CHAPTER 7

Fertility, Early Age Mortality and Maternal Mortality

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7.1 Introduction

In the absence of a complete vital registration system in Cambodia estimates of fertility and early age mortality are made from data collected at censuses and surveys. Because the questions about fertility and mortality, especially infant and child mortality are very sensitive questions to be asked of the respondents, it requires tact and a great deal of experience to obtain correct answers from the respondents. Further, a census being a huge operation where very detailed training and long periods of field work can not be devoted as can be done in a survey, information about fertility and child mortality obtained in a census are always liable to be under reported.

Therefore, a number of demographic techniques have to be applied in estimating fertility and mortality from census data. Some of the data collected require indirect techniques to estimate measures of fertility and mortality while some others require direct calculations of these measures. These indirect techniques of estimating fertility and mortality were first developed by the late William Brass during the 1970s while studying the demography of sub-Saharan Africa (United Nations 1983:73)[1]. The method of estimating fertility basically utilizes information collected at a census or survey on the number of children ever born to women classified by age of women and reported number of child births during a fixed period prior to the census or survey, also classified by age of women. The information on children ever born, together with information on children surviving (or children dead) classified by age of women is used for estimating early age mortality (under the age of five years).

In countries with deficient vital registration systems, the collection of such information has become a regular feature of censuses and surveys. Another method, developed by Rele (1967) converts information on child-woman ratio obtained from tabulations of population age-distribution, to total fertility rates. There are a few other indirect methods of estimating fertility. One such method links women of reproductive ages 15 and beyond with their own children (up to the age of 15 years) present in a household, and with suitable reverse survival of the women and their matched children yields estimates of age-specific and total fertility rates for up to 15 years in the past. This is the Own-Children method of fertility estimation (United Nations 1983: 182). Another method adopted regularly in Indonesian surveys and censuses utilizes information on the last (most recent) live births given by women, which is then classified by age of women to calculate age-specific and total fertility rates. This method was first applied by Dasvarma and Hull (1984) to the 1980 Indonesian Population Census data, and yielded results which were comparable to other estimates.

7.2. Estimates of Fertility

At the 2008 Census of Cambodia, two types of data were collected that were specifically related to fertility, namely (see Annex 4, Part 3 of Form B: Household Questionnaire):

> Number of children ever born to women. When tabulated by five year age-group of women this information can provide indirect estimates of fertility, and
> Births occurring to women in during the 12 months immediately preceding the census. When tabulated by five year age-group of women, this information can provide direct measures of fertility.

There are several indirect techniques which can be applied to data on children ever born for estimating age specific and total fertility rates. However, some of the indirect techniques require certain assumptions regarding the past course of fertility. For example, the Brass P/F Ratio method requires fertility to have remained unchanged. If this method is applied to data when fertility has been declining, as is currently the

[1] The references are given in Annex 6

case in Cambodia, it overestimates current fertility. This was also the case with the estimate of total fertility rate based on the 1998 Population census data. Data on the number of births during the last 12 months provide direct measures of age-specific and total fertility rates but, as commonly observed in most developing countries; these data tend to under-report the number of children born in the past 12 months and therefore, underestimate fertility.

In addition, the following fertility related information has been derived from data collected at the 2008 Census:

Child-woman ratio, and

Own Children.

These two provide indirect estimates of fertility.

Child-woman ratio (CWR): Rele (1966) found a linear relationship between CWR and gross reproduction rate (GRR) for given levels of life expectancy at birth between 20 and 70 years. The GRR, which is the total fertility rate for female births only, can be converted to total fertility rate (TFR) for both sexes combined by assuming a suitable sex ratio at birth. Two types of CWR can be used for estimating TFR: (i) CWR as a ratio of the number of children (both sexes) aged 0-4 years to the number of women aged 15 to 49 years, and (ii) the ratio of children (both sexes) aged 5-9 years to the number of women aged 20 to 54 years. In the present analysis, the CWR used is the ratio of the number of children aged 0-4 to the number of women aged 15-49. The reference period of fertility estimates based on the CWR is five years preceding the census or survey. However, the TFR based on the Rele method is liable to be underestimated because the population aged 0-4 is generally under-enumerated (NIS, 2005: 34).

