9 INFANT AND CHILD MORTALITY

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Estimates of levels, trends and differentials in neonatal, post-neonatal and child mortality are important for monitoring and evaluating ongoing health programs and for formulating future policies. Levels of infant and child mortality are not only indicators related to health conditions, but are generally regarded as important indicators of the level of development of a society. Infant mortality rates and under-five mortality rates are used to assess the level of development, commonly as part of composite indexes. Infant and under-5 mortality rates appear in almost all international indicator sets on development, including those of the Millennium Development Goals.

This section focuses on the findings of the TDHS-2003 with respect to mortality during infancy and early childhood. The results of the TDHS-2003 are critical for the reassessment of policies and strategies for the improvement of survival chances of children in Turkey, since estimates from the vital registration system are not available. The section also includes estimates of perinatal mortality and examines the risk factors for births in Turkey.

Estimates in this chapter were computed by using the birth history data derived from the individual questionnaire. All ever-married female respondents in the TDHS-2003 were asked to provide a complete birth history, including the sex, birth date, survival status, and current age or age at death for each of their live births. The data were used to calculate five measures of infant and child mortality, namely:

- **Neonatal mortality**, the probability of dying in the first month of life
- **Post-neonatal mortality**, the probability of dying after the first month of life but before the first birthday
- **Infant mortality** ($_1q_0$), the probability of dying in the first year of life
- **Child mortality** ($_4q_1$), the probability of dying between the first and fifth birthday
- **Under-five mortality** ($_5q_0$), the probability of dying before the fifth birthday.

Perinatal mortality estimates were computed by using data from the birth history, as well as the demographic calendar. The latter was used to collect information on stillbirths.

9.1 Assessment of Data Quality

Infant and child mortality rates are subject to both sampling and non-sampling errors. The measurement of sampling errors is relatively easy, but non-sampling errors are difficult to detect and correct for. Non-sampling errors cover a wide range of errors, involving under-reporting of births and deaths, errors by the interviewers in recording responses, and the like. International research has shown that infant and child mortality estimates from sample surveys

are susceptible to such errors. The first step in the consideration of the TDHS-2003 mortality data is to look for evidence of non-sampling errors in order to assess whether information collected in the survey on infant and child mortality are of acceptable quality.

One of the most powerful interviewing tools for collecting information on births and deaths is the birth history. However, birth histories are subject to respondent recall errors, and these errors may result in biased rates and trends over time. Therefore, a preliminary assessment of the quality of birth history data is made in this section with respect to completeness and accuracy of date reporting, heaping of age at death, and sex-selective omission of births.

A commonly encountered problem in birth history data is unreported birth dates and ages at death. Interviewers were required to obtain full information on birth dates (i.e., month and year of birth) for births occurring since January 1998 (for which calendar data was collected). Table D.4 in Appendix D shows that complete information on birth dates were collected for virtually all births occurring since 2001 and for nearly 94 percent of births during 1998-2000. There is somewhat greater deterioration in the completeness of birth date information the further back one goes from the survey date, but the percentage is above 90 percent for births occurring since 1985. Overall, the percentage of live births in the 15 years preceding the survey for which information on year of birth was missing is 4 percent. Both month and year of birth were missing for about one percent of all live births in the 15-year period before the TDHS-2003. Less than one percent of deaths recorded in the birth histories lacked an age at death. The TDHS-2003 data appear to be of good quality with respect to the completeness of the information collected on dates of birth and ages at death.

A further assessment of the data in regard to quality of birth dates does not reveal any systematic evidence of heaping. A pattern observed in previous surveys, the transference of births by interviewers out of the period for which health and calendar data were collected, does not seem to have happened in TDHS-2003. The calendar year ratios for the year 1998, the first year to be included in the health and calendar sections, are higher than 100, pointing to excess of births rather than a deficit (Table D.4 in Appendix D).

A closer inspection of the birth history data from the TDHS-2003 also reveals that heaping of ages at death was also minimal. In sample surveys, a commonly observed phenomenon is the heaping of age at death on convenient digits, for example on 6, 12, 18 or 24 months. This phenomenon may lead to the calculation of biased rates, especially if, as a net result, deaths are shifted from one age segment used in computing mortality rates to another. In this regard, one critical shift would be to record infant deaths as child deaths, by respondents heaping the age at death on 12 months, or by interviewers recording ages of death as "1 year". This seems to have not occurred in a considerable degree in the TDHS-2003, particularly for the last 10 year period (Table D.6 in Appendix D). A simulation model was applied to the data to see if the heaping of age at death on 12 months would bias estimates of infant mortality. The results indicated that any bias in the infant mortality rate from heaping would be less than 5 percent. The rates presented here are therefore calculated directly by assigning all deaths reported at 12 months or "1 year" to the post-infant age period.

