8 INFANT AND CHILD MORTALITY

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8.1 INTRODUCTION

Infant and child mortality rates are some of the most important social indicators in Zambia. The national population policy developed in 1984 targeted the reduction of infant mortality from 97 deaths per 1,000 live births in 1980 to 65 per 1,000 live births by the year 2000 and to 50 by the year 2015. In this chapter, information about the levels, trends and differentials are provided, as well as data on high-risk fertility behaviour. The data are disaggregated by sex, socio-economic characteristics, demographic characteristics and other variables that influence mortality levels among children under age five.

Estimates of childhood mortality are based on information from the birth history section of the questionnaire administered to individual women. In the birth history section, women were asked to provide information about all their births starting with the first one, irrespective of whether they were still alive. Additional information about sex of children, whether the children were still alive, age at death for dead children, date of birth for all children and whether the children lived with the mother or elsewhere were collected. This information has provided robust direct estimates of early childhood mortality in Zambia which compare well with other estimates from censuses.

The direct early childhood mortality rates estimated with this data are:

Neonatal mortality: the probability of dying within the first month of life

Infant mortality: the probability of dying before the first birthday

Postneonatal mortality: the difference between infant and neonatal mortality

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 for child mortality which is expressed per 1,000 children who survived to 12 months of age.

Data collected using the birth history in the 2001-2002 ZDHS are subject to a number of potential errors. First, the data reflect only surviving women age 15-49 years; no data are available for children of women who died. To the extent that child mortality of surviving and non-surviving women differs substantially and that young children of non-surviving women make up a significant portion of all young children, the mortality indicators compiled from the birth history would be biased.

Another possible error is underreporting of events; respondents are likely to forget events that occurred in the more remote past. Omission of infants' deaths may take place, especially in cases where deaths occur early in infancy. If such deaths are selectively reported, consequences will not only be a lower infant mortality rate (IMR) and neonatal mortality rate (NNMR), but also a low ratio of neonatal deaths to infant deaths. On the other hand, misstatements of the date of birth and age at death will result in distortion of the age pattern of death. This may affect the final indices obtained because of shifting of ages above or below the cut-offs for the different mortality categories.

Fifty-nine percent of all neonatal deaths in the 20 years preceding the 2001-2002 ZDHS were early neonatal deaths (Appendix Table C.5). This figure is within the expected range and is the same as reported in the 1996 ZDHS. Further, it appears that infant deaths for births that occurred longer before the survey have not been underreported. The proportion of early neonatal deaths increases with an increase of the period before the survey. In the 1996 ZDHS, a reverse pattern was observed. The pattern observed in the 2001-2002 ZDHS can be attributed to the increase in heaping of deaths at 7 days with the reduction of the time period before the 2001-2002 ZDHS.

Another aspect that affects the childhood mortality estimates is the quality of reporting of age at death. In general, these problems are less serious for periods in the recent past than for those in the more distant past. If ages at death are misreported, it may bias the estimates, especially if the net effect of age misreporting results in transference of deaths from one age bracket to another. To minimise errors in the reporting of age at death, the interviewers were instructed to record the age at death in days if the death took place within one month after birth, in months if the child died within 24 months, and in years if the child was two years or older.

Table C.6 shows that the number of reported deaths at age 12 months is sometimes more than twice that of adjacent ages (11 and 13 months). If some of these deaths actually took place at less than 12 months of age, transference to age 12 months or older will result in a lower estimate of infant mortality than the actual level. However, age heaping is higher for births in the 5 to 14 years prior to the survey than for the most recent births. Overall, the heaping of deaths at 12 months of age is relatively minor compared with the total number of infant deaths in each period, and does not warrant adjustment of the data.

8.2 Levels and Trends in Infant and Child Mortality

Table 8.1 shows the variations in neonatal, postneonatal, infant, child and under-five mortality rates for successive five-year periods before the survey. The level of under-five mortality was 168 deaths per 1,000 births during the five-year period before the 2001-2002 ZDHS, indicating that around 1 in 6 Zambian children born during the period died before their fifth birthday. The indicators in the table can be segmented into two sections, neonatal mortality and postneonatal mortality which are components of the infant mortality rate; and infant mortality and child mortality which are components of the under-five mortality rate. Viewed this way, most of the deaths of infants (61 percent) occur after the first month of birth and those of children under five (about 57 percent) before their first birthday. Given the short period of reference in a child's life referred to by neonatal mortality and infant mortality, a disproportionate number of deaths occur in the first month and first year of childhood.