Own children: In the absence of a line number linking mothers to her own children, the Own Children tables were constructed from information on relationship to the head of the household, and as such are liable to some errors in completely linking the mothers to their biological children, particularly when more than one mother resides in a household in extended families. However, this type of error appears to have been reduced given the observed transition to nuclear families as indicated by the smaller average household sizes (4.7) in 2008 compared to larger average household sizes (5.2) in 1998.

Tables 7.1, 7.2 and 7.3 give the estimates of Cambodian fertility based on the 2008 Census for Total, Urban and Rural areas respectively. The tables also provide estimates of Cambodian fertility for other periods from other sources for comparative purposes. Table 7.1 shows that the estimates of TFR for Cambodia Total, based on Brass P/F Ratio, Arriaga-Brass, Rele and Own Children methods are respectively 3.3, 2.7, 2.7 and 2.8 respectively. Based on reported births in the last 12 months the TFR works out to be 1.6, which is a gross underestimate.

Under conditions of declining fertility as indicated by the estimates of TFR from the 2000 and the 2005 Cambodian Demographic and Health Survey (CDHS), the Brass P/F ratio method would give an overestimate of fertility. The other indirect estimates are considered somewhat underestimates because of the reasons mentioned above.

One of the direct impacts of fertility decline in a population is the shrinking of the base of the age pyramid (the 0-4 age-group). The age pyramids of the population of Cambodia in 1998 and 2008 show that the proportion of the population aged 0-4 has declined from 12.8 percent in 1998 to 10.3 percent in 2008, indicating a continuation of fertility decline which has started before 1998. This is true notwithstanding possible under enumerations of the population aged 0-4 years. A rough idea of the extent of decline in fertility during 1998-2008 may be obtained from the decadal percentage decline in the proportion of the population age 0-4 years, which works out to be about 24 percent. The 2000 CDHS gave a TFR of 4.0, which is centred on mid -1997. A 24 percent decline would imply a TFR of 3.1 centred on mid - 2007.

Therefore, taking into account the above arguments and the declining trend in fertility in Cambodia since 2000, it may be concluded that the total fertility rate in Cambodia during 2005-2008 falls within the range 2.7 to 3.4, or an average of the two, namely 3.1. The urban TFR is between 1.8 and 2.4, i.e., an average of 2.1, and the rural TFR is between 2.9 and 3.6, i.e., an average of 3.3.

Table 7.1 Estimates of fertility based on the 2008 Census of Cambodia: Total

Method	Estimated Total Fertility Rate (TFR) per woman	Estimated crude birth rate per 1,000 population	Reference Period	Reference Point
(1)	(2)	(3)	(4)	(5)
Based on 2008 census				
Brass P/F Ratio	3.4	26.9	2004-2008	Sept 2005
Arriaga-Brass	2.7	N.A.	March 2007-March 2008	Sept 2007
Rele (CWR 0-4,15-49); (e_0=63.94)	2.7	N.A	March 2003-March 2008	Sept 2005
Own children method	2.8	N.A	March 2006-March 2008	Sept 2007
Direct estimate (based on reported births in the past 12 months)	1.6	13.0	March 2007-March 2008	Sept 2007
Other estimates				
2005 CDHS	3.4	N.A	2002-2005	June 2004
2000 CDHS	4.0	N.A	1995-2000	June 1997

Table 7.2 Estimates of fertility based on the 2008 Census of Cambodia: Urban

Method	Estimated Total Fertility Rate (TFR) per woman	Estimated crude birth rate per 1,000 population	Reference Period	Reference Point
(1)	(2)	(3)	(4)	(5)
Based on 2008 census				
Brass P/F Ratio	2.4	23.9	2004-2008	Sept 2005
Arriaga-Brass	1.9	N.A	March 2007-March 2008	Sept 2007
Rele (CWR 0-4,15-49); (e_0=63.94)	1.8	N.A	March 2003-March 2008	Sept 2005
Own Children method	1.9	N.A	March 2006-March 2008	Sept 2007
Direct estimate (based on reported births in the past 12 months)	1.0	9.4	March 2007-March 2008	Sept 2007
Other estimates				
2005 CDHS	2.8	N.A	2002-2005	June 2004
2000 CDHS	3.1	N.A	1995-2000	June 1997

