Infant and under-five mortality in Afghanistan: current estimates and limitations

Kavitha Viswanathan,[a] Stan Becker,[b] Peter M Hansen,[c] Dhirendra Kumar,[d] Binay Kumar,[d] Haseebullah Niayesh,[e] David H Peters[a] & Gilbert Burnham[a]

[a] Department of International Health, The Johns Hopkins Bloomberg School of Public Health, E8132, 615 N. Wolfe St, Baltimore, MD, 21205, United States of America (USA).

[b] Department of Population, Family and Reproductive Health, The Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA.

[c] The GAVI Alliance, Geneva, Switzerland.

[d] Indian Institute of Health Management Research, Rajasthan, India.

[e] Department of Monitoring and Evaluation of the Ministry of Public Health of the Islamic Republic of Afghanistan, Kabul, Afghanistan.

Correspondence to Kavitha Viswanathan (e-mail: kviswana@gmail.com).

(Submitted: 20 June 2009 – Revised version received: 22 November 2009 – Accepted: 24 November 2009 – Published online: 7 April 2010)

Abstract

Objective To examine historical estimates of infant and under-five mortality in Afghanistan, provide estimates for rural areas from current population-based data, and discuss the methodological challenges that undermine data quality and hinder retrospective estimations of mortality.

Methods Indirect methods of estimation were used to calculate infant and under-five mortality from a household survey conducted in 2006. Sex-specific differences in underreporting of births and deaths were examined and sensitivity analyses were conducted to assess the effect of underreporting on infant and under-five mortality.

Findings For 2004, rural unadjusted infant and under-five mortality rates were estimated to be 129 and 191 deaths per 1000 live births, respectively, with some evidence indicating underreporting of female deaths. If adjustment for underreporting is made (i.e. by assuming 50% of the unreported girls are dead), mortality estimates go up to 140 and 209, respectively.

Conclusion Commonly used estimates of infant and under-five mortality in Afghanistan are outdated; they do not reflect changes that have occurred in the last 15 years or recent intensive investments in health services development, such as the implementation of the Basic Package of Health Services. The sociocultural aspects of mortality and their effect on the reporting of births and deaths in Afghanistan need to be investigated further.

Introduction

According to the *State of the world's children*, Afghanistan's under-five mortality rate of 257 deaths per 1000 live births is the third highest in the world, surpassed only by the rates for Sierra Leone and Angola.[1] Cited infant mortality rates for 2005 are also very high, at 165 deaths per 1000 live births.[1] However, these are model-based projections that have not been updated since at least 1993, despite widespread changes in Afghanistan over the intervening period, such as the implementation of the Basic Package of Health Services in 2003 and 2004.[2] Also, these projections and other estimates are derived largely from a seminal demographic study conducted between 1972 and 1974 – the National Demographic and Family Guidance Survey (NDFGS). Other demographic and health surveys have been conducted in Afghanistan in the 30 years since the NDFGS but are of limited usefulness in explaining demographic patterns in the country because of methodological constraints and geographical coverage. More recently, the Afghanistan Health Survey (AHS) 2006, with a multistage cluster design, was conducted to gather information on maternal and child health, child survival, family planning, health care use and related expenditures in rural Afghanistan. The aim was to determine how much progress had been made in delivering the Basic Package of Health Services implemented in 2003 and 2004.

Efforts to estimate mortality in Afghanistan, as in many other developing countries, face numerous constraints. Women seldom know their exact ages or birth dates, and there is extensive age-heaping (i.e. rounding of actual ages to end in 5 or 0). Underreporting of deaths is also a common problem; in any retrospective survey, the longer the time since a child's death, the greater the likelihood the death is not reported.[3] Many areas are geographically difficult to reach and unsafe. Literate female interviewers who can travel to remote areas are few and, in the absence of female surveyors, male interviewers are often unable to interview female respondents, especially in conservative Pashtun areas.

This study had three objectives: to examine historical estimates of infant and under-five mortality in Afghanistan; to describe the mortality results derived from the AHS, which are the first estimates based on current population data; and to discuss common methodological challenges in Afghanistan that constrain data quality and hinder retrospective estimation of mortality.

Methods

Historical estimates

To examine historical estimates of infant and under-five mortality in Afghanistan, we compared the results (overall and rural) of surveys conducted in Afghanistan between 1972 and 2003, including the NDFGS, the partially completed 1979 Afghanistan Census, and the Multiple Indicator Cluster Survey of 1997 and 2003.