Table 8.1 Early childhood mortality rates

Neonatal, postneonatal, infant, child, and under-five mortality rates for three five-year periods preceding the survey, Zambia 2001-2002

Years preceding the survey	Neonatal mortality (NN)	Postneonatal mortality[1] (PNN)	**Infant mortality** ($_1q_0$)	Child mortality ($_4q_1$)	**Under-five mortality** ($_5q_0$)
0-4	37	58	95	81	168
5-9	29	63	93	83	168
10-14	31	64	95	87	174

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

Although Table 8.1 also presents indicators for the 10-14 year period before the survey, indicators in the table will not be used to infer trends. The primary reason for this is that reported mortality data for time periods more distant from the survey date may be subject to less complete reporting of events and less accurate reporting of dates of birth and ages at death than data for time periods immediately preceding the survey. Accordingly, trend analysis will be based on mortality estimates for the 0-4 year time periods preceding the 1992, 1996 and 2001-2002 ZDHS surveys.

Table 8.2 shows the childhood mortality rates for the 0-4 year period preceding the three recent ZDHS surveys. The table shows that all childhood mortality rates had increased in the period 1992-1996 and all but one (neonatal mortality) declined in the period 1997-2001. Under-five mortality, which had shown a modest increase from 191 to 197 deaths per 1,000 births between the 1992 and 1996 surveys, subsequently fell sharply to 168 in the 2001-2002 ZDHS. A similar pattern is evidenced for infant mortality. Although it is not clear what might be causing the decline in childhood mortality in Zambia, several factors could be involved. One possible factor could be the impressive coverage of vitamin A supplements for children. Data in Chapter 11 show that two-thirds of children 6-59 months were reported to have received a vitamin A supplement in the six months prior to the survey. Research has shown that adequate intake of vitamin A can reduce child mortality substantially (Pokhrel et al., 1994). Another possible factor is that, as mentioned earlier, the child mortality data omit the experience of children whose mothers have died. It is likely that the childhood mortality rates of children whose mothers have died are higher than those of children whose mothers are still alive. However, one analysis indicates that omission of data from deceased women would have a very small effect on the mortality estimates from 2001-2002 survey (Hodgins, 2003). Of course, sampling error could be responsible for some or all of the difference in the rates estimated by the three surveys. For example, consider the IMR estimates of the 1996 and 2001-2002 surveys (117 and 95 per 1,000, respectively). The 95 percent confidence interval for the 1996 estimate (100 to 117 per 1,000) (CSO, MOH, and Macro International, 1997: Appendix B) overlaps with that of the 2001-2002 estimate (85 to 105 per 1,000) (see Appendix B), indicating that sampling variability could be responsible for the observed variation in the rate.

Table 8.2 Trends in early childhood mortality rates

Neonatal, postneonatal, infant, child and under-five mortality rates for the five-year period preceding the survey, ZDHS 2001-2002, ZDHS 1996, and ZDHS 1992

Survey	Approximate calendar period	Neonatal mortality (NN)	Postneonatal mortality[1] (PNN)	**Infant mortality** ($_1q_0$)	Child mortality ($_4q_1$)	**Under-five mortality** ($_5q_0$)
ZDHS 2001-2002	1997-2001	37	58	95	81	168
ZDHS 1996	1992-1996	35	74	109	98	197
ZDHS 1992	1987-1991	43	65	107	94	191

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

8.3 EARLY CHILDHOOD MORTALITY BY SOCIOECONOMIC CHARACTERISTICS

Early childhood mortality rates by socio-economic characteristics are presented in Table 8.3. The table focuses on geographic and education differentials of women. The rates have been computed for a ten-year period instead of a five-year period in order to reduce sampling errors.

