CHAPTER 2

Estimating Fertility and Mortality in Cambodia

1. Introduction

In the absence of a reliable 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 a sufficiently long period on 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 the so called 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). 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. There are a few other indirect methods of estimating fertility. One such method, developed by Rele (1967) converts information on child-woman ratio obtained from tabulations of population age-distribution, to total fertility rates. Another method links women of reproductive ages 15 years and beyond with their own children (up to the age of 15 years) present in a household. Suitable reverse survival of the women and their matched own 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 developed by Lee-Jay Cho (United Nations 1983).

There is another simple method of estimating current fertility from information on the last (i.e., the most recent) births to women classified by their age. This method was first applied by Dasvarma and Hull (1984) to the 1980 Indonesian Population Census data, and was found to yield results which were comparable to other estimates. This method is regularly used in Indonesian surveys and censuses to obtain alternative sets of estimates of age-specific and total fertility rates.

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2. Source and quality of data

The main source of data for this analytical report is the Cambodian Population census of 2008. Where appropriate other sources such as the 1998 Population census, the Cambodian demographic and Health Surveys of 2000 and 2005 and the 2004 Intercensal Population Survey have also been used.

The Post Enumeration Survey conducted soon after the 2008 census revealed an under-enumeration of 2.77% which is about one percent more than the extent of under-enumeration found in the 1998 Census. Yet this error in coverage is considered reasonable and acceptable given the large scale and complexity of the census operation and is comparable with the level of under-enumeration found in other countries of the region. The content error is considered acceptable for all the selected characteristics except for a moderate inconsistency in secondary activities (NIS, 2009). The quality of overall age-sex reporting has been found to be good as indicated by the calculated values of Whipple's index (109.87, indicating almost no preference or digits 0 and 5), Myer's index (3.9, indicating almost no digit preference) and the UN-age-sex accuracy index (30.37, indicating reasonable accuracy) (NIS 2009). Thus it can be assumed that in general the quality of data collected at the 2008 Census has been good. However, it is expected that there would be large scale under-reporting of births and deaths when direct questions were asked about the occurrence of these events in the households in the past 12 months.

2.1. Age-patterns of the average number of children ever born and surviving.

The average number of children ever born (CEB) by age-group of women show the expected increasing pattern with women's age. The sex-ratio of CEB by age-group of women in the reproductive ages 15-49 is in the acceptable range of 104 to 105 male children for every 100 female children except for the youngest (15-19) age-group (Table 1).

A comparison of the CEB between 1998 and 2008 confirms a general decline in fertility in the last decade (Figure 1).

Table 1. Number of children ever born by age-group of women, Cambodia 2008. Total

Age-group	Number of women	Number of children ever born (CEB)			Sex ratio of CEB (Males /Females)	Average number of CEB per woman
		Both sexes	Males	Females		
15-19	84,528	52,399	26,251	26,148	1.00394	0.06679
20-24	699,441	407,400	207,982	199,418	1.04294	0.58247
25-29	627,325	899,215	460,136	439,079	1.04796	1.43341
30-34	357,957	861,660	440,366	421,294	1.04527	2.40716
35-39	436,438	1,374,827	703,574	671,253	1.04815	3.15011
40-44	392,967	1,503,513	769,100	734,413	1.04723	3.82605
45-49	354,518	1,537,866	785,985	751,881	1.04536	4.33791
50+	1,025,172	4,565,468	2,302,375	2,263,093	1.01736	4.45337
TOTAL	4,678,346	11,202,348	5,695,769	5,506,579	1.034357	2.39451

Source: Population Census of Cambodia, 2008. Priority Table F3. Females aged 15 and over by Parity, Total Children Ever Born, 5-year Age Group and Educational level. (NIS 2009).

Similarly, the pattern of the average number of children surviving by age-group of women show the expected increasing pattern with women's age (Figure 2). However, in both the graphs, a commonly observed asymptotic shape of the curves of children ever born and children surviving is found in the Cambodian data, indicating the continuation of fertility till very late in the reproductive span.

Figure 1. Average number of children ever born (CEB) by age-group of women
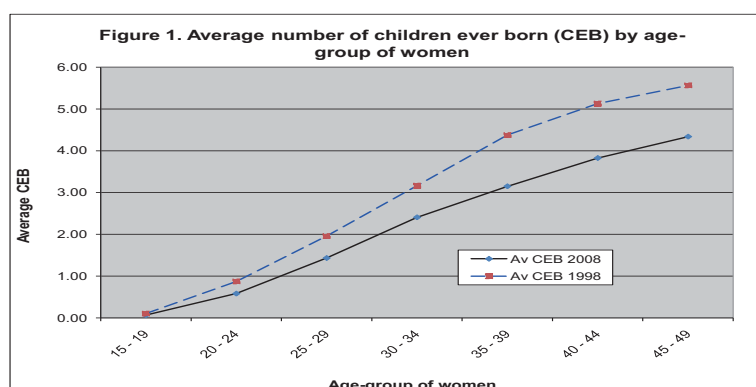
Source: Drawn from Priority Table D3, 1998 Census; and Table F3, 2008 Census

Figure 2. Average number of children surviving (CS) by age-group of women
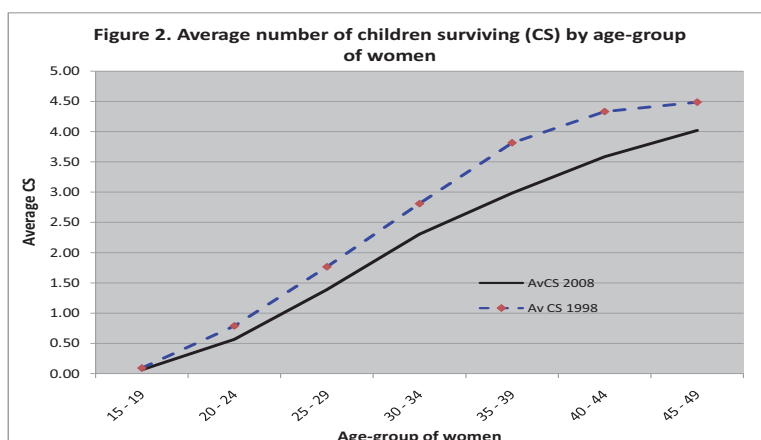
Source: Drawn from Priority Table D5, 1998 Census; and Priority Table F5, 2008 Census

2.2. Childlessness

Childlessness or, the proportions of women having had no live birth decreases with age from age 15-19. Almost all of the women still childless at age 45-49 are childless due to their incapability to produce a live birth. In other words, the proportion of women childless at age 45-49 indicates primary sterility.