Current estimates

Survey sampling and data collection

The sampling frame used to select villages for the survey was obtained from the Central Statistics Office in July 2006. The sampling frame, a precensus household listing conducted between 2003 and 2005, included over 45 000 enumeration units in rural and urban areas. The AHS included a total of 425 sampled clusters (enumeration units), of which 397 were completed; the remaining 28 were not completed due to security-related reasons. The final sample included 8278 households. Data collection started in mid-September 2006 and was completed by late December 2006.

The AHS covered 29 of the 34 provinces of Afghanistan. The provinces of Helmand, Kandahar, Nuristan, Uruzgan and Zabul, as well as some districts in other provinces, were excluded before sampling because they were unsafe for survey teams and monitors. The six major cities of Herat, Jalalabad, Kabul, Kandahar, Kunduz and Mazar were also excluded because the primary interest of the Ministry of Public Health of the Islamic Republic of Afghanistan was to gather information on priority indicators for rural areas. Thus, the results from the AHS are representative of 72% of the rural population of Afghanistan.

Two-stage cluster sampling was used to select households. In the first stage, clusters were selected from a list of all enumeration units with probability proportional to size. In the second stage, a compact segment method was used to sample households within a cluster.[17] The enumeration unit was segmented into groups, each containing an equal and predetermined number of compounds. One segment was randomly chosen. A separate household listing exercise was not conducted due to time and financial constraints, and the number of households within each compound was not known; therefore, all compounds in a segment were listed and a fixed number of compounds were selected based on simple random sampling. If a compound

contained multiple households, all of them were interviewed to ensure that all households in a segment had the same probability of being selected.

The survey interviewed (i) all women who had ever been married and who were between the ages of 10 and 49 years, and (ii) unmarried primary caretakers at least 18 years of age in charge of children between the ages of 0 and 59 months whose mothers were either dead or no longer living in the household.

Ethical approval was obtained from the institutional review boards at the Ministry of Public Health and the Johns Hopkins Bloomberg School of Public Health, United States of America (USA).

The Brass indirect method of estimation, specifically the Trussell variant for West model life tables, was used to calculate the infant and under-five mortality rates.[3,18] The Brass technique uses age patterns of fertility (parity) and the proportions of children dead among children ever born to women of different ages, and converts them into the probabilities of a child dying before reaching certain ages. These probabilities of dying are, in turn, translated into mortality estimates by using model life tables. The infant and under-five mortality rates were estimated using the QFive programme (United Nations Population Division, New York, NY, USA).[19]

All women between the ages of 15 and 49 years were included in calculations of mortality. Each eligible respondent was asked questions on the total number of children that she had delivered and the total number of children that were dead.

Given evidence of underreporting of deaths of children in women aged 25 years and above, the mortality analysis was confined to women aged 15–19 and 20–24 years. To detect unusual data patterns that could be masked by larger age groupings, further data-quality checks were conducted in these age groups using mothers' exact age. The data were examined on overall proportion dead, proportion dead by sex, sex ratio at birth, and ratio of proportion of dead boys to proportion of dead girls by age of mother. Sex-specific differences in underreporting of births and deaths were also examined by parity of mother. The natural sex ratio quotient of 0.512 (i.e. a total of 105 boys born for every 100 girls born) was used to calculate the expected numbers of girls and boys by parity, and these values were then compared to the observed numbers. Differential reporting of births was also examined by parity for women who had only girls, only boys, or mixed births. Observed numbers lower than those expected could reflect

underreporting of births, which could in turn be associated with underreporting of deaths if respondents are more likely to report the births of surviving than of dead children. Therefore, sensitivity analyses were conducted to assess the effect of different proportions of dead children among underreported births on the estimated infant and under-five mortality rates in this study population.

Results

Overview of historical estimates

Table 1 shows the infant and under-five mortality rates estimated from surveys conducted in Afghanistan between 1972 and 2003.

Overall mortality estimates

Table 2 shows, for each 5-year age group of women, the percentage who were married, the number of children ever born and the percentage of children still living.

Table 3 gives estimates of infant and under-five mortality rates by age of mother, with their reference dates as produced by the QFive programme. The low mortality rates estimated for early reference years compared to more recent years suggests underreporting of child deaths by older women. The final mortality rates presented are weighted estimates from two age groups (15–19 and 20–24 years) based on the proportion of ever-married women in each group. The reference date for the estimates is also a weighted date. The estimated infant and under-five mortality rates were lower for girls than for boys (Table 4).