One further check that was performed to assess the reliability of birth history data was to calculate sex ratios at birth for all live births. These ratios are expected to fluctuate around 105 male births per 100 female births. Table D.4 in Appendix D shows that the overall sex ratio for all births in the birth history is 104.4, which is in line with expectations. The sex ratio of live births during the 2000-2004 period is also in line with expectations, at 105.4. For earlier periods, fluctuations are observed in sex ratios at birth, without any systematic over or under reporting of males or females.

9.2 Levels and Trends in Infant and Child Mortality

The first panel of Table 9.1 presents infant and child mortality rates for periods 0-4, 5-9, and 10-14 years preceding the TDHS-2003. The first two of these periods largely correspond to the five-year periods preceding the TDHS-1998, which are shown in the lower panel of the table, thus enabling comparisons between the two surveys[1].

The estimated infant mortality rate for the most recent period (0-4 years preceding the survey) is 29 per 1,000 live births. Some 59 percent of infant deaths occurred during the neonatal period (i.e. during the first four weeks of life). Child mortality is found to be approximately 9 per 1,000. The results also show that the probability of dying before the fifth birthday is around 37 per 1,000.

Most of the deaths before the first birthday in Turkey occur before completing the first month of life. In other words, as observed in the TDHS-1998, the pattern where neonatal mortality rates exceed post-neonatal mortality rates is continuing. An examination of the variation in mortality rates by age segments also reveals that a large proportion of under-five deaths occur before the first birthday (78 percent).

Table 9.1 Infant and child mortality

Neonatal, post neonatal, infant, child and under-five mortality rates by five-year periods preceding the TDHS-2003 and TDHS-1998

Years preceding survey	Neonatal mortality (NN)	Post neonatal mortality (PNN)	**Infant mortality ($_1q_0$)**	Child mortality ($_4q_1$)	**Under-five mortality ($_5q_0$)**
TDHS-2003					
0-4	17	12	29	9	37
5-9	24	22	47	10	56
10-14	34	25	59	11	69
TDHS-1998					
0-4	26	17	43	10	52
5-9	30	24	54	14	67

[1] The TDHS-2003 fieldwork was completed between December 2003 and May 2004; a somewhat longer data collection period was in effect compared to the TDHS-1998. The latter was completed during the summer and autumn months of 1998. On the average, the median reference date of estimates from the TDHS-2003 would differ by about 4 months from the estimates of the TDHS-1998, when five year period preceding each of the surveys is considered.

The figures in Table 9.1 point out to a relatively fast pace of decline in infant and child mortality rates in Turkey. For the two most recent periods, major declines in neonatal mortality (29 percent) and post-neonatal mortality (45 percent) have taken place. In general, a decline of about 38 percent in the infant mortality rate, and a decline of about 34 percent in the under-five mortality rate are implied by the results of the TDHS-2003. These declines are somewhat faster than those observed in the TDHS-1998. Using information from prior surveys, Figure 9.1 shows that the infant mortality rate has declined from 53 deaths per 1,000 live births in 1993 to 29 deaths per 1,000 in 2003.