Table 2. Percent of women childless by age, Cambodia Total, 1998, 2005 and 2008

Age-group	Percent childless - All women		
	1998 Census	CDHS 2005	2008 Census
15 - 19	93.9	94.8	95.3
20 - 24	51.4	51.5	61.4
25 - 29	23.0	23.3	30.9
30 - 34	13.3	11.0	16.4
35 - 39	9.1	9.3	10.9
40 - 44	7.6	8.7	8.9
45 - 49	6.6	7.2	8.0
Total	37.6	36.9	42.2

Source: Priority Table D3 1998 census, CDHS 2005 and Priority Table F3 2008 Census

The proportions childless have remained fairly stable between the 1998 Census and the 2005 CDHS in most of the age-groups, but show considerable increases in 2008, particularly in the age-groups 20-24 and above (Table 2 and Figure 3). This could reflect a genuine tendency for a larger percentage of women not to have children, but this could

also indicate under-reporting of children ever born, especially if those children are not living. Such under-reporting would have an impact on both the fertility and mortality estimates.

Figure 3. Percent childless among all women- Cambodia Total 1998, 2005, 2008
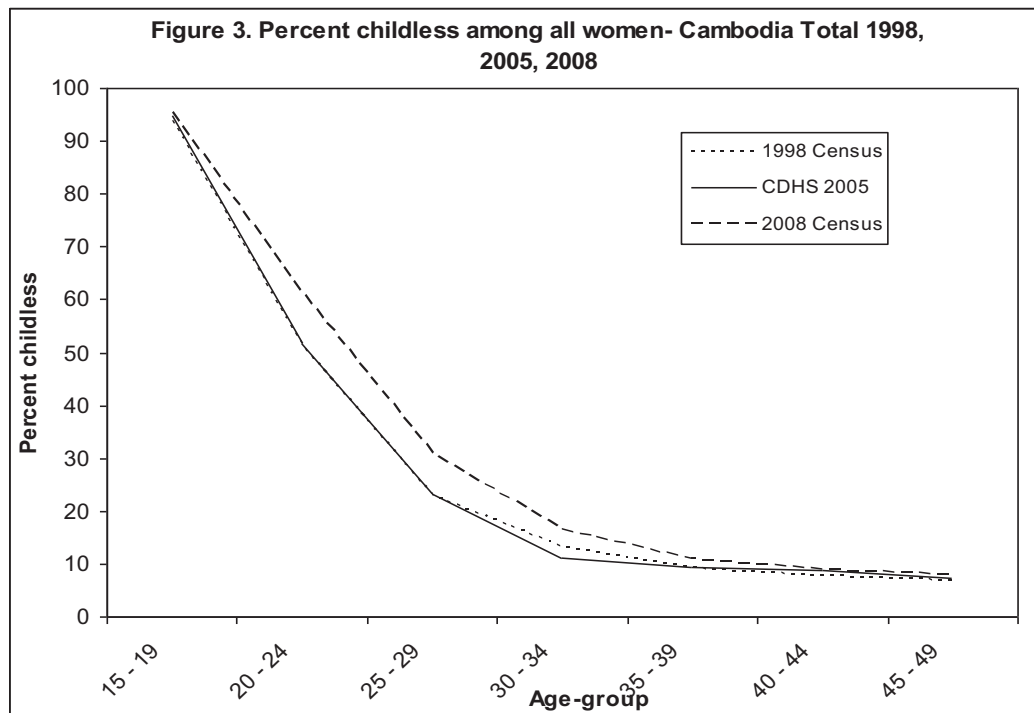
Source: Priority Table D3 1998 census, CDHS 2005 and Priority Table F3

3. Estimates of fertility

At the 2008 General Population Census in Cambodia two types of data were collected that were specifically related to fertility, namely (see Annex 4, Part 3 of From 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 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

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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).

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 (5.3) in 2008.

## 3.1. Estimates of fertility at the national level.

3.1.1. Overall fertility

Tables 3, 4 and 5 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 3 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.

Figure 4. Age-specific fertility rates, CDHS 2000, CDHS 2005 and Census 2008. Cambodia Total
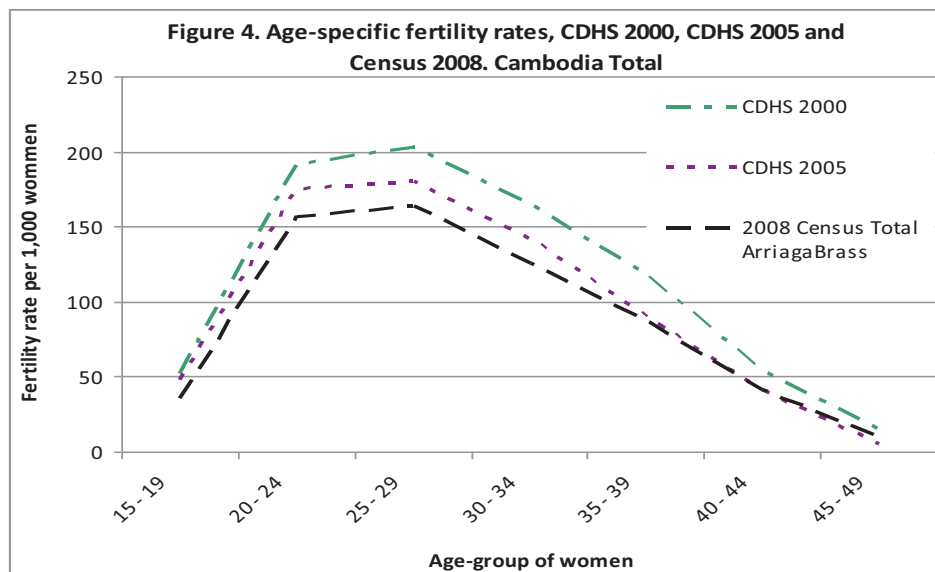
Sources: CDHS 2000 and CDHS 2005 obtained from the reports on the Cambodia Demographic and Health Surveys 2000 and 2005. 2008 census: computed after appropriately inflating the age specific fertility rates generated by the MORTPAK software.