Sex-specific differences

Table 5 shows a breakdown of the sex ratio at birth and the ratio of the proportion of dead boys to proportion of dead girls by parity of the mother for women aged 15–24 years. Column 3 of the table shows the sex ratio at birth, which was highly skewed towards boys, especially for lower parities (the typical range of the sex ratio at birth is 104–107 boys for every 100 girls).[20] Column 4 of Table 5 shows a very high ratio of boy deaths to girl deaths; model life tables show infant and child mortality rates that are only 10–20% higher for boys than for girls, at most. Also, the proportion of dead boys among women who gave birth to only boys was much higher than the proportion of dead girls among women who gave birth to only girls (Column 5, Table 5). The

ratio of the proportion of dead boys to the proportion of dead girls was lower for women who had given birth to at least three children, only one of them a boy (Column 7, Table 5).

Fig. 1 presents the estimated infant and under-five mortality rates obtained by assuming that deaths were underreported and applying the sensitivity analysis with varying proportions of girls among the deaths presumed to be missing. The weighted infant mortality rate estimates ranged from 129 deaths per 1000 live births (no adjustments) to 156 deaths per 1000 live births (after adjustment for all presumably unreported dead girls). The under-five mortality rate ranged from 191 deaths per 1000 live births (no adjustments) to 234 deaths per 1000 live births (after adjustment for all presumably unreported dead girls). Studies conducted in Bangladesh suggest that liveborn children not reported are more often dead than those who are reported.[21,22] Becker & Mahmud found that 25% of missed liveborns were children who had died;[21] Espeut found the percentage to be 85.[22] If Becker & Mahmud's percentage is applied, the infant and under-five mortality rates obtained are 132 and 196 per 1000 live births, respectively; if Espeut's percentage is applied, the rates are 151 and 231 per 1000 live births. If the imbalance between boys and girls is assumed to be entirely attributable to unreported births in girls and 50% of the unreported liveborn girls are dead (i.e. an average of the two estimates from the validation studies), the estimated infant mortality rate then becomes 140 and the under-five mortality rate becomes 209 per 1000 live births.

Discussion

Our findings show that in rural Afghanistan infant and under-five mortality rates are lower than the estimates in *State of the world's children* and that the infant mortality rate is similar to the projected rate for 2005 under the median scenario applied to derive the United Nations Children's Fund's best estimates (130 per 1000 live births for 2005)[6] and the United States Bureau of the Census estimates, based on census data from 1979 (137 per 1000 live births).[5] These national estimates are not directly comparable to the rural estimates from the AHS; however, because approximately 80% of the population of Afghanistan lives in rural areas, national estimates are similar to rural estimates. Because the AHS provides estimated infant and under-five mortality rates from a new primary data source, it fills a gap in the understanding of current levels of mortality in Afghani children. However, the AHS and other available estimates

of infant and under-five mortality rates in Afghanistan should be interpreted with caution in light of their limitations. Further research in this area is needed.

The AHS did not cover urban areas or highly unsafe regions of the country. Urban areas may have lower infant and under-five mortality than rural areas, but the urban–rural differentials observed in the NDFGS and 2003 Multiple Indicator Cluster Survey shown in Table 1 indicate that infant and under-five mortality rates at the national level may be only slightly lower than those in rural areas of Afghanistan. Highly unsafe regions of the country that could not be covered in the 2006 AHS may have higher mortality levels than areas that were covered. The use of mortality estimates based on the youngest maternal age groups may introduce bias and instability in the estimates, since a child's risk of dying is related to the mother's age.

The skewed sex ratio at birth observed in the AHS has several possible explanations. Preference for sons manifests itself before birth in the form of sex-selective abortions, and after birth as female infanticide or abandonment and unequal treatment or neglect of girls, which lead to higher female mortality. Sex-selective abortion as a cause of the skewed sex ratio is discarded as an explanation for Afghanistan, where few ultrasound machines exist and antenatal care is uncommon. There is little evidence (either from the literature or anecdotally) that infanticide is practiced in Afghanistan. Thus, the skewed sex ratio may stem from a combination of intentional misclassification of girls as boys and underreporting of girls, provided the number of boys reported is correct. Misclassification of girls as boys affects sex-specific mortality rates, but it does not affect overall mortality rates if the total number of children ever born is correct. Anecdotal evidence suggests that households that have more girls than boys may intentionally misclassify girls as boys, since there is some stigma in Afghanistan attached to having only girls. Underreporting of girls could indicate that dead girls are not being counted in the total births. Conservative households may intentionally underreport the number of living girls in the household to keep strangers from knowing about the presence of females. Also, many households refuse to divulge the names of females in the household, and some may refuse to report the presence of living females. Underreporting of girls would introduce error into overall estimates of mortality.