Table 7.3 Estimates of fertility based on the 2008 Census of Cambodia: Rural

Method	Estimated Total Fertility Rate (TFR) per woman	Estimated crude birth rate per 1,000 population	Reference Period	Reference Point
(1)	(2)	(3)	(4)	(5)
Based on 2008 census				
Brass P/F Ratio	3.6	27.7	2004-2008	Sept 2005
Arriaga-Brass	2.9	N.A	March 2007-March 2008	Sept 2007
Rele (CWR 0-4,15-49); (e_0=63.94)	3.0	N.A	March 2003-March 2008	Sept 2005
Own Children method	3.1	N.A	March 2006-March 2008	Sept 2007
Direct estimate (based on reported births in the past 12 months)	1.8	13.9	March 2007-March 2008	Sept 2007
Other estimates				
2005 CDHS	3.5	N.A	2002-2005	June 2004
2000 CDHS	4.2	N.A	1995-2000	June 1997

7.3 Estimates of mortality

The following mortality related data are available from the 2008 Census of Population and Housing:

Number of children ever born and surviving to women of reproductive ages 15 and above, classified by 5 year age-group of women. This can provide indirect estimates of early age mortality.

Deaths occurring in the household during the 12 months immediately preceding the census, classified by age of the deceased. This type of data can provide direct estimates of early age and adult mortality. These data also included information on deaths of women of reproductive ages due to maternal cause, i.e., deaths related to pregnancy and child birth, and their sequelae for up to 6 weeks after delivery. This type of data can provide direct estimate of maternal mortality.

In the present analysis, estimates of early age mortality, comprising infant and child mortality, and maternal mortality will be presented.

The method of indirectly estimating infant and child mortality from information on children ever born and children surviving (CEBCS), classified by age-group of women consists of calculating the proportions of children dead (as a complement of the proportions of children surviving) and converting them to measures of probability of dying under various ages under 5 with use of multipliers developed by Brass (see United Nations, 1983: for a description of the method).

The estimates of infant mortality derived by the two variants of the Brass method from the CEBCS data for Cambodia total, rural and urban are of the order of 26, 17-24 and 27-28 respectively (Tables 7.4, 7.5 and 7.6). These estimates are implausibly low, as are the estimates of child and under-five mortality, particularly in the context of the immediate past declines in early age mortality indicated by the 2000 and 2005 Cambodian Demographic and Health Survey, and the estimates of early age mortality derived from the 2004 Cambodia Intercensal Population Survey (CIPS).

On the other hand, the approximate measure of infant mortality obtained by taking the ratio of the deaths under the age of one year to the number of live births in past 12 months shows a figure of 58 infant deaths per 1,000 live births for Cambodia Total (Table 7.4). Despite the gross under-reporting of the numbers of births and deaths during the past 12 months, as evident from the questionably low crude birth rate (13.0) and crude death rate (3.34) given in Tables 7.1 and 7.4, together they appear to provide a reasonable measure of infant mortality. This indicates similar levels of under-reporting of births and deaths at the census.

In view of the above arguments, it seems very likely that infant mortality rate as of January 2006 was between 58 and 62 per 1,000 live births or if we take the average of the two, 60 per 1,000 live births. The corresponding likely infant mortality rates for the urban and rural areas are 35 and 62 per 1,000 respectively. The estimates of child mortality and under-five mortality are too inconsistent with the trends implied by the estimates obtained from other sources such as the 2005 and the 2000 Cambodian Demographic and Health Surveys.

The maternal mortality ratio (MMR), obtained from information about maternal deaths in the past 12 months collected at the 2008 census is 461, 287 and 490 maternal deaths per 100,000 live births for the period September 2007-September 2008 for total, urban and rural areas respectively. As mentioned before, in spite of the under-reporting of births and deaths including maternal deaths occurring in the past 12 months, when used in conjunction with one another, the reported maternal deaths and live births appear to provide plausible estimates of maternal mortality ratio.