Table 3: Estimates of fertility based on the General Population Census in Cambodia 2008: Cambodia Total

Method	Estimated Total Fertility Rate (TFR) per woman	Estimated crude birth rate per 1,000 population	Reference Period	Reference Point
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

Source: Based on computations of direct and indirect estimates of fertility from data obtained from Priority Priority Tables F1 to F4 (Total)

Table 4: Estimates of fertility based on the General Population Census in Cambodia 2008: Cambodia Urban

Method	Estimated Total Fertility Rate (TFR) per woman	Estimated crude birth rate per 1,000 population	Reference Period	Reference Point
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

Source: Based on computations of direct and indirect estimates of fertility from data obtained from Priority Priority Tables F1 to F4. (Urban)

Table 5: Estimates of fertility based on the General Population Census in Cambodia 2008: Cambodia Rural

Method	Estimated Total Fertility Rate (TFR) per woman	Estimated crude birth rate per 1,000 population	Reference Period	Reference Point
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

Source: Based on computations of direct and indirect estimates of fertility from data obtained from Priority Priority Tables F1 to F4. (Rural)

3.1.2. National fertility by background characteristics

The total fertility rates, estimated according to education and type of economic activity of women are shown in Table 6. As expected, literate women have lower fertility than illiterate women. Further, among the literate women, fertility shows the expected declining pattern with increasing educational level. This is consistent with the findings of previous demographic enquiries conducted in Cambodia such as the Cambodia Demographic Health Surveys of 2000 and 2005.

However, fertility according to economic activity of women exhibits an unexpected pattern. Although the data presented in Table 7 imply that economically inactive women have a slightly higher fertility compared to economically active women in general, it is rather puzzling to find that there is very little difference between the fertility of economically active employed women and economically active unemployed women. In fact, the data given in Table 7 suggest that employed women have a slightly higher fertility than unemployed women.

Table6. Estimates of fertility by education and economic activity of women, Cambodia 2008 Census Total

Characteristics	Estimated Total Fertility Rate (TFR)*
Education	
Illiterate	3.6
Literate	2.8
Below Primary including no schooling	3.1
Primary and Lower Secondary	2.5
Secondary and above	1.8
Economic activity	
Economically inactive	3.2
Economically active unemployed	2.6
Economically active employed	2.9

Source: Based on computations of direct and indirect estimates of fertility from data obtained from Priority Tables F1 to F4 (Total)

*The TFRs are estimated by taking the averages of the estimates derived by the Arriaga One Census method and Arriaga two Census method, similar to what has been done for the national and provincial level estimates of fertility.

3.1.3. Births according to type assistance received during delivery

In connection with data on births during the 12 months preceding the census, information was also collected about the type of assistance that women received when they gave birth. This is shown in percentages in Table 7, which reveals that a high percentage of births (one-third or more) was assisted by traditional birth attendants, while midwives attended nearly one half of the births. Births attended by qualified health personnel (i.e., doctor, nurse and midwife) comprised one half of all births occurring in the past 12 months. Younger women had a slightly higher propensity to seek the assistance of qualified health personnel compared to older women.

The still high dependence on traditional birth attendants is a matter for consideration in view of the Millennium Development Goals, one of the targets of which is to increase the proportion of births attended by qualified health personnel in order to reduce maternal mortality in the country.

Table 7. Births in the last year according to type of assistance received during delivery, by age-group of women. Cambodia 2008 census. Total

Age-group	Total		None	Doctor	Nurse	Midwife	Traditional Birth Attendant	Other	Not reported
	Number	Percent							
15-19	10,948	100.0	0.2	2.7	6.8	53.1	36.1	0.1	0.6
20-24	53,278	100.0	0.2	3.4	7.8	54.5	33.1	0.1	0.2
25-29	53,821	100.0	0.2	3.8	7.9	54.3	32.3	0.1	0.2
30-34	24,060	100.0	0.2	3.6	6.6	51.5	36.1	0.1	0.2
35-39	20,553	100.0	0.4	3.4	6.1	47.8	39.5	0.1	0.1
40-44	9,261	100.0	0.5	3.2	5.1	46.3	41.5	0.1	0.1
45-49	2,543	100.0	0.7	3.3	4.6	42.1	39.0	0.4	0.3
Total	174,464	100.0	0.3	3.5	7.2	52.5	34.7	0.1	0.2

Source: Computed from Priority table F7.

3.2. Estimates of fertility at the provincial level

The estimates of fertility at the province level were made following a similar methodology to that of the national level estimate, namely the Brass P/F Ratio (Arriaga one census), Brass P/F Ratio (Arriaga two census), Own Children (OC) method, Rele method, all of which provided indirect estimates of fertility. In addition, fertility was also calculated directly by using information about the live births taking place in the household in the past 12 months prior to the census enumeration. The resulting estimates of total fertility rate by province are shown in Table 8, which also shows OC estimate and the Brass P/F ratio estimate. However, as mentioned earlier, the direct calculations provide large scale underestimates of fertility. On the other hand, the Brass P/F Ratio (Arriaga one census) is provides an overestimate of fertility. Therefore, following the method of estimating fertility at the national level, the estimates of provincial fertility have been derived by taking the average of the Arriaga two census and Arriaga one census estimates. This is similar to what has been done at the national level the trends in provincial fertility since the 2000 Cambodia Demographic and Health Survey. For a visual presentation, the trends and differentials in fertility (as measured by TFR) are also shown in Figures 5 and 6.

Table 8. Estimates of total fertility rate (TFR) by province, Total (Rural+Urban). Cambodia 2008 Census

Province	Estimated TFR		
	2008 Census	CDHS 2005	CDHS 2000
	(March 2007- March 2008)	(2002-2005)	(1995-2000)
1. Banteay Meanchey	2.7	3.8	4.3
2. Battambang	3.2	3.5	4.5
3. Kampong Cham	3.1	3.2	4.2
4. Kampong Chhnang	3.6	4.3	5.2
5. Kampong Speu	3.4	3.7	4.6
6. Kampong Thom	3.3	3.7	4.3
7. Kampot	3.1	3.2	4.1
8. Kandal	2.8	3.1	3.8
9. Koh Kong	3.6	3.9	4.3
10. Kratie	3.7	4.2	4.6
11. Mondul Kiri	4.5	5.2	6.3
12. Phnom Penh	2.0	2.5	2.1
13. Preah Vihear	4.0	4.9	4.6
14. Prey Veng	2.9	3.0	3.5
15. Pursat	3.6	3.9	4.9
16. Ratnak Kiri	4.9	5.2	6.3
17. Siem Reap	3.2	4.2	4.6
18. Preah Sihanouk	3.1	3.9	4.1
19. Stung Treng	4.2	4.9	4.6
20. Svay Rieng	2.8	3.0	3.5
21. Takeo	3.0	3.2	4.1
22. Otdar Meanchey	3.3	4.2	4.6
23. Kep	3.3	3.2	4.1
24. Pailin	3.6	3.5	4.5
Total Cambodia	3.1	3.4	4.0

Source: Based on computations of direct and indirect estimates of fertility from data obtained from Priority Tables F1 to F4 for the provinces. The CDHS 2005 and CDHS 2005 estimates are obtained from the two Cambodia Demographic and Health Survey reports.
Note: Parentheses denote the reference periods

When compared with the estimates of total fertility rate derived from the 2005 and 2000 Cambodia Demographic and Health Survey (CDHS 2005 and CDHS 2000) it can be seen that all of the provinces except Preah Vihear have experienced the expected declines in fertility throughout the period covered by the 2000 CDHS and the 2008 census. In the case of Preah Vihear, there was slight increase in its total fertility rate between the 2000 and 2005 CDHS, and then a decline as of the 2008 census. The fluctuation in TFR for Preah Vihear could be due to sampling or the inapplicability of assumptions of the estimation techniques or a combination of both, and should not be given too much attention. But the main finding is that all of the provinces have experienced declines in fertility during the overall period covered by the 2000 CDHS and 2008 census.