The high ratio of deaths in children of women who gave birth to only boys compared to deaths in children of women who gave birth to only girls indicates that deaths in girls are

probably underreported. It suggests that underreporting of liveborn girls is likely to be a greater problem than misclassification of girls as boys. Dead girls are probably underreported and may not even be included among total births. The underreporting of deaths among girls would lead to underestimation of the true mortality rate. Table 6 (available at: http://www.who.int/bulletin/volumes/88/##/##-######/en/index.html) summarizes possible threats to validity in this study, including their likely direction and magnitude.

While available mortality estimates for Afghanistan need to be interpreted with caution, large gains have been made in Afghanistan's health sector in recent years. For example, studies have shown marked progress in primary health care, especially in the quality of patient care and the availability of essential drugs and family planning supplies; in antenatal care to pregnant women; in improved health worker skills; and in the number of female health workers providing care throughout the country.[23] Coverage with maternal and child health services such as family planning, skilled antenatal care, skilled birth attendance and child immunization has also increased.[24–26]

There is a clear need for robust and current measures of fertility and mortality in Afghanistan, especially in view of widespread changes in the country, including large investments in health services development, and the various obstacles to accurate measurement in the country. Given these obstacles, which make it difficult to accurately estimate mortality retrospectively, a better understanding is needed of the sociocultural determinants of mortality and how they affect the reporting of births and deaths in Afghanistan. Systems for measuring and reporting mortality need to be institutionalized in the country to generate better data for planning and policy-making. The findings from this study also have wider implications for child mortality statistics published elsewhere, such as in *State of the world's children*, which are often accepted as accurate although they can be flawed, especially in countries that lack a well-established vital registration system and rigorous methods for regularly measuring mortality. Strengthening expert review of these estimates and investing in studies on mortality-related reporting practices in countries with data limitations may result in more robust estimates.

Competing interests:

None declared.

References

1. United Nations Children's Fund. *State of the world's children*. New York: UNICEF; 2007.

2 United Nations Children's Fund. *State of the world's children*. New York: UNICEF; 2008.

3. United Nations. *Manual X: indirect techniques of demographic estimation*. New York: UN Department of Economic and Social Information and Policy Analysis; 1983 (Population Studies No. 81).

4. Chu S, Hill R, Graham S. *National demographic and Family Guidance survey of the settled population of Afghanistan. Vol. 1: Demography and knowledge, attitudes and practices of Family Guidance*. Washington, DC: United States Agency for International Development; 1975.

5. Hobbs F. *Afghanistan: a demographic profile*. Washington, DC: Center for International Research, US Bureau of the Census; 1988.

6. United Nations Children's Fund. *Best estimates of social indicators for children in Afghanistan*. Kabul: UNICEF; 2006.

7. Trussell J, Brown E. A close look at the demography of Afghanistan. *Demography* 1979;16:137-56. PMID:428605 doi:10.2307/2061085

8. CIET International. 1997 Afghanistan Multiple Indicator Baseline Survey. Kabul: CIET; 1997.

9. Central Statistics Office & United Nations Children's Fund. *Moving beyond two decades of war: progress of provinces. Multiple Indicator Cluster Survey 2003*. Kabul: CSO, UNICEF; 2003.

10. Boss LP, Brink E, Dondero T. Infant mortality and childhood nutritional status among refugees in Pakistan. *Int J Epidemiol* 1987;16:556-60. PMID:3440665 doi:10.1093/ije/16.4.556

11. Smith A. *Diarrhoea morbidity, mortality and treatment practices*. Peshawar: United Nations High Commissioner for Refugees; 1989.

12. Tangermann RH, Pamuk E. *Evaluation of infant mortality and childhood nutritional status among Afghan refugees in Pakistan, 1990*. Peshawar: United Nations High Commissioner for Refugees; 1990.

13. United Nations. *Demographic yearbook*. New York: UN Department of Economic and Social Information and Policy Analysis; 1994.