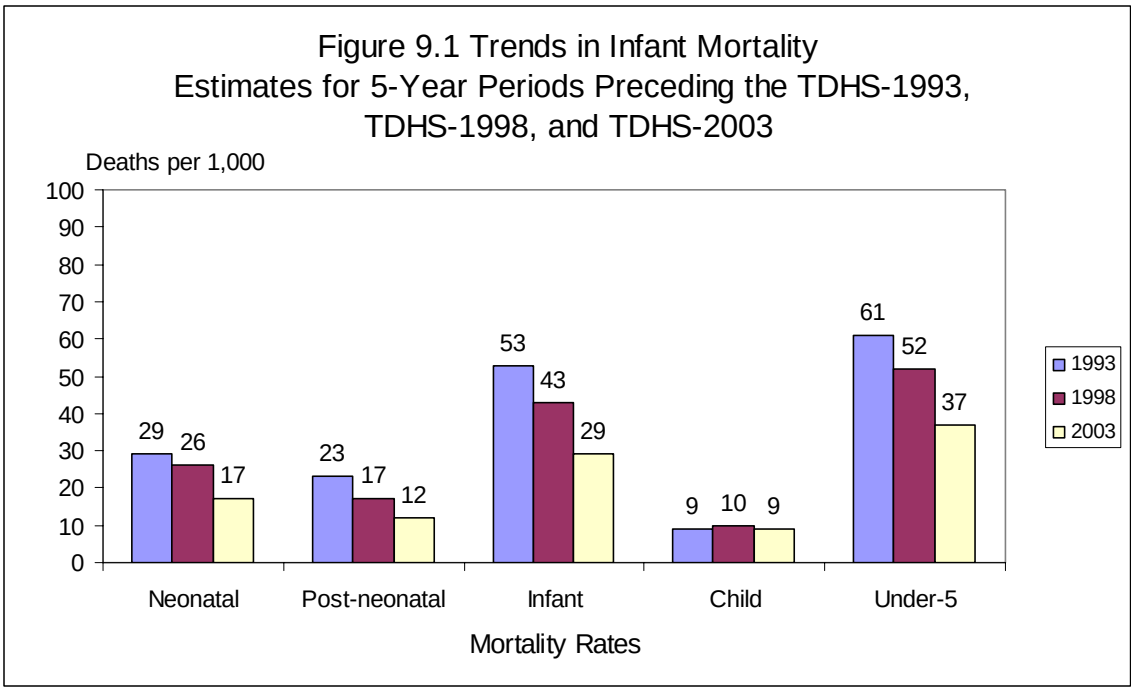

Table 9.1 also presents comparable mortality estimates from the TDHS-1998. Such comparisons are useful for further assessing the quality of data, as well as confirming the observed trends. Since the two surveys are approximately five years apart, the estimates for the 5-year periods preceding the two surveys overlap to a large extent. The estimates for the 5-9 year period preceding the TDHS-2003 are comparable with the estimates for the 0-4 year period preceding the TDHS-1998. The same comparability is also applicable to 10-14 and 5-9 year periods preceding the TDHS-2003 and TDHS-1998 respectively.

The consistency between the two surveys is impressive. In none of the estimates does one find a difference of more than 5 per thousand. Such differences are negligible and in fact imply full agreement between two sets of independent estimates in sample surveys.

9.3 Differentials in Infant and Child Mortality

Table 9.2 presents the mortality rates by urban-rural residence, region, and level of mother's education for the five-year period preceding the survey. The figures should be interpreted with caution, since they are based on a small number of observations and are,

therefore, statistically unstable. The infant mortality rate in the rural areas is about 70 percent higher than in urban areas (39 and 23 per 1,000, respectively). Most of the difference is attributable to differences in the post-neonatal mortality. In rural areas, the excess of neonatal mortality over post-neonatal mortality is smaller than in urban areas.

Table 9.2 Early childhood mortality rates by socioeconomic characteristics

Neonatal, post-neonatal, infant, child, and under-five mortality for the five-year period preceding the survey by socioeconomic characteristics, Turkey 2003

Socioeconomic characteristic	Neonatal mortality (NN)	Post neonatal mortality (PNN)[1]	**Infant mortality ($_1q_0$)**	Child mortality ($_4q_1$)	**Under-five mortality ($_5q_0$)**
Residence					
Urban	15	8	23	7	30
Rural	21	18	39	11	50
Region					
West	15	7	22	8	30
South	19	10	29	2	30
Central	10	10	21	12	33
North	20	14	34	14	48
East	23	18	41	7	49
Selected NUTS 1 Regions					
İstanbul	16	4	19	13	32
Southeast Anatolia	21	16	38	9	46
Education					
No education/Prim. incomplete	29	22	51	13	63
First level primary	14	11	25	8	33
Second level primary and higher	15	3	18	6	24

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

Infant and under-five mortality rates are higher than the national average in the North and East regions. In all regions, neonatal mortality exceeds post-neonatal mortality, with the exception of the Central region where the two rates are equal. Similar findings are also applicable for under-5 mortality rates. However, the child mortality rate for the South region is exceedingly low, most probably due to chance fluctuations, a characteristic often found in survey data especially in cases when the phenomenon under consideration falls within the definition of a rare event.

The strong relationship between survival chances of children and the level of education of their mothers is once again revealed by the TDHS-2003. For all measures of mortality, probabilities of dying are lower for children of mothers with higher educational levels. For instance, the infant mortality rate among children of mothers who have had no education or had not completed primary school is 51 per thousand, where the same rate is only 18 per thousand among children of women with second level primary or higher education.

Table 9.3 shows differentials in infant and child mortality by various biodemographic characteristics. In order to base the calculations on sufficient numbers of deaths and exposure, the rates are calculated for the 10-year period before the survey.