Figure 5: Trends in total fertility rates (TFR) by province, Cambodia 2000 DHS, 2005 DHS and 2008 Census: Total
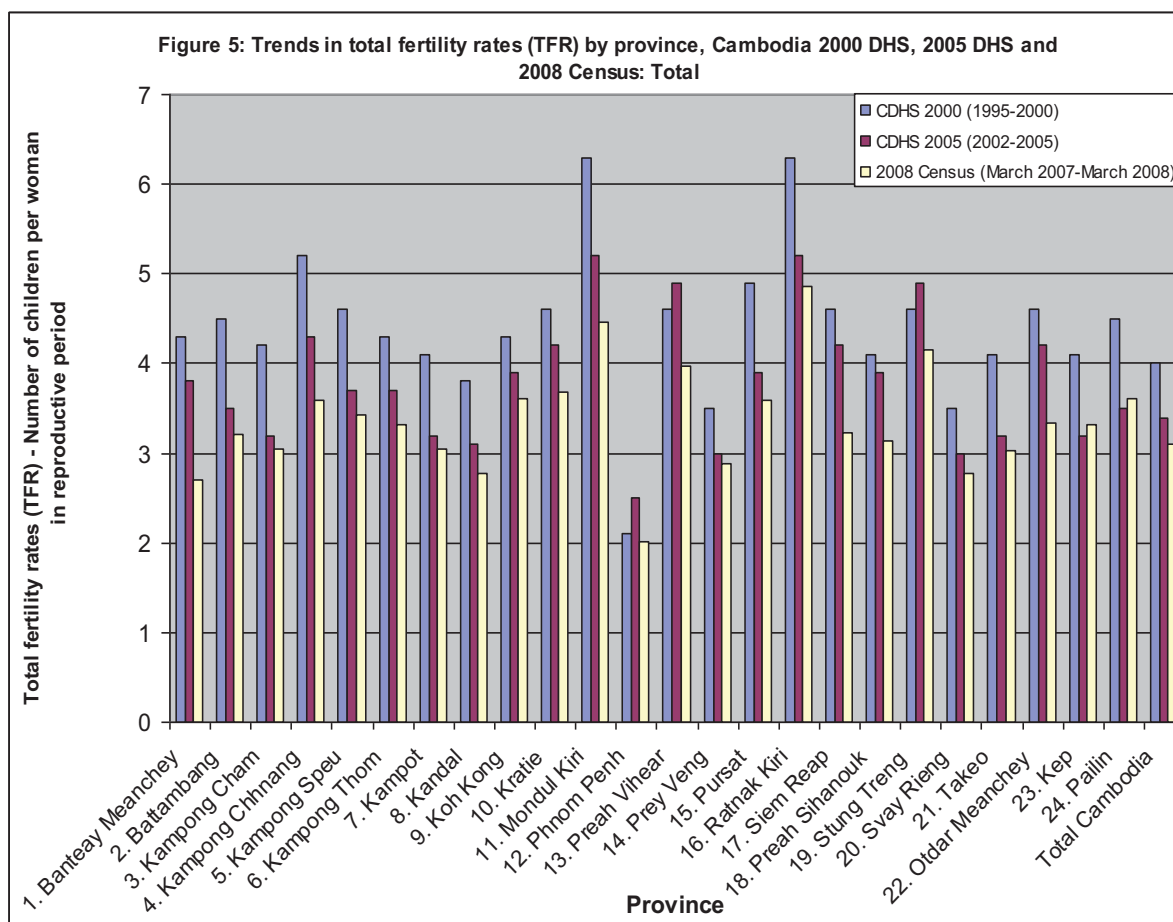
Source: Table 6.

Figure 6 shows the provinces ranked according to TFR estimated from the 2008 Census. Phnom Penh has the lowest TFR at 2.0, which is just below replacement level fertility. Being the most urbanised province of the country, where the nation's capital is located it is not surprising that Phnom Penh has the country's lowest fertility. The highest TFR of 4.9 belongs to Ratanak Kiri, although Mondul Kiri is not far behind with a TFR of 4.5. In all, there are four provinces in Cambodia, namely Preah Vihear, Stung Treng, Mondul Kiri and Ratanak Kiri which still show a TFR of 4 and above.