Table 8.3 Early childhood mortality by background characteristics

Neonatal, postneonatal, infant, child, and under-five mortality rates (per 1,000) for the ten-year period preceding the survey, by selected background characteristics, Zambia 2001-2002

Background characteristic	Neonatal mortality (NN)	Postneonatal mortality[1] (PNN)	**Infant mortality** ($_1q_0$)	Child mortality ($_4q_1$)	**Under-five mortality** ($_5q_0$)
Residence					
Urban	31	46	77	69	140
Rural	35	68	103	89	182
Province					
Central	35	57	92	110	192
Copperbelt	24	43	68	71	134
Eastern	29	55	84	89	166
Luapula	36	118	154	112	248
Lusaka	29	41	70	72	137
Northern	39	74	113	84	187
North-Western	25	49	74	60	130
Southern	29	47	76	77	148
Western	60	79	139	72	201
Mother's education					
No education	39	70	108	101	198
Primary	34	64	99	87	177
Secondary or higher	27	44	70	55	121

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

Early childhood mortality is lower in urban areas than in rural areas. However, there are exceptions with some rural provinces (North-Western and Southern provinces) having mortality rates comparable with urban provinces (Copperbelt and Lusaka provinces). In fact, North-Western province has the lowest under-five mortality rate (130 per 1,000 births) among all the provinces. This finding has also been corroborated by the 2000 Census data where the under-five mortality rate for North-Western province was measured at 137 per 1,000 births (CSO 2002b).

There are variations in childhood mortality indicators by background characteristics. The largest variations are in infant, child, and under-five mortality rates. Neonatal mortality has the least variation with the outlier being Western province where at 60 per 1,000 births the rate is more than twice that of the rate in Copperbelt province, 24 per 1,000 births. The rate in Copperbelt province (24 per 1,000 births), an urban province, is closely followed by North-Western province (25 per 1,000 births), one of the most rural provinces in Zambia.

Luapula province has the highest postneonatal mortality rate (118 per 1,000 births); it is almost three times higher that of Copperbelt province (43 per 1,000 births). Similarly, Luapula province has the highest infant, child, and under-five mortality rates. The rates in Luapula province are almost twice those of the lowest provinces: Copperbelt for infant mortality and North-Western province for child and under-five mortality.

The childhood mortality rates by mother's level of education of show the expected relationship, with children of better educated women having lower mortality rates.

A comparison of neonatal, infant, and under-five mortality from the 1992, 1996 and 2001-2002 surveys is shown in Table 8.4. For neonatal mortality, there was little change in urban rates between the three surveys but a steady decline in rural areas. For infant and under-five mortality, rates rose between 1992 and 1996 and then declined from 1996 to 2001-2002, both in urban and rural areas, although the increase in both infant and under-five mortality between 1992 and 1996 is small. The trend between the three surveys in early childhood mortality rates within the same category of mother's education is generally a curve, with rates increasing between 1992 and 1996 and then dropping from 1996 to 2001-2002. The only exception is the neonatal mortality rates for children of mothers with primary and secondary or higher education: rates generally decline between the three surveys.

Table 8.4 Trends in early childhood mortality rates by residence and education

Neonatal, infant, and under-five mortality rates for the ten-year periods preceding the survey, by residence and mother's education, ZDHS 2001-2002, ZDHS 1996, and ZDHS 1992

	Neonatal mortality (NN)			Infant mortality ($_1q_0$)			Under-five mortality ($_5q_0$)		
Residence and mother's education	ZDHS 1992	ZDHS 1996	ZDHS 2001-2002	ZDHS 1992	ZDHS 1996	ZDHS 2001-2002	ZDHS 1992	ZDHS 1996	ZDHS 2001-2002
Residence									
Urban	32	32	31	78	92	77	151	173	140
Rural	47	39	35	116	118	103	201	205	182
Mother's education									
No education	47	48	39	115	133	108	204	222	198
Primary	40	36	34	99	110	99	182	201	177
Secondary or higher	35	27	27	79	82	70	135	142	121

8.4 EARLY CHILDHOOD MORTALITY RATES BY DEMOGRAPHIC CHARACTERISTICS

Studies have shown that a number of demographic factors are strongly associated with the survival chances of young children. These factors include sex of the child, age of the mother at birth, birth order, length of the preceding birth interval, and the size of the child at birth. Table 8.5 presents mortality rates for by selected demographic characteristics. Again, for most variables in Table 8.5, the mortality estimates are calculated for a ten-year period before the survey so that the rates are based on a sufficient number of cases in each category to ensure statistical significance. However, five-year rates are presented for the birth weight variable because information collected for this indicator was available only for births during the period since 1996.