14. United Nations Children's Fund. 2000 Multiple Indicator Cluster Survey (MICS2): situational analysis of women and children in east of Afghanistan. Kabul: UNICEF; 2001.

15. Bartlett LA, Mawji S, Whitehead S, Crouse C, Dalil S, Ionete D, et al. Where giving birth is a forecast of death: maternal mortality in four districts of Afghanistan, 1999-2002. *Lancet* 2005;365:864-70. PMID:15752530 doi:10.1016/S0140-6736(05)71044-8

16. Central Statistics Office. *Settled population by civil division (urban and rural) and sex 2006*. Kabul; CSO; 2006.

17. Turner AG, Magnani RJ, Shuaib M. A not quite as quick but much cleaner alternative to the Expanded Programme on Immunization (EPI) cluster survey design. *Int J Epidemiol* 1996;25:198-203. PMID:8666490 doi:10.1093/ije/25.1.198

18. Brass W, Coale AJ. Methods of analysis and estimation. In: Brass W, ed. *The demography of tropical Africa.* Princeton: Princeton University Press; 1968.

19. United Nations. *QFIVE: United Nations Program for Child Mortality Estimation*. New York: Department of Economic and Social Information and Policy Analysis; 1990 (Population Studies No. 107).

20. Chanazarian A. Determinants of sex ratio at birth: review of recent literature. *Soc Biol* 1986;35:214-35.

21. Becker S, Mahmud S. *A validation study of backward and forward pregnancy histories in Matlab, Bangladesh*. Dhaka: International Statistical Institute; 1984 (World Fertility Survey Scientific Report Series No. 52).

22. Espeut D. A validation of birth and pregnancy histories in Matlab, Bangladesh [Doctoral dissertation]. Baltimore: The Johns Hopkins University; 2002.

23. Hansen PM, Peters DH, Niayesh H, Singh LP, Dwivedi V, Burnham G. Measuring and managing progress in the establishment of basic health services: The Afghanistan Health Sector Balanced Scorecard. *Int J Health Plann Manage* 2008;23:107-17. PMID:18435428 doi:10.1002/hpm.931

24. Johns Hopkins Bloomberg School of Public Health & Indian Institute of Health Management Research. *Afghanistan multiple indicator cluster survey 2003: a re-analysis of critical health service delivery indicators*. Kabul: Ministry of Public Health; 2005.

25. Johns Hopkins Bloomberg School of Public Health & Indian Institute of Health Management Research. *2005 national risk and vulnerability assessment. analysis of priority health service delivery indicators*. Kabul: Ministry of Public Health; 2006.

26. Johns Hopkins Bloomberg School of Public Health & Indian Institute of Health Management Research. *Afghanistan Health Survey 2006: estimates of priority health indicators*. Kabul: Ministry of Public Health; 2008.

Table 1. **Estimated infant and under-five mortality rates, by maternal age group and with estimation method indicated, obtained from historical surveys in Afghanistan, 1971–2003**

National					Historical estimate	
Source	Year	IMR	U5MR	Maternal age group (years)	Mortality calculation method	Comment
NDFGS, 1972–1974[4]	1971	220	335	20–24	Brass: the estimate presented in the report is closest to the West model	The estimated U5MR was not presented in the survey report but was calculated here using raw unadjusted data on total number of women in the different age groups, children born and children surviving, obtained from Trussell and Brown.[7] The paper presents the West model estimate. The report did not give the woman's age on the year of the estimate, but the 20–24 year age group was chosen as it most closely matched the estimate in the survey report. The unadjusted estimated IMR presented was 185 per 1000 live births.
Afghanistan Census, 1979[5]	1979	183	NA	–		Due to insecurity, the census was only completed in 55–60% of the country; precensus estimates were used for areas not covered.
MICS, 1997[8]	1994	142	233	25–29	Brass (model used not known)	The U5MR estimate is from UNICEF's *Best estimates 2006*. The 1997 MICS report did not present a U5MR estimate.
MICS 2003[9]	2002	115	172	15–19	Brass: South model	Reported, but rejected by UNICEF headquarters due to doubts about data quality

Rural

NDFGS, 1972–1974[4]	1971	232	388	20–24	Brass: the estimate presented in the report is closest to the North model	The U5MR estimate was not presented in the survey report, but was calculated here using raw unadjusted data on total number of women in the different age groups, children born and children surviving in rural areas, obtained from Trussell and Brown.[7] The North model estimate is presented here to keep the IMR and U5MR estimates comparable. The report did not give the woman's age on the year of the estimate, but the 20–24 year age group was chosen as it most closely matched the estimate given in the survey report.