Figure 6: Estimates of total fertility rate by province, Cambodia 2008 census Total
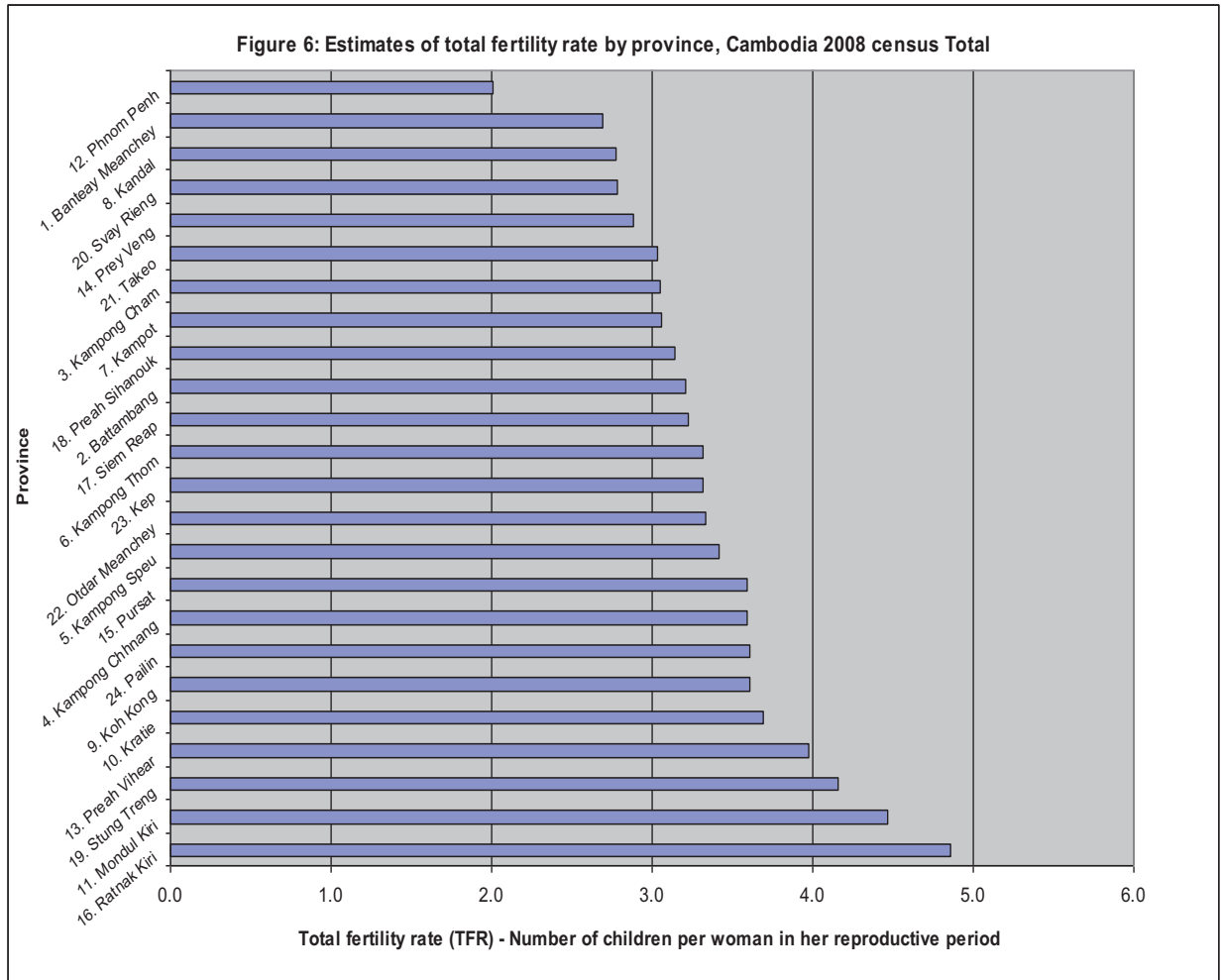
Source: Table 6, Column 2.

4. 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).

4.1. Estimates of mortality at the national level – Total, Urban and Rural

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 9, 10 and 11). These estimates are implausibly low, as are the estimates of child and under-five mortality, particularly in the context of the immediately 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 8). 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 (13.9) and crude death rate (3.34) given in Tables 8 and 9, 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 March 2007-March 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). An estimate of maternal deaths is 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 March 2003-March 2004. Thus the

estimated MMR of 461 per 100,000 live births for Cambodia for the period March 2007-March 2008 seems quite plausible. The 2005 CDHS gave an MMR of 472 per 100,000 live births. Thus the MMR of Cambodia has shown a fluctuating trend between the 2000 CDHS and the 2008 Census, but statistically an unchanged level over a period of about eight years.

Table 9: Estimates of early age mortality, maternal mortality and crude death rate based on the General Population Census in Cambodia 2008: Cambodia Total

Method	Infant mortality rate ($_1q_0$)	Child mortality rate ($_4q_1$)	Under five mortality ($_5q_0$)	Crude death rate per 1,000 population	Maternal mortality ratio per 100,000 live births	Reference Period	Reference Point
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

Source: Based on computations of direct and indirect estimates of infant mortality from data obtained from Priority Tables F1 to F6 (Total).

Table 10: Estimates of early age mortality, maternal mortality and crude death rate based on the General Population Census in Cambodia 2008: Cambodia Urban

Method	Infant mortality rate ($_1q_0$)	Child mortality rate ($_4q_1$)	Under five mortality ($_5q_0$)	Crude death rate per 1,000 population	Maternal mortality ratio per 100,000 live births	Reference Period	Reference Point
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

Source: Based on computations of direct and indirect estimates of infant mortality from data obtained from Priority Tables F1 to F6 (Urban)

Table 11: Estimates of early age mortality, maternal mortality and crude death rate based on the General Population Census in Cambodia 2008: Cambodia Rural

Method	Infant mortality rate ($_1q_0$)	Child mortality rate ($_4q_1$)	Under five mortality ($_5q_0$)	Crude death rate per 1,000 population	Maternal mortality ratio per 100,000 live births	Reference Period	Reference Point
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

Source: Based on computations of direct and indirect estimates of infant mortality from data obtained from Priority Tables F1 to F6 (Rural).

4.2. Estimates of mortality at the provincial level

4.2.1. Infant mortality

As with the national level data, estimates of infant and child mortality for the provinces were obtained by applying the Palloni-Heligman (UN General) and the Trussell (Coale - Demeny West) variations of Brass Child Survivorship methods. Similar to the national level estimate, these methods provided under-estimates of infant and child mortality for the provinces. Again, similar to the national level data, direct calculations of infant mortality obtained from information on the number of deaths under 1 year of age and the number of live births in the preceding 12 months appeared to provide more reasonable estimates of infant mortality. In order to maintain consistency in the estimates, the direct calculations of infant mortality rate (IMR) were adjusted slightly upward by the ratio 60/58 where 60 per 1,000 is the estimated IMR of Cambodia Total and 58 per 1,000 is the IMR for Cambodia Total, calculated from data on infant deaths and live births in the preceding 12 months. The IMR for provinces thus estimated are shown in Table 10. In general, compared to the estimates of provincial infant mortality rates obtained at the 2005 Cambodia Demographic and Health Survey, the estimates obtained from the 2008 census data appear to be reasonable for most of the provinces in that they show the expected declining trend consistent with the national trends.

However, the infant mortality rates of some provinces namely, Kampot, Mondul Kiri, Prey Vihear, Ratanak Kiri and Preah Sihanouk appear to show an increase compared to the CDHS 2005 estimates. Such unexpected trends may also be observed when comparing the estimates of infant mortality rates (IMR) derived from the 2000 and 2005 Cambodia Demographic and Health Survey (Table 12), where the IMRs of a number of provinces appear to have increased between the two surveys mentioned above. In particular, the infant mortality rates of Mondul Kiri, Preah Vihear, Ratanak Kiri and Preah Sihanouk appear to be too high considering their estimates from previous surveys (Table 12).

Estimating mortality and fertility rates based on small numbers for small geographic areas is not free from bias and unreliability, and therefore one should not attach too much credence to such estimates. Direct measures of IMR, which are based on reported number of deaths, classified by age, occurring in the household in the past 12 months, are much liable to be affected by errors in reporting the age at death of the deceased. Errors of this kind may be more common at the very young ages when the age at death of a child above one year may be reported as under one year, thereby inflating the number of infant deaths.