Table 9.3 Early childhood mortality rates by biodemographic characteristics

Neonatal, post-neonatal, infant, child, and under-five mortality for the ten-year period preceding the survey by biodemographic characteristics, Turkey 2003

Biodemographic characteristic	Neonatal mortality (NN)	Post neonatal mortality (PNN)[1]	**Infant mortality ($_1q_0$)**	Child mortality ($_4q_1$)	**Under-five mortality ($_5q_0$)**
Sex of child					
Male	22	18	39	9	48
Female	20	16	36	9	45
Mother's age at birth					
< 20	20	27	47	13	60
20-29	20	16	35	7	42
30-39	25	15	40	10	50
40-49	11	15	26	55	79
Birth order					
1	15	13	27	5	33
2-3	20	16	36	9	44
4-6	25	22	47	16	62
7+	45	35	80	15	94
Previous birth interval[2]					
< 2 years	39	35	74	16	89
2 years	23	16	38	11	49
3 year	14	12	25	9	34
4 years or more	16	11	27	7	34
Size at birth[3]					
Small or very small	20	15	36	NA	NA
Average or larger	13	9	22	NA	NA

NA= not applicable
[1] Computed as the difference between the infant and child mortality rates
[2] Excludes first-order births
[3] Refers for the five-year period before the survey

The influence of various biodemographic characteristics on survival chances of infants is well known, and the TDHS-2003 results confirm most of the expected relationships. Male mortality rates are higher than those for females during all age segments, as expected. Table 9.3 also shows that children of teenage mothers, high-birth-order children, and children born following a short birth interval face elevated risks of dying than those in other subgroups. Particularly notable are differentials by birth interval, where infant mortality rates are as high as 74 per thousand among children born after a birth interval of less than 2 years.

Children's weight at birth is also closely associated with their chances of survival. Children reported by mothers as "small or very small" at birth were 53 percent more likely to die during the neonatal period compared with children whose birth weight was reported as being "average or larger than average."

9.4 Perinatal Mortality

The TDHS-2003 asked women to report on pregnancy losses and the duration of the pregnancy for each loss, for all such pregnancies ending since January 1998 through to the interview date. Pregnancy losses occurring after seven completed months of gestation (stillbirths) plus deaths to live births within the first seven days of life (early neonatal deaths) constitute perinatal deaths. When the total number of perinatal deaths is divided by the total number of pregnancies reaching seven months gestation, the perinatal mortality rate is derived.

Table 9.4 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, Turkey, 2003

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	7	8	28	525
20-29	19	31	19	2,668
30-39	20	12	36	908
40-49	2	1	*	79
Previous pregnancy interval in months				
First pregnancy	13	10	19	1,244
<15	6	14	42	463
15-26	13	7	23	865
27-38	3	8	22	520
39+	13	13	24	1,088
Residence				
Urban	29	29	21	2,752
Rural	19	23	29	1,429
Region				
West	12	14	19	1,354
South	7	8	27	564
Central	10	7	20	822
North	1	4	(19)	253
East	19	20	33	1,187
Selected NUTS 1 Regions				
İstanbul	4	6	16	647
Southeast Anatolia	9	9	27	679
Mother's education				
No education/Prim. incomplete	17	18	38	905
First level primary	26	22	21	2,259
Second level primary	5	11	19	820
High school and higher	0	2	(8)	196
Total	48	52	24	4,180

[1] Stillbirths are foetal deaths in pregnancies lasting seven or more months.
[2] Early neonatal deaths are deaths at age 0-6 days among live-born children.
[3] The sum of the number of stillbirths and early neonatal deaths divided by the number of pregnancies of seven or more months' duration.
Note: Figures in parentheses are based on less than 250 unweighted pregnancies.

Table 9.4 shows perinatal mortality rates, according to demographic and socioeconomic characteristics. The perinatal mortality rate is estimated at 24 per thousand during the 5 years preceding the TDHS-2003. As expected, the perinatal mortality rate exhibits a U-shaped relationship with the age of the mother, with the rate declining to 19 per thousand when the mother's age is 20-29. Pregnancies after a short pregnancy interval are also expected to be at high perinatal risk; in Turkey, the perinatal mortality rate is as high as 42 per thousand when the pregnancy interval is less than 15 months.

Perinatal mortality rates are higher in rural areas (29 per thousand) compared with urban areas (21 per thousand). The rate is higher in the South and East region than the national average. Once again, a strong relationship is evident between mother's education and perinatal mortality risks. For women in the lowest education category, perinatal mortality rate is as high as 38 per thousand, but declines to a level almost a third of the national average for pregnancies of women with high school or more education.