Female children have a lower mortality risk than males. The under-five mortality risk for males is more than 10 percent greater than that for females. Among the demographic characteristics, a preceding birth interval of less than 24 months poses the highest risk for child survival. For example, the data show that when the birth interval is less than 24 months, infant mortality is double that for a birth interval of 36 months or more. It should be noted that there is now a new international consensus (Setty-Venugopal and Upadhyay, 2002) that the optimal interval between births is at least 36 months. As illustrated in Table 8.5, early childhood mortality is higher for births occurring after an interval of 24-35 months than those occurring 36 or more months after a previous birth. For example, the infant mortality risk ratio for births occurring after an interval of 24-35 months (75 per 1,000) to births occurring after 36-47 months (69 per 1,000) is 1.09, i.e., children born 24-35 months after a previous birth are 9 percent more likely to die in the first year of life than those born 36-47 months after a previous birth). These findings show the importance of birth spacing as a means of reducing childhood mortality.

Mortality risks for each category of childhood mortality generally display a U-shape curve by mother's age and birth order. In Zambia, an exception to this pattern occurs in the case of child mortality (age 1-4); the child mortality rate for birth order 2-3 is higher than that of children of other birth orders.

Table 8.5 Early childhood mortality by demographic characteristics

Neonatal, postneonatal, infant, child, and under-five mortality rates for the ten-year period preceding the survey, by selected demographic characteristics, Zambia 2001-2002

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	34	61	95	89	176
Female	32	60	93	74	160
Mother's age at birth					
<20	43	67	110	84	185
20-29	29	61	89	84	166
30-39	34	53	87	75	155
40-49	38	72	110	90	191
Birth order					
1	42	65	107	81	180
2-3	28	59	87	90	169
4-6	31	61	92	72	157
7+	37	56	93	83	169
Previous birth interval[2]					
<24 months	62	96	157	106	247
24-35 months	24	51	75	79	148
36-47 months	19	50	69	70	134
48+ months	26	46	72	70	137
Birth size[3]					
Small or very small	84	61	145	na	na
Average or larger	29	57	86	na	na

Note: Rates based on 250 to 499 exposed persons are in parentheses.
na= Not applicable
[1] Computed as the difference between the infant and the neonatal mortality rates
[2] Excludes first-order births
[3] Rates for the five-year period preceding the survey

Studies have shown that a child's weight at birth is an important determinant of its survival chances. It should be noted that, since relatively few mothers had information on the child's exact weight at birth, mothers were instead asked whether their child was very large, larger than average, average, smaller than average, or small at birth, since this has been found to be a good proxy for the child's weight. Children reported to be small or very small are almost three times more likely to die in the first month than children reported to be average or larger. Their postneonatal and infant mortality rates are also significantly elevated.

8.5 WOMEN'S STATUS AND EARLY CHILDHOOD MORTALITY

Greater participation of women in household decision-making and greater control of their own lives have long been thought to lead to a better household situation overall.. A better household situation will have a positive effect on the well-being of children. Table 8.6 shows childhood mortality rates tabulated by three indices of women's status: the number of household decisions in which the woman has the final say, the number of reasons for which she feels a woman is justified in refusing to have sex with her husband and the number of reasons for which she feels wife beating is justified (see Chapter 3 for a detailed description of these indices).

Table 8.6 shows that there is no clear relationship between levels of childhood mortality and the number of decisions in which a woman has a final say in household decision-making. Similarly, no clear trends are apparent between child mortality and women's ability to refuse sex with their husbands. The only clear relationship between women's status indicators and early childhood mortality is with acceptability of wife-beating. In this case, risk of child death increases by number of reasons considered to justify beating, across all categories of early childhood mortality.