Table 12. Infant mortality rate, maternal mortality ratio (from births, deaths and maternal deaths in the preceding 12 months), Cambodia, by province Total 2008 census, and IMR from CDHS 2005 and CDHS 2000

Province	Infant mortality rate and implied life expectancy at birth 2008 Census		Infant mortality rate		Maternal mortality ratio
	Adjusted IMR* 2008 Census	Implied life expectancy at birth (both sexes)	CDHS 2005	CDHS 2000	Cambodia 2008 census
	(March 2007-March 2008)		(1995-2005)	(1990-2000)	(March 2007-March 2008)
1. Banteay Meanchey	44.9	65.9	76.0	78.2	263.50
2. Battambang	48.1	65.2	97.0	98.0	219.41
3. Kampong Cham	49.9	64.8	94.0	107.9	451.02
4. Kampong Chhnang	42.1	66.6	87.0	129.3	277.22
5. Kampong Speu	62.4	61.8	107.0	68.3	460.78
6. Kampong Thom	58.3	62.8	87.0	64.5	590.68
7. Kampot	69.6	60.2	67.0	100.4	823.40
8. Kandal	48.4	65.1	85.0	89.2	305.06
9. Koh Kong	75.1	59.1	88.0	70.7	1,113.26
10. Kratie	76.7	58.7	84.0	71.3	491.03
11. Mondul Kiri	156.8	44.0	122.0	169.8	1,498.75
12. Phnom Penh	33.4	68.8	42.0	37.6	298.42
13. Preah Vihear	170.3	41.9	111.0	71.3	476.33
14. Prey Veng	54.0	63.8	121.0	111.0	613.66
15. Pursat	56.4	63.2	86.0	139.4	269.49
16. Ratnak Kiri	231.6	33.8	122.0	169.8	1,441.73
17. Siem Reap	36.3	68.0	67.0	77.9	366.00
18. Preah Sihanouk	106.1	52.8	88.0	100.4	806.45
19. Stung Treng	105.2	53.0	111.0	71.3	423.53
20. Svay Rieng	84.8	57.0	92.0	102.0	558.84
21. Takeo	60.1	62.4	96.0	96.0	568.85
22. Otdar Meanchey	75.6	58.9	90.0	77.9	257.07
23. Kep	57.2	63.0	67.0	100.4	1,383.13
24. Pailin	60.6	62.3	97.0	98.0	630.63
Total Cambodia	60.0	62.4	--	92.7	460.84

Source: Based on computations of direct and indirect estimates of infant mortality from data obtained from Priority Tables F1 to F6 of the provinces (Total).

* Note: The directly calculated IMR of each province has been adjusted upward by the ratio 60/58,where 60 per 1,000 is the final estimated IMR of Cambodia Total and 58 per 1,000 is the IMR for Cambodia Total calculated from data on infant deaths and live births in the preceding 12 months.

4.2.2. Life expectancy at birth implied by the infant mortality rates of the provinces

The infant mortality rates estimated for each province and shown in Table 13 have been used in conjunction with the Coale and Demeny Model Life Tables (Model West) to derive the estimates of life expectancy at birth for each province. They show the expected differentials according to province. However, the life expectancy at birth for Mondul Kiri, Preah Vihear and Ratanak Kiri appear to be too low. Like the infant mortality rates, not much credence should be attached to these estimates.

Table 13. Life expectancy at birth by province implied by their estimated infant mortality rates, Cambodia 2008 Census Total

Province	Life expectancy at birth		
	(March 2007-March 2008)		
	Male	Female	Both sexes
1. Banteay Meanchey	64.0	67.9	65.9
2. Battambang	63.3	67.2	65.2
3. Kampong Cham	62.9	66.7	64.8
4. Kampong Chhnang	64.7	68.6	66.6
5. Kampong Speu	60.0	63.8	61.8
6. Kampong Thom	60.9	64.7	62.8
7. Kampot	58.5	62.1	60.2
8. Kandal	63.2	67.1	65.1
9. Koh Kong	57.3	60.9	59.1
10. Kratie	57.0	60.5	58.7
11. Mondul Kiri	42.5	45.5	44.0
12. Phnom Penh	66.8	70.8	68.8
13. Preah Vihear	40.5	43.4	41.9
14. Prey Veng	61.9	65.7	63.8
15. Pursat	61.4	65.1	63.2
16. Ratnak Kiri	32.5	35.0	33.7
17. Siem Reap	66.1	70.0	68.0
18. Preah Sihanouk	51.3	54.4	52.8
19. Stung Treng	51.5	54.6	53.0
20. Svay Rieng	55.3	58.8	57.0
21. Takeo	60.5	64.3	62.4
22. Otdar Meanchey	57.2	60.8	59.0
23. Kep	61.2	65.0	63.0
24. Pailin	60.4	64.2	62.3
Total Cambodia	60.5	64.3	62.4

Source: Computed from Colale and Demeny Model West Life Tables
based on infant mortality rates given in Table 11.

4.2.3. Maternal mortality

Direct measures of maternal mortality ratio (MMR) based on the reported number of maternal deaths and live births occurring in the preceding 12 months are presented in Table 11, which shows very high levels of maternal mortality in Koh Kong, Mondul Kiri, Ratanak Kiri, Kep (more than 1,000 maternal deaths per 100,000 live births), high maternal mortality in Kampong Thom, Kampot, Prey Veng, Preah Sihanouk, Svay Rieng, Takeo and Pailin (more than 500 maternal deaths per 100,000 live births). Again, caution should be exercised when interpreting these ratios. Moreover, it may be noted that the estimates of MMR from the 2008 Census data for Mondul Kiri, Prey Vihear, Purast, Preah Sihanouk, Stung Treng, Otdar Meanchey, Kep and Pailin are based on fewer than 20 infant deaths, which makes the respective maternal mortality ratios highly unreliable.

4.2.4 Maternal deaths according to type of assistance received at the time of death and place of death

Information about the type of assistance received at the time of maternal death and the place where the death occurred is given in Table 14.

Table 14. Maternal deaths and live births by type of assistance received during delivery. Cambodia 2008 Census Total. All ages.

Type of assistance	Place of death					
	Hospital	Health centre	Home	Other	Total Number	Percent
Doctor	258	12	41	2	313	38.9
Nurse	17	24	20	3	64	8.0
Midwife	39	33	54	3	129	16.0
Traditional Birth Attendant	0	0	96	8	104	12.9
Other	5	0	10	6	21	2.6
None	1	0	143	29	173	21.5
Total	320	69	64	51	804	100.0

Source: Computed from Priority Table G3.