9.5 High-risk Fertility Behaviour

As the findings in the previous section indicate, a strong relationship exists between a mother's pattern of fertility behavior and her children's survival chances. Infants and young children born to very young mothers or to older mothers, born after a short birth interval, or born after their mothers have already had many children, face higher mortality risks. In the following analysis, mothers are classified as "too young" if they were less than 18 years old at the time of the birth, and "too old" if they were 34 or older at the time of the birth. A "high birth order" is one occurring after three or more previous births. A "short birth interval" is defined as a birth occurring less than 24 months after a previous birth. In the analysis of birth intervals, only children whose preceding birth interval was less than 24 months are included, even though a short birth interval also increases the risk of dying for the previous child at the beginning of the interval. The latter relationship is subject to reverse causality in that the death of an earlier child may cause the subsequent interval to be short.

Column 1 in Table 9.5 shows the percentage of children born in the five years preceding the survey who were in specific risk categories. Risk ratios are also presented for each of the risk categories (see column 2, Table 9.5). A risk ratio here is defined as the ratio of the proportion dead among children in a risk category, to the proportion dead among children *not in any high-risk category.*

Thirty-nine percent of children born in the five years preceding the survey were at elevated risk of dying at the time of their birth. First births to women between ages 18-34 are not included in this figure since they are considered to be in an unavoidable risk category. Among all children, 27 percent had an increased risk due to a single risk category, and 13 percent had an increased risk due to multiple factors. It is evident from the table that high birth order and short birth intervals are major factors contributing to elevated risks of mortality. Some 23 percent of children born in the last five years were of high birth orders, while 18 percent were born after a short interval.

Children whose mothers were in a single high-risk category faced more than twice the risk of dying than those children whose mothers were not in any of the risk categories. For those in a multiple high-risk category, relative mortality risks were up to 3 times the risks faced by children not in any risk category (Column 2, Table 9.5). The table shows that children born after a short birth interval faced 2.5 times higher risk of dying compared to those in the no-risk category. The findings also show that children born into any of the risk categories face up to 240 percent higher mortality risks.

Table 9.5 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 percent distribution of currently married women at risk of conceiving a child with an elevated risk of dying, by category of increased risk, Turkey 2003

Background characteristic	Percentage of births	Risk ratio	Percentage of currently married women[a]
Not in any high-risk category	30.6	1.00	29.0[b]
Unavoidable risk category			
(First births)	30.4	1.14	7.1
Single high-risk category			
Mother's age <18	3.1	1.78	0.2
Mother's age >34	2.5	1.49	17.8
Birth interval <24 months	10.0	2.49	7.4
Birth order >3	10.9	1.98	8.7
Subtotal	26.5	2.11	34.1
Multiple high-risk category			
Age <18 & birth interval <24[c] months	0.3	2.04	0.0
Age >34 & birth interval <24 months	0.3	0.00	0.3
Age >34 & birth order >3	4.9	2.54	25.4
Age >34 & birth interval <24 months and birth order >3	0.9	3.74	1.1
Birth interval <24 months and birth order >3	6.0	3.52	3.0
Subtotal	12.5	3.03	29.1
In any high-risk category	39.0	2.40	63.9
Total	100.0	-	100.0
Number of births	4,132	-	7,672

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*.

[a] Women were assigned to risk categories according to the status they would have at the birth of a child, if the child were conceived at the time of the survey: age less than 17 years and 3 months, age older than 34 years and 2 months, latest birth less than 15 months ago, and latest birth of order 3 or higher.

[b] Includes sterilised women

[c] Includes the combined categories *Age <18 and birth order >3*.

The final column of Table 9.5 includes the distribution of currently married women according to category of increased risk they would have been in if they had conceived at the time of the survey. A woman's current age, time elapsed since last birth, and parity are used to determine into which category her next birth would have fallen if she had conceived at the time

of the survey. For example, if a woman age 37 who had five children and had had her last birth three years before the survey were to have become pregnant, she would have fallen into the multiple risk category of being too old (34 or older) and at too high a parity (4 or more children). Women who have been sterilized are categorized as not being in a high-risk category.

Sixty-four percent of women who were married at the time of the TDHS-2003 were found to be at risk of conceiving a child with an increased risk of dying. Twenty-nine percent of women fell into none of the risk categories while another 29 percent of women fell into a multiple risk category. As shown in the second column of the table, if a woman in this category were to conceive, the survival chances of a child would be considerably lower than those of births to women not in the risk categories. The largest group of women fell into the multiple risk category where the child to be born would have had, at the time of birth, a mother who was older than 34 and who already had at least three births.