimates for Uzbekistan are available from three national-level surveys: the 2002 UHES, the 2000 Multiple Indicator Cluster Survey (MICS), and the 1996 UDHS. All of these surveys used the World Health Organization's definitions of live birth and child death.[3]

Infant mortality rates are also available from the Ministry of Health. The MOH rates are based on data collected in a national registration system that relies on local health officials to register events following protocols that were established during the Soviet era. These protocols define live births somewhat differently than the World Health Organization does. One difference is that a pregnancy ending at a gestation age of less than 28 weeks (or weighing less than 1,000 grams or measuring less than 35 centimeters) is considered premature and is classified as a late miscarriage—even if signs of life are present at the time of delivery—unless the child survives for seven days. Only if the child survives the early neonatal period is it classified as a live birth. A second difference concerns full-term births (pregnancy ending at a gestation age of 28 weeks or more). The event is classified as a live birth if the child breathes at the time of delivery, but is considered a stillbirth if breathing is not evident at delivery (even though other signs of life are present). Thus, some events classified as miscarriages or stillbirths in the registration system would be classified as live births and infant deaths according to the WHO definitions used in the three surveys.

In addition to the differences in definitions between the surveys and the registration system, there are differences in the methodology of data collection. In all three surveys, information about births and child deaths was obtained from the mother. In contrast, data collection for the registration system requires that either a health official or a family member be proactive and take the initiative to register the occurrence of births and deaths of deceased children.

Infant mortality estimates from the various sources are shown in Table 8.2 and Figure 8.1. It is evident that the estimates from the three surveys and the estimates based on the registration data represent different levels of mortality. The survey estimates are substantially higher than those from the MOH. For the most recent period (1998-2002), the survey estimate of infant mortality (62 per 1,000) is three times the MOH estimate (19 per 1,000).

[3] The 2002 UHES and the 1996 UDHS used similar data collection processes and direct estimation techniques to produce infant mortality estimates. The 2000 MICS employed a different methodology for both data collection and rate estimation. MICS estimates are based on the reported proportion dead of children ever born to respondents and involves the conversion of those proportions to a mortality rate—a procedure known as the "Brass Estimation Technique" (United Nations Children's Fund, 2001). The important point here is that despite the differences in methodology between these surveys, all IMR estimates are quite close and far exceed recent IMRs reported by the Ministry of Health.

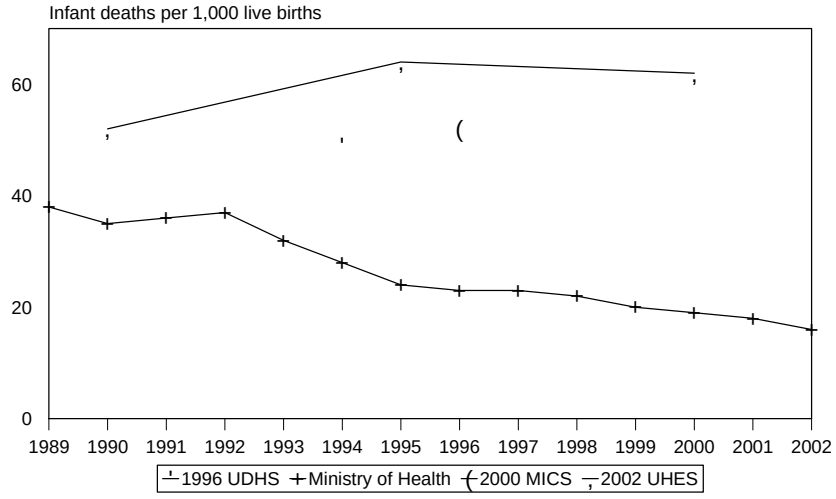
Table 8.2 Infant mortality estimates from various sources

Recent infant mortality estimates from three surveys (2002 UHES, 2000 MICS, 1996 UDHS) and the Ministry of Health, by time period, Uzbekistan 1988-2002

Calendar period	2002 UHES	2000 MICS	1996 UDHS	Ministry of Health
1998-2002	61.7			19.1
1993-1997	64.1	52[a]		27.2
1992-1996			49.1	
1988-1992	52.2			37.6

[a] Calendar period for MICS estimate was not specified in the MICS report; can be taken as the period 1993-1997.
Sources: 2000 MICS (UNICEF, 2001), Ministry of Health (WHO/EURO, 2003)