Of the 804 maternal deaths reported to have occurred in the 12 months before the census, nearly 63 percent were attended by qualified medical personnel (39 percent by doctors, eight percent by nurses and 16 percent by midwives). About 15.5 percent were attended by medically non-qualified personnel such as traditional birth attendants (13 percent), others such as relatives or friends (2.6 percent). But what is surprising to note is that more than a fifth (21.5 percent) of the maternal deaths are reported to have been attended by no one.

Most of the maternal deaths happened at a health facility, although significant numbers also happened at home or other places.

As can be expected, most of the deaths attended by medically qualified persons happened at a health facility such as hospital or health centre, whereas an overwhelming majority of

maternal deaths attended by medically non-qualified persons happened at home or other places (i.e., at a non-health facility).

4.3. Estimates of mortality according to natural regions

Since the directly calculated measures of infant and maternal mortality by province are liable to be affected by the smallness of the numbers of infant and maternal deaths, it might be necessary to consider   calculating the infant mortality rate and maternal mortality ratio according to larger areas of aggregation, such as the natural regions of the country. Cambodia is divided into four natural regions: (i) Plain Region, (ii) Tonle Sap Region, (iii) Coastal Region and (iv) Plateau and Mountain region.

The infant mortality rates and maternal mortality ratios by natural regions are shown in Table 15. As expected, the highest infant and maternal mortality are found in the Plateau and Mountain region, followed by the Coastal region. But perhaps surprisingly, it is the Tonle Sap region and not the Plain region which exhibits the lowest infant and maternal mortality.

Table 15. Infant mortality rate and maternal mortality ratio according to natural regions of Cambodia. 2008 Census. Total

Natural regions and their constituent provinces	In the 12 months preceding the census			Infant mortality rate (per 1,000 live births)	Maternal mortality ratio (per 100,000 live births)
	Number of infant deaths	Number of maternal deaths	Number of live births		
Plain Region (Kampong Cham, Kandal, Phnom Penh, Prey Veng, Svay Rieng Takeo)	3,672	327	72,727	52.23	449.63
Tonle Sap Region (Banteay Meanchey, Battambang, Kampong Chhnang, Kampong Thom, Pursat, Siem Reap, Otdar Meanchey, Pailin	3,043	217	65,252	48.24	332.56
Coastal Region (Kampot, Koh Kong, Preah Sihanouk, Kep)	893	109	12,065	76.57	903.44
Plateau and Mountain region (Kampong Speu, Kratie, Mondul Kiri, Preah Vihear, Ratnak Kiri, Stung Treng)	2,511	151	24,420	106.37	618.35

Source: Table 11.

4.4. Causes of death

In collecting data on the number of deaths occurring in the household in the past 12 months, information was also collected about the cause of death. This section discussed the percentages of death by cause of death (i) for children under five, (ii) for males by broad age-groups and (iii) for females by broad age-groups.

4.4.1. Cause of death among children under five

In general, the infectious and parasitic diseases have accounted for more than 80 percent of deaths of children of both sexes under five in Cambodia. The broadly defined cause of death Fever alone accounted for 31.4 percent of child deaths (Table 16). Dengue fever and malaria together accounted for more than 18 percent of the child deaths. Tetanus has reportedly killed nearly 12 percent of children under five, while accidents and diarrhoea have accounted for nearly 7 percent of child deaths each. Fever is a loosely defined cause of death and efforts should be made to obtain more precise information about causes of death in future enquiries.

This cause of death structure among children under five indicates that efforts to reduce child mortality in Cambodia should include the prevention and treatment of a range of diseases, but in particular, the diseases related to fever, dengue and malaria.

Table 16. Cause of death among children under five, Cambodia 2008 Census. Total

Both sexes		Males		Females	
Cause of death	Percent of deaths	Cause of death	Percent of deaths	Cause of death	Percent of deaths
All causes	100.0	All causes	100.0	All causes	100.0
Fever	31.5	Fever	33.0	Fever	31.7
Dengue fever & malaria	18.4	Tetanus	15.5	Dengue fever & malaria	19.8
Tetanus	12.2	Other illness	13.7	Tetanus	12.1
Other illness	11.7	Dengue fever & malaria	11.9	Other illness	11.5
Accidents	6.8	Not Known	8.0	Diarrhoea	6.6
Diarrhoea	6.5	Diarrhoea	5.2	Accidents	5.7
Not Known	5.6	Accidents	5.1	Not Known	5.4
Heart disease	3.7	Heart disease	4.1	Heart disease	3.8
Tuberculosis	3.2	Tuberculosis	3.0	Tuberculosis	2.8
HIV/AIDS	0.5	HIV/AIDS	0.4	HIV/AIDS	0.6

Source: Computed from Priority Table G2.

Fever is till the most dominant cause of death for each of male and female children under five, but the other causes of death appear to affect the male and female children slightly differently. For example, male children appear to be more prone to dying from tetanus than female children, whereas female children appear to be more susceptible to dengue fever and malaria. A very small percentage of children, both male and female have been

reported to have died from HIV/AIDS, which is presumably due to vertical transmission of the diseases from mother to child during the mother's pregnancy.

4.4.2 Cause of death among males by broad age-group

Table 16 shows the cause of death structure among males aged 5-59 years and 60 years and over. These are quite different from the cause of death structure among male children under five in that the infectious and parasitic diseases do not figure in death causation as prominently as they do in the case of children under give. Further, among males aged five years and over, the cause of death structure is different between the two broad age-groups: 5-59 and 60 years and over. Accidents accounted for almost a quarter of all deaths among males aged 5-59 years, followed by dengue fever and malaria, other illnesses, fever and heart disease. Among males aged 60 years and over, the category "Other illnesses" is reported to have accounted for nearly 42 percent of deaths. This category appears to contain a diverse group of causes of death and it does not help the health planner if such a high percentage of deaths is assigned to undefined causes. Next to "Other illnesses", heart disease and tuberculosis are reported to have accounted for large proportions (18 and 14 percent respectively) of deaths of males aged 60 years and over (Table 17).

Table 17. Cause of death among males age-groups 5-59 and 60+, Cambodia 2008 Census. Total

Males aged 5-59 years		Males aged 60 years and more	
Cause of death	Percent of deaths	Cause of death	Percent of deaths
All causes	100.0	All causes	100.0
Accidents	24.6	Other illness	41.7
Dengue fever and malaria	18.6	Heart disease	17.8
Other illness	15.0	Tuberculosis	13.9
Fever	12.6	Fever	7.7
Heart disease	7.7	Accidents	6.2
Tuberculosis	6.0	Not Known	5.4
Tetanus	4.8	Dengue fever and malaria	3.1
Not Known	4.5	Diarrhoea	2.5
Diarrhoea	3.7	Tetanus	1.6
HIV/AIDS	2.5	HIV/AIDS	0.2

Source: Computed from Priority Table G2.