Information on births and deaths occurring in the past 12 months was collected at the 2004 Cambodian Intercensal Population Survey (2004 CIPS). Although no specific question on maternal deaths was asked, an approximate estimate of maternal deaths can be obtained by dividing the number of female deaths due to pregnancy complications, delivery complications and abortion by the number of births occurring in the past 12 months. This calculation provides an approximate estimate of MMR of 491 per 100,000 live births for Cambodia for the period September 2003-September 2004. Thus the estimated MMR of 461 per 100,000 live births for Cambodia for the period September 2007-September 2008 seems plausible. The 2005 CDHS gave an MMR of 472 per 100,000 live births. The maternal mortality ratio (MMR) has shown a fluctuating trend between the 2000 CDHS and the 2008 census, but statistically an unchanged level over a period of about 8 years.

Table 7.4 Estimates of early age mortality, maternal mortality and crude death rate based on the 2008 Census of Cambodia: Total

Method	Infant mortality rate	Child mortality rate	Under five mortality	Crude death rate per 1,000 population	Maternal mortality ratio per 100,000 live births	Reference Period	Reference Point
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Based on 2008 Census: Brass Child Survivorship methods							
(i) Palloni-Heligman: UN General Model	0.026	0.006	0.044	N.A	N.A	N.A	Jan 2006
(ii) Trussell: Coale-Demeny West Model	0.026	0.006	0.044	N.A	N.A	N.A	Feb 2006
Direct estimate (based on reported births in the past 12 months)	0.058	N.A	N.A	3.34	460.8	March 2007-March 2008	Sept 2007
Other estimates							
2005 CDHS	0.066	0.019	0.083		472.0 (June 1999)	1995- 2005	June 2000
Based on 2004 CIPS: Brass Child Survivorship methods							
(i) Palloni-Heligman: UN General Model	0.062	0.024	0.108	N.A	N.A	N.A	Apr 2002
(ii) Trussell: Coale-Demeny West Model	0.063	0.025	0.108	N.A	N.A	N.A	Apr 2002
2000 CDHS	0.095	0.0.33	0.124	N.A	N.A	1990-2000	June 1995

Table 7.5 Estimates of early age mortality, maternal mortality and crude death rate based on the 2008 Census of Cambodia: Urban

Method	Infant mortality rate (1q0)	Child mortality rate (4q1)	Under five mortality (5q0)	Crude death rate per 1,000 population	Maternal mortality ratio per 100,000 live births	Reference Period	Reference Point
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Based on 2008 Census: Brass Child Survivorship methods							
(i) Palloni-Heligman: UN General Model	Less than 0.024	0.005	0.021	N.A	N.A	N.A	Jan 2006
(ii) Trussell: Coale-Demeny West Model	0.017	0.002	0.022	N.A	N.A	N.A	Feb 2006
Direct estimate (based on reported births in the past 12 months)	0.034	N.A	N.A	2.11	287.4	N.A	N.A
Other estimates							
2005 CDHS	0.065	0.012	0.076	N.A	N.A.	1995-2005	June 2000
Based on 2004 CIPS: Brass Child Survivorship methods:							
(i) Palloni-Heligman: UN General Model	0.035	0.009	0.081	N.A	N.A	N.A	Mar 2002
(ii) Trussell: Coale-Demeny West Model	0.036	0.010	0.082	N.A	N.A	N.A	May 2002
2000 CDHS	0.072	0.022	0.093	N.A	N.A	N.A	June 1995

Table 7.6 Estimates of early age mortality, maternal mortality and crude death rate based on the 2008 Census of Cambodia: Rural