Figure 8.1 Infant Mortality Estimates from Three Surveys and the Ministry of Health



There are a number of reasons for placing greater credibility in the infant mortality estimates from surveys than from the MOH. First, several studies of mortality in the Central Asian Republics during the Soviet era have concluded that the registration systems in those countries undercounted infant deaths and that infant mortality rates based on the register data are underestimates.[4] There is no evidence that the collection of infant mortality data by the registration systems has improved in these countries in the post-Soviet era. Second, all three recent population-based surveys report infant mortality rates substantially higher than those of the MOH. Third, there is overwhelming evidence that to the extent that there is error in reporting of infant and child deaths in surveys, it is in the direction of underreporting of deceased children. Thus, the survey estimates should be considered minimal estimates. And fourth, the results of the 2002 UHES are similar to the rates estimated by survey methods for other countries in the region with similar health care systems, for example, Kazakhstan (61.9 per 1,000) and the Kyrgyz Republic (61.3 per 1,000) (Sullivan and Themme, 2003).

[4] For example, see Anderson and Silver, 1986, 1997; Ksenofontova, 1994; Velkoff and Miller, 1995; Kingkade and Sawyer, 2001.

8.4 DIFFERENCES IN ESTIMATES OF INFANT MORTALITY

As suggested above, some of the differences between the infant mortality estimates from the 2002 UHES and the MOH are due to definitional issues. However, definitional issues can only account for differences during the early neonatal period (the mortality rate for children less than seven days old). Table 8.3 shows the degree to which the overall difference in the infant mortality for the period 1998-2002 arises from mortality before age seven days or from the remainder of infancy. Of the overall difference of 42 deaths per 1,000 (62 as opposed to 20 per 1,000), about two-thirds (63 percent) is attributable to the period from age seven days to the end of infancy.

This indicates that definitional issues account for less than half of the overall difference between infant mortality estimates from the surveys and those from the MOH. If the survey mortality rates are valid, the apparent conclusion is that there is considerable underreporting of events in the registration system that is independent of issues of definition. The implication is that even if Uzbekistan were to adopt the WHO definitions of live birth and infant death, underestimation of infant mortality by the MOH would not be eliminated. There are factors other than the definitional issues that result in underreporting of infant deaths in the registration system.

Table 8.3 Mortality rates for segments of infancy

Percent contribution of differences in the mortality rates for segments of infancy to the total difference in infant mortality estimates, 2002 UHES and Ministry of Health

Segment of infancy	Mortality rates 1998-2002			Percent contribution of segment of infancy to the difference in IMR estimates
	2002 UHES	Ministry of Health[1]	Absolute difference	
Under 7 days	19.8	4.3	15.5	37.0
7-365 days	41.9	15.5	26.4	63.0
Total	61.7	19.8	41.9	100.0

[1] Calendar period for MOH estimate is 1998-2001.
Source: Ministry of Health (WHO/EURO, 2003)

8.5 SOCIOECONOMIC DIFFERENTIALS IN CHILDHOOD MORTALITY

Table 8.4 show differentials in infant and child mortality from the 2002 UHES by socioeconomic characteristics. The estimated rates for subgroups of the population are for the 10-year period preceding the survey.

Infant mortality is significantly higher in rural areas (75 per 1,000) than in urban areas (43 per 1,000). Mortality rates for the neonatal, postneonatal, and child segments of childhood mortality are all higher in rural than in urban areas.

There are substantial differences in mortality by mother's level of education. Estimates of infant mortality differ by a factor of three between the least educated women (95 per 1,000) and the most educated women (29 per 1,000).

Mortality differentials by ethnicity indicate that children born to women of Uzbek ethnicity are at greater risk of dying at all ages than children born to women of other ethnicities.

Table 8.4 Early childhood mortality rates by socioeconomic characteristics

Neonatal, postneonatal, infant, child, and under-five mortality rates for the ten-year period preceding the survey, by socioeconomic characteristics, Uzbekistan 2002