Table 8.6 Early childhood mortality by women's status indicators

Neonatal, postneonatal, infant, child and under-five mortality rates for the ten-year period preceding the survey, by selected women's status indicators, Zambia 2001-2002

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	31	66	97	87	175
1-2	33	63	95	89	176
3-4	36	55	91	72	156
Number of reasons to refuse sex with husband					
0	38	77	115	80	186
1-2	30	53	82	92	167
3-4	34	61	95	80	167
Number of reasons wife beating is justified					
0	30	46	76	67	138
1-2	31	55	86	77	157
3-4	34	62	95	87	174
5	36	70	106	86	182

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

8.6 HIGH-RISK FERTILITY BEHAVIOUR

There is a strong relationship between maternal fertility patterns and children's survival risks. Typically, the risk of early childhood death is higher among children born to mothers who are too young or too old, children born after too short a birth interval and among children of high birth order, than among other children. For the purpose of the analysis that follows, 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 at the time of the birth. Furthermore, for the purpose of this report and for the sake of trend analysis, a "short birth interval" is defined as less than 24 months after the previous birth, and a child is of "high birth order," if the mother had previously given birth to three or more children (i.e., the child is of birth order four or higher). It should be noted that first births, although they are often at increased risk of dying, are assigned to the "not in any high-risk" category because the first birth is not considered avoidable.

Table 8.7 shows the percent distribution of children born in the five years before the survey by these risk factors. The data presented in the first two columns of Table 8.7 address the issue of high-risk fertility behaviour from the perspective of the child. The first column shows the percentage of births in the five-year period before the survey that fall into one or more of the categories where the risk of dying is elevated. The second column presents the ratio of the proportion dead in each high-risk category to the proportion dead among children not in any high-risk category. Categories in which this risk ratio exceeds 1.0 are considered to have an elevated risk of dying.

Only 27 percent of births are in a "risk-free" category (not in any high-risk category). Forty-one percent of births are in the single high-risk category, with 26 percent being third order births or higher. Births in the multiple high-risk category are not as common as births in the single high-risk category. The percentage of births in the multiple high-risk category (18 percent) is less than half that of births in the single high-risk category.

Table 8.7 High-risk fertility behaviour

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, Zambia 2001-2002

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	27.0	1.00	19.9[a]
Unavoidable risk category			
First order births, mother's age 18-34	14.3	1.14	5.4
Single high-risk category			
Mother's age <18	9.2	1.30	0.8
Mother's age >34	0.2	1.15	2.5
Birth interval <24 months	5.5	1.34	10.3
Birth order >3	26.1	0.90	20.5
Subtotal	41.0	1.05	34.1
Multiple high-risk category			
Age <18 & birth interval <24 months[2]	0.5	2.00	0.6
Age >34 & birth order >3	10.9	0.82	21.4
Age >34 & BI <24 months & birth order >3	1.4	2.99	4.8
Birth interval <24 months & birth order >3	4.9	1.42	13.8
Subtotal	17.7	1.19	40.6
In any avoidable high-risk category	58.7	1.09	74.7
Total	100.0	na	100.0
Number of births	6,649	na	4,694

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 & birth order >3
[a] Includes sterilised women

In general, risk ratios are higher for children in multiple high-risk categories than in single high-risk categories. Most vulnerable are children born to mothers older than 34 years, less than 24 months after a preceding birth, and of a birth order greater than 3. Such children are almost three times more likely to die as children who are not in any risk category. However, only 1 percent of births fall in this category. Among single high-risk categories, a birth interval of less than 24 months results in a child running a 34 percent higher risk of dying than children not in any high-risk category; 6 percent of births are in this group.

Finally, the last column of Table 8.7 shows the potential for high-risk births from the perspective of the woman, i.e., the percentage of currently married women who, if they had become pregnant at the time of the survey, would give birth to a child with an elevated risk of dying. A woman's current age, time elapsed since the last birth, and parity are used to determine the risk category in which any birth a woman conceived at the time of the survey would fall. For example, if a respondent age 40 with a parity of four, and most recent birth within the 18 months before the survey were to become pregnant, she would fall in the multiple-risk category of being at too old, too high parity (three or more births) and giving birth too soon. Eighty percent of the women have the potential to give birth to a child with an elevated risk of dying; the majority of these women (41 percent) have the potential to give birth to children in the multiple high-risk categories.