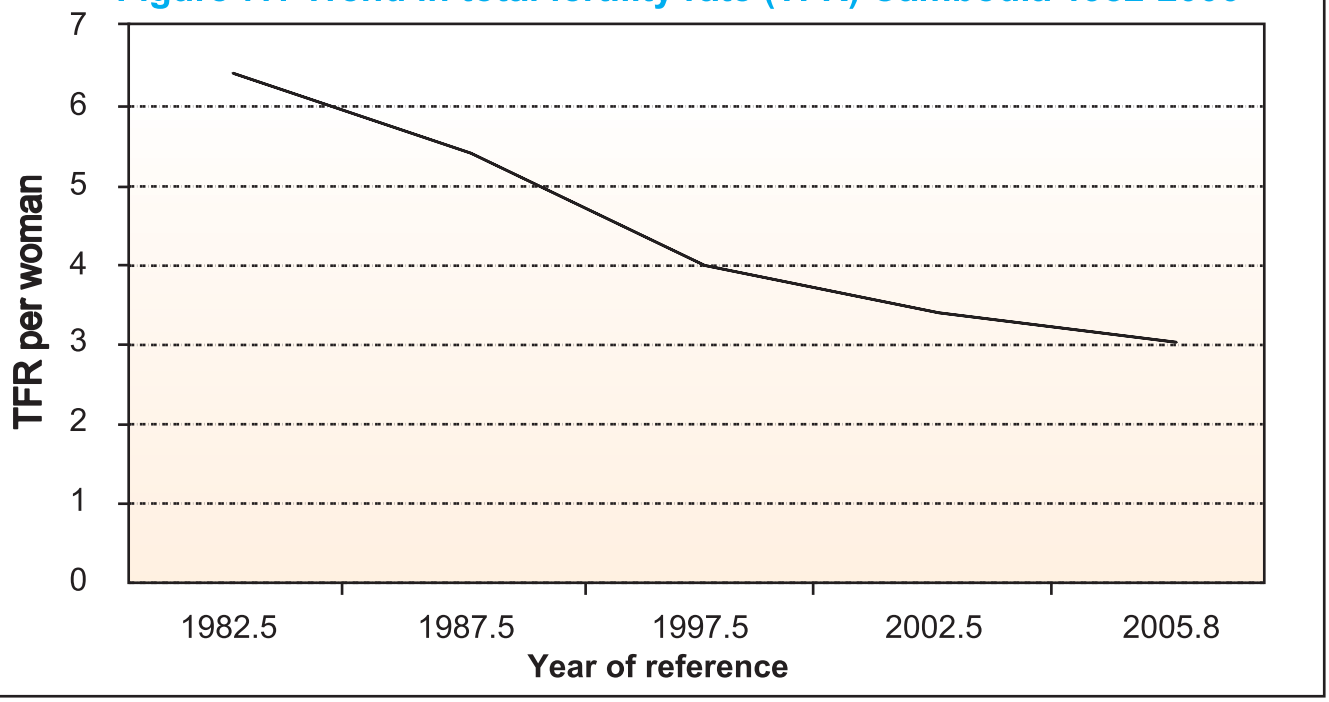
Method	Infant mortality rate (1q0)	Child mortality rate (4q1)	Under five mortality (5q0)	Crude death rate per 1,000 population	Maternal mortality ratio per 100,000 live births	Reference Period	Reference Point
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Based on 2008 Census: Brass Child Survivorship methods							
(i) Palloni-Heligman: UN General Model	0.027	0.006	0.048	N.A.	N.A	N.A	Feb 2006
(ii) Trussell: Coale-Demeny West Model	0.028	0.006	0.048	N.A	N.A	N.A	Mar 2006
Direct estimate (based on reported births in the past 12 months)	0.062	N.A	N.A	3.64	490.3	N.A	N.A
Other estimates							
2005 CDHS	0.092	0.021	0.111	N.A	N.A	1995-2005	June 2000
Based on 2004 CIPS: Brass Child Survivorship methods							
(i) Palloni-Heligman: UN General Model	0.066	0.027	0.112	N.A	N.A	N.A	Feb 2002
(ii) Trussell: Coale-Demeny West Model	0.067	0.027	0.112	N.A	N.A	N.A	Mar 2002
2000 CDHS	0.096	0.034	0.126	N.A	N.A	N.A	June 1995

7.4. Conclusion

The best source of information on fertility and mortality is a complete and accurate vital registration system. Until such time as a vital registration system is fully operational in Cambodia, data collected at censuses and surveys have to be depended upon for estimating fertility and mortality. In a survey more resources and time can be devoted to training of interviewers and data collection, which simply can not be done in a census. As such, estimates of fertility and mortality based on census data should be interpreted as providing indications of trends in these demographic parameters and of the range in which the values of parameters could lie.