Socioeconomic characteristic	Neonatal mortality (NN)	Postneonatal mortality[1] (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
Residence					
Urban	26.8	16.1	42.9	11.0	53.4
Rural	37.9	36.6	74.6	14.0	87.5
Mother's education					
Primary/middle	58.8	35.8	94.6	8.4	102.2
Secondary	34.9	33.3	68.1	14.9	82.0
Secondary special	25.9	23.7	49.7	12.3	61.4
Higher	21.0	8.4	29.4	6.3	35.5
Ethnicity					
Uzbek	35.9	29.1	65.1	13.3	77.5
Other	18.4	28.4	46.8	9.8	56.1
Making ends meet					
Great difficulty	31.9	35.0	66.9	13.4	79.4
Some difficulty	34.3	28.0	62.4	12.0	73.6
A little difficulty	35.1	25.2	60.3	13.4	72.9
Easily	34.4	26.0	60.4	12.6	72.2
Total	33.9	29.1	62.9	12.9	75.0

[1] Computed as the difference between the infant and the neonatal mortality rates

Mortality differentials by indicator of household economic stability (making ends meet) are in the expected direction, but the differences are modest. For children of women residing in households having great difficulty in making ends meet, infant mortality is 67 per 1,000, while for children of women in households that easily make ends meet, infant mortality is 60 per 1,000.

8.6 Demographic Differentials in Childhood Mortality

The relationship between early childhood mortality and demographic variables is shown in Table 8.5. For most populations in Uzbekistan, male children experience higher mortality than female children. Nationally, the level of infant mortality is 67 per 1,000 for males and 59 per 1,000 for females. Thus, infant deaths are 14 percent more likely among males than females.

Differentials in infant mortality by age of mother or birth order are small except for the relatively high rate among children of birth order four or higher (78 per 1,000).

There is a clear association between mortality risk and the length of the preceding birth interval. Children born after a short birth interval (i.e., less than 24 months after a preceding birth) are at greater risk of dying than those born after longer intervals. The infant mortality rate for births following an interval of less than 24 months (80 per 1,000) is greater than the rate for births following an interval of 24-35 months (64 per 1,000), and much greater than the rate for births following an interval of 36-47 months (32 per 1,000). This relationship suggests that some mortality reduction would result if the proportion of births occurring after a short birth interval were reduced.

Table 8.5 Early childhood mortality rates by demographic characteristics

Neonatal, postneonatal, infant, child, and under-five mortality rates for the ten-year period preceding the survey, by demographic characteristics, Uzbekistan 2002

Demographic characteristic	Neonatal mortality (NN)	Postneonatal mortality[1] (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
Child's sex					
Male	37.4	29.4	66.8	12.1	78.1
Female	30.1	28.7	58.8	13.6	71.6
Mother's age at birth					
<20	39.8	23.7	63.5	14.1	76.7
20-29	32.6	27.6	60.2	9.9	69.5
30-39	33.8	35.8	69.5	21.2	89.3
40-49	*	*	*	*	*
Birth order					
1	36.1	22.0	58.1	7.9	65.6
2-3	29.2	30.1	59.3	12.3	70.8
4+	41.3	37.0	78.3	20.6	97.2
Preceding birth interval					
<24 months	42.9	37.5	80.4	10.4	90.0
24-35 months	29.5	34.3	63.9	16.6	79.4
36-47 months	13.1	19.2	32.3	12.3	44.2
48+ months	30.4	31.7	62.2	22.2	83.0
Total	33.9	29.1	62.9	12.9	75.0

Note: An asterisk indicates that the figure is based on fewer than 250 unweighted cases and has been suppressed.
[1] Computed as the difference between the infant and the neonatal mortality rates

8.7 DIFFERENTIALS IN CHILDHOOD MORTALITY BY WOMEN'S STATUS

Several questions were included in the 2002 UHES from which indicators of women's status could be developed. These indicators are meant to provide insight into a woman's ability to act effectively in her own interest and in the interest of those who depend on her. It follows that if women—the primary caretakers of children—enjoy high status, the health and survival of their infants should be enhanced.

Female respondents were asked about their participation in household decisionmaking and about the circumstances under which a wife is justified in refusing to have sexual relations with her husband. Indicators were developed that scale 1) a woman's participation in household decisionmaking and 2) her right to refuse sexual relations (see chapter 16). The higher the scores on these indicators, the higher a woman's status and the more empowered she is to care for her children.

Table 8.6 shows childhood mortality rates according to two indicators of women's status. For both indicators, there is a strong association between increasing status of women (higher scores on the index) and decreasing levels of childhood mortality. Infant mortality among children of women who have no say in household decisionmaking is 102 per 1,000, while for women who participate extensively in decisionmaking, the rate is half as high (50 per 1,000). Similarly, infant mortality is much higher among children of women who believe there is no justifiable reason for a woman refusing sexual relations with her husband (92 per 1,000) than among women who believe there are 3 or 4 reasons (60 per 1,000) that justify a woman refusing sexual relations with her husband.