Regional/refugee

MICS 2003[9]	2002	121	183	15–19	Brass: South model	Reported but rejected by UNICEF headquarters due to doubts about data quality
CDC/UNHCR, 1985[10]	1984	156	225	–	Direct (nutrition and mortality survey)	Afghan refugees in Pakistan: North-west Frontier, Punjab and Balochistan provinces
CDC/UNHCR, 1985[10]	1985	119	NA	–	Direct (nutrition and mortality survey)	Afghan refugees in Pakistan: North-west Frontier, Punjab and Balochistan provinces
CDC/UNHCR, 1986[10]	1986	81	121	–	Direct (nutrition and mortality survey)	Afghan refugees in Pakistan: North-west Frontier, Punjab and Balochistan provinces
UNHCR[11]	1989	73	93	–	Direct	Afghan refugees in Pakistan: North-west Frontier province.

CDC/UNHCR/Medicins Sans Frontières, Holland, 1990[12]	1990	84	127	–	Direct	Afghan refugees in Pakistan: North-west Frontier and Balochistan provinces. The IMR for Afghan refugees in Pakistan for 1984–1990 is similar to the national IMR of 107.7 per 1000 live births for Pakistan for 1988.[13]
UNICEF MICS, 2000[14]	1995	113	165	25–29	Brass: West model	Conducted in 6 eastern Afghan provinces: Ghanzi, Kunar, Laghman, Nangarhar, Paktika and Paktiya
Bartlett et al., 2005[15]	2000[a]	78	109	NA	Direct for IMR and Brass for U5MR	Conducted in one district in Kabul City
Bartlett et al., 2005[15]	2000[a]	128	190	NA	Direct for IMR and Brass for U5MR	Conducted in one semiurban district in Laghman province
Bartlett et al., 2005[15]	2000[a]	217	323	NA	Direct for IMR and Brass for U5MR	Conducted in one remote rural district in Badakhshan province

NDFGS, Afghanistan Demographic and Family Guidance Survey; CDC, Centers for Disease Control and Prevention; IMR, infant mortality rate; MICS, Multiple Indicator Cluster Survey; NA, not available; U5MR, under-five mortality rate; UNHCR, United Nations High Commissioner for Refugees; UNICEF, United Nations Children's Fund.

[a] Survey covered 1999 to 2002, with the mid-point for the IMR estimate in late 2000. The year of the estimated U5MR is unknown.

Data obtained from Afghanistan's Central Statistics Office.[16]

Table 2. **Number of women, number of women ever married, number of children ever born to them and percentage of children still living, by maternal age group, Afghanistan, 2004**

	Women			
Age (years)	**No.**	**% married**	**No. of children ever born**	**% of children surviving**
15–19	3695	**21**	844	87.9
20–24	2238	**64**	3415	84.9
25–29	2060	**91**	7609	85.4
30–34	1357	**97**	7236	85.7
35–39	1547	**99**	9856	85.5
40–44	940	**99**	6387	83.9
45–49	709	**100**	4405	83.4

Table 3. **Infant and under-five mortality rate estimates by maternal age group, Afghanistan**

Age (years)	**Reference date**	**IMR (95% CI)**	**U5MR (95% CI)**
15–19	2005, August	127 (92–163)	188 (132–245)
20–24	2004, June	130 (109–151)	192 (158–226)
25–29	2002, November	111 (99–124)	162 (142–182)
30–34	2000, October	103 (91–114)	148 (130–166)
35–39	1998, July	97 (87–108)	140 (123–156)
40–44	1996, January	100 (87–113)	144 (123–165)
45–49	1993, January	95 (79–110)	135 (111–160)

CI, confidence interval; IMR, infant mortality rate; U5MR, under-five mortality rate.

Table 4. **Mortality estimates[a] by sex, Afghanistan, 2004**

Indicator	Reference date[b]	Overall estimate (95% CI)	Female estimate (95% CI)	Male estimate (95% CI)
IMR	2004, November	129 (103–155)	120 (90–151)	138 (105–171)
U5MR	2004, November	191 (149–233)	184 (134–233)	197 (147–250)

CI, confidence interval; IMR, infant mortality rate; U5MR, under-five mortality rate.