Considering all the factors mentioned above and taking into account the trends in demographic parameters from other sources and various estimates derived in this chapter, it may be concluded that the total fertility rate in Cambodia is around 3.0, infant mortality is around 60 and per 1,000 live births and maternal mortality ratio is around 461 per 100,000 live births. The estimates of child and under-five mortality are too implausible to arrive at a conclusive figure. Figures 7.1 and 7.2 show that the declining trend in fertility and infant mortality is continuing, although the speed of decline appears to have slowed down a little, which is to be expected at comparatively moderate levels of these parameters.

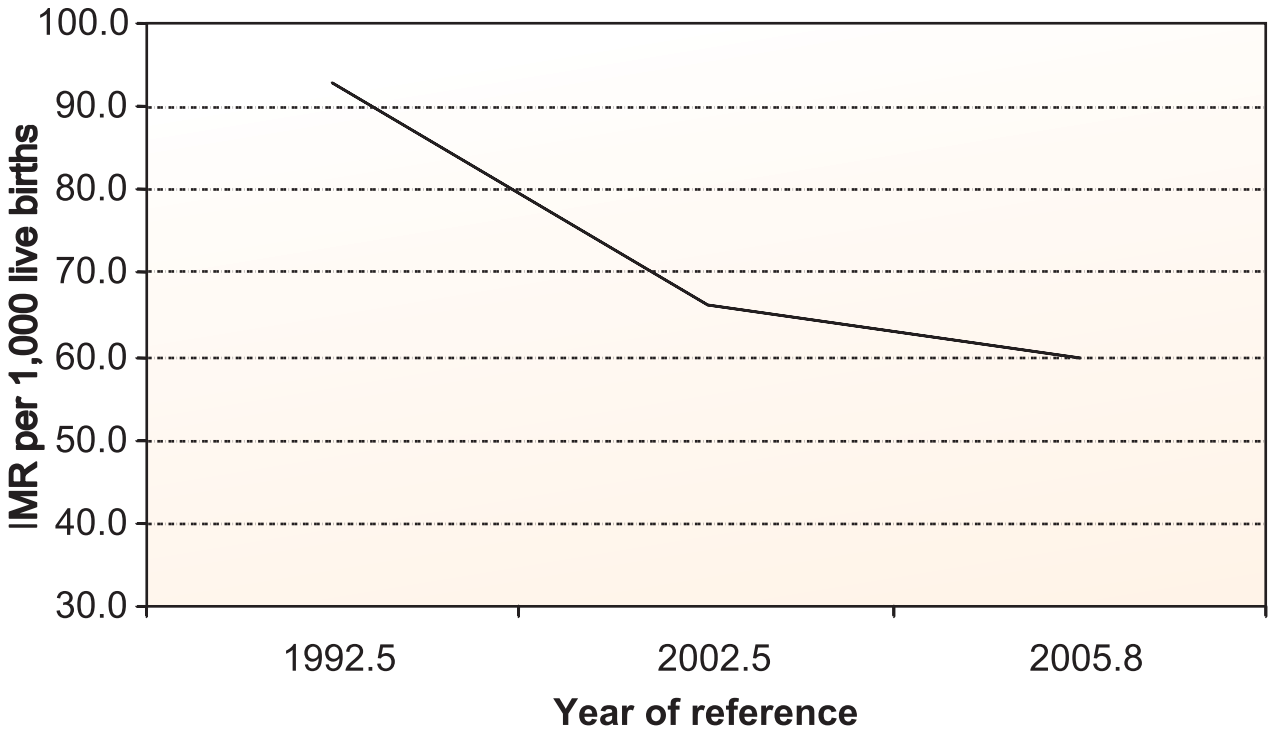
Figure 7.1 Trend in total fertility rate (TFR) Cambodia 1982-2006



Sources of the estimates: 1982.5 to 1997.5: CDHS 2000; 2002.5: CDHS 2005; 2005.8: the present estimate from 2008 census.

A better confirmation of the trends and levels in fertility, early age mortality and maternal mortality may be obtained from the next Demographic and Health Survey, due to be held in 2010.

Figure 7.2 Trend in infant mortality rate (IMR) Cambodia 1992-2006



Sources of the estimates: 1992.5 and 2002.5: CDHS 2005;
2005.8: the present estimate from 2008 census.