Table 8.6 Early childhood mortality by women's status

Neonatal, postneonatal, infant, child and under-five mortality rates for the ten-year period preceding the survey, by women's status indicators, Uzbekistan 2002

Indicator of women's status	Neonatal mortality (NN)	Postneonatal mortality[1] (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
Number of decisions in which woman has final say[2]					
0	42.6	59.5	102.0	8.7	109.9
1-3	32.2	26.8	59.0	10.4	68.8
4-6	37.3	23.1	60.5	16.3	75.8
7-8	26.0	24.3	50.3	15.6	65.2
Number of reasons to refuse sex with husband					
0	26.7	65.7	92.4	6.7	98.4
1-2	40.8	53.5	94.2	8.0	101.5
3-4	33.4	26.2	59.6	13.4	72.1
Total	33.9	29.1	62.9	12.9	75.0

[1] Computed as the difference between the infant and the neonatal mortality rates
[2] Either by herself or jointly with others

8.8 HIGH-RISK FERTILITY BEHAVIOR

Many research studies have shown a strong relationship between fertility patterns and children's risk of dying. Typically, mortality risks are greater for children born to mothers who are too young or too old, who are born after a short birth interval, or who have a high birth order. In this analysis, a mother is classified as "too young" if she is less than 18 years of age, and "too old" if she is over 34 years of age. A "short birth interval" is defined as a birth occurring within two years of the previous birth, and a child is of "high birth order" if the mother had previously given birth to four or more children.

Table 8.7 shows the distribution of children born in the five years before the survey by risk category. While first births to women age 18-34 are shown in Table 8.7, they are not included in the analysis because they are not considered an avoidable risk.

Column 1 of Table 8.7 shows that, in the five-year period before the survey, 27 percent of births were in a single high-risk category and 7 percent were in a multiple high-risk category.

Column 2 of the table shows risk ratios for high-risk births relative to births not having any high-risk characteristics. The risk ratio for births in a single high-risk category is 1.07 (i.e., elevated by 7 percent over births in the not-in-any-high-risk category). For births with multiple high-risk characteristics, the risk ratio is 2.52 (i.e., elevated by 152 percent over births in the not-in-any-high-risk category).

Column 3 of Table 8.7 looks to the future and addresses the question: how many currently married women have the potential for having a high-risk birth? The results were obtained by simulating the risk category into which a birth to a currently married woman would fall if she were to become pregnant at the time of the survey. For example, a woman who is 37 years old at the time of the survey and has had four previous births, the last of which occurred three years before the survey, would be classified in the multiple high-risk category *age > 34 and birth order > 3,* which carries a risk ratio of 3.03 (i.e., elevated by 203 percent over births in the not-in-any-high-risk category).

Seventy-one percent of currently married women have the potential to give birth to a child with an elevated risk of dying. Forty-one percent of women have the potential to give birth to a child with multiple high-risk factors.

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 dying and the risk ratio, and the percent distribution of currently married women by category of risk if they were to conceive a child at the time of the survey, Uzbekistan 2002

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	36.0	1.00	23.0[a]
Unavoidable risk category			
First-order births between ages 18 and 34 years	30.0	0.77	6.50
Single high-risk category			
Mothers's age <18	1.0	0.00	0.0
Mother's age >34	1.8	1.31	6.7
Birth interval <24 months	12.9	1.14	9.3
Birth order >3	11.2	1.05	13.4
Subtotal	26.9	1.07	29.3
Multiple high-risk category[2]			
Age <18 and birth interval <24 months	0.1	0.00	0.0
Age >34 and birth interval <24 months	0.1	2.13	0.1
Age >34 and birth order >3	3.9	3.03	34.2
Age >34 and birth interval <24 months and birth order >3	0.4	3.64	1.1
Birth interval <24 months and birth order >3	2.5	1.67	5.8
Subtotal	7.0	2.52	41.2
In any avoidable high-risk category	34.0	1.37	70.5
Total	100.0	na	100.0
Number of births	2,444	na	3,720

Note: Risk ratio is the ratio of the proportion dead of births in a specific high-risk category to the proportion dead of 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 occurred less than 15 months ago, or latest birth being of order 3 or higher.
[2] Includes the combined categories *age<18* and *birth order>3*
[a] Includes sterilized women