[a] These are the weighted estimates from two maternal age groups (15–19 and 20–24 years) based on the proportion of ever-married women in each group.

[b] This is a weighted date.

Table 5. **Sex ratio at birth and ratio of proportion of dead boys to proportion of dead girls by parity of mother and sex distribution of children, for women aged 15–24 years, Afghanistan, 2004**

Parity	No. of women	Ratio				
		Boys ever born to girls ever born	Proportion of boys dead to proportion of girls dead, for all women	Proportion of boys dead for women with only boy births to proportion of girls dead for women with only girl births	Proportion of boys dead to proportion of girls dead, for women with 1 girl birth and remaining boy births	Proportion of boys dead to proportion of girls dead, for women with one boy birth and remaining girl births
1	543	1.360	1.504	1.504		
2	490	1.154	1.488	1.726		
3	353	1.101	1.028	1.647	0.706	1.141
4	191	1.015	1.259	1.262	2.579	1.112

Table 6. **Factors potentially affecting the validity of infant and under-five mortality estimates for Afghanistan**

Factor	Likely direction of effect	Likely magnitude of effect
Exclusion of urban areas	Overestimate	The IMR and U5MR estimates for urban areas from the NDFGS were calculated here using raw unadjusted data on total number of women in the different age groups, children born and children surviving, obtained from Trussell and Brown.[8] The urban IMR (using the same model as the rural estimate in Table 1) was 178 and the urban U5MR was 299 per 1000 live births for women aged 20–24 years. The urban estimates for IMR and U5MR were both 30% lower than the rural estimates for IMR and U5MR in the same study. Approximately 20% of the Afghanistan population lives in urban areas. If the level of difference found between urban and rural estimates from NDFGS is applied to AHS estimates, the IMR estimate in the AHS would drop from 129 to 121 per 1000 live births and the U5MR would drop from 191 to 180 per 1000 live births (a 6% decrease).
Exclusion of highly unsafe areas	Underestimate	Approximately 28% of the rural population in Afghanistan was excluded from the survey due to high levels of insecurity. These insecure areas are likely to have higher mortality than other areas, due to higher incidence of violent conflict, disruption of health services and possible disruptions to food production systems and markets. In the absence of data on what levels of mortality in these areas are, there is little basis upon which to estimate the magnitude of the effect. If the excluded insecure areas had 30% higher mortality rates than areas included in the survey, the IMR estimate from AHS would increase from 129 to 141 per 1000 live births and the U5MR estimate would increase from 191 to 209 per 1000 live births (a 9% increase).
Use of youngest maternal age group	Overestimate	Infants of mothers in the youngest age group tend to have higher mortality than infants of mothers in other age groups. Thus, mortality may be overestimated in the current study, but the magnitude is likely to be small because weights were applied reflecting the relative proportion of married women in each age group (and most were in the 20–24 age group) and the estimated mortality levels for infants from the two age groups are similar.

| Misclassification of girls as boys | No effect on overall mortality | The misclassification of girls as boys would have no effect on overall mortality estimates, assuming the total number of children ever born and total number of dead children is correct. It would, however, affect sex-specific mortality estimates, depending on whether the misclassified girls are living or dead. The misclassification of dead girls as boys would contribute to an overestimate of mortality in boys and an underestimate of mortality in girls. The misclassification of living girls as boys would have the opposite effect. The magnitude of the effect depends on the proportion of dead and living girls misclassified as boys, if any. |
| Underreporting of dead girls | Underestimate | Fig. 1 presents a sensitivity analysis showing the effect of underreporting of dead girls on the mortality estimates. Assuming that the proportion dead among the underreported girls is greater than the proportion dead among the reported girls, this would contribute to an underestimate of mortality. Mortality estimates range from 125 IMR and 184 U5MR with 0% of underreported girls being dead, to 156 IMR and 234 U5MR with 100% of underreported girls being dead. Both scenarios are hypothetical and extremely unlikely. There is little evidence upon which to assume the likely proportion dead among the underreported girls. If half of the underreported girls are dead, the IMR estimate would be 140 and the U5MR estimate would be 209 (a 9% increase). |

NDFGS, Afghanistan Demographic and Family Guidance Survey; AHS, Afghanistan Health Survey; IMR, infant mortality rate; U5MR, under-five mortality rate.

Fig. 1. **Sensitivity analysis: infant and under-five mortality rates estimated by applying varying proportions of dead girls among unreported girls, Afghanistan**