4.4.3 Cause of death among females by broad age-group

Table 18 shows the cause of death structure among females aged 5-59 years and 60 years and over. Further, the cause of death structure among females over their reproductive ages 15-49 years is also shown. Similar to males, death causation among females aged 5 years and over is different from that among female children aged under five years, particularly with respect to infectious and parasitic diseases. Further, similar to males, the cause of death structure among females is different with respect to the three broad age-groups: 5-59, 60 years and over and 15-49 years. Dengue and malaria, fever, accidents and heart disease account for 63 percent of deaths among females aged 5-59 years.

Deaths among women aged 60 years and over were caused mainly by the group defined as "other illnesses" which accounted for nearly one half of female deaths in this age-group. Among the defined causes of death heart disease, fever, tuberculosis and accidents comprised the leading causes of death in this age-group. Women who died in their reproductive ages 15 and 49 years, died mainly from dengue and malaria, heart disease, accidents and fever. Delivery and pregnancy complications accounted for just under a tenth of females deaths in their reproductive ages.

Table 18. Cause of death among females age-groups 5-59, and 60+ and 15-49, Cambodia 2008 Census. Total

Females aged 5-59 years		Females aged 60 years and more		Females aged 15-49 years	
Cause of death	**Percent of deaths**	**Cause of death**	**Percent of deaths**	**Cause of death**	**Percent of deaths**
All causes	100.0	All causes	100.0	All causes	100.0
Dengue fever and malaria	18.3	Other illness	48.9	Other illness	20.8
Other illness	16.6	Heart disease	14.6	Dengue fever and malaria	17.4
Fever	15.6	Tuberculosis	12.7	Heart disease	13.4
Accidents	12.3	Fever	6.9	Accidents	11.8
Heart disease	9.7	Accidents	6.5	Fever	10.8
Tuberculosis	7.2	Not Known	4.4	Tuberculosis	9.8
Tetanus	4.7	Diarrhoea	3.1	Delivery complications	6.4
Delivery complications	4.1	Dengue fever and malaria	1.5	Not Known	4.1
Diarrhoea	3.7	Tetanus	1.0	Tetanus	3.9
Not Known	3.6	Pregnancy complications	0.3	HIV/AIDS	3.5
HIV/AIDS	2.6	Delivery complications	0.1	Pregnancy complications	2.6
Pregnancy complications	1.7	HIV/AIDS	0.0	Diarrhoea	2.5

Source: Computed from Priority Table G2.

5. 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 operating in Cambodia, data collected at censuses and surveys have to be depended upon for estimating fertility and mortality. In survey much 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 estimated to be 3.1, infant mortality 60 and per 1,000 live births and maternal mortality ratio is estimated to be 461

per 100,000 live births. Life expectancy at birth at the national level is estimated as 60.5 years for males, 64.3 years for females and 62.4 years for both sexes. The estimates of child and under-five mortality are too implausible to arrive at a conclusive figure. Figures 7 and 8 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.

The estimates of fertility according to women's background characteristics show the expected pattern of declining fertility with increasing education. Similarly, economically active women are found to have a slightly lower fertility than economically inactive women. However, among the economically active women, there does not appear to be much difference between the unemployed and employed women. In fact the former appear to have a slightly lower fertility than the latter.
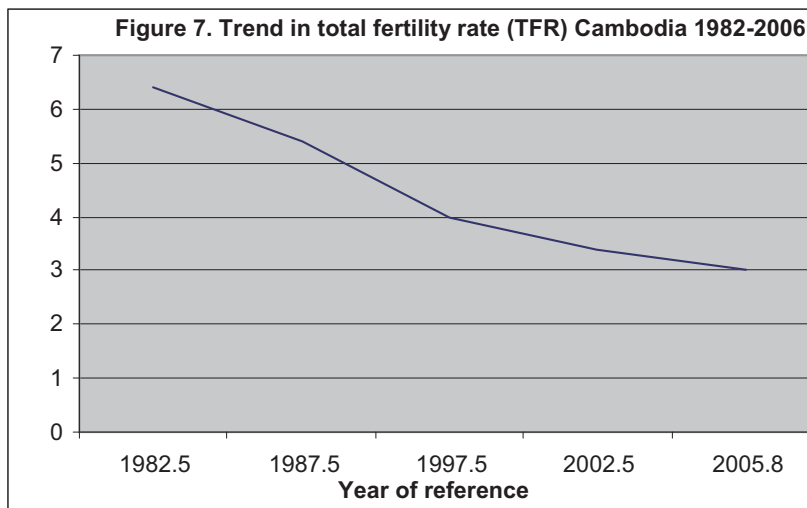
Sources of the estimates: 1982.5 to 1997.5: CDHS 2000; 2002.5: CDHS 2005; 2005.8: the present estimate from 2008 census.

A 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 8. Trend in infant mortality rate (IMR) Cambodia 1992-2006
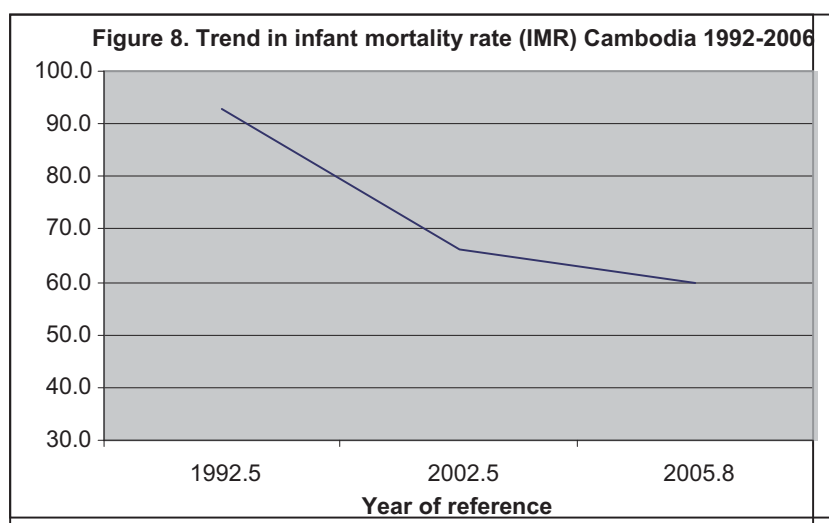
Sources of the estimates: 1992.5 and 2002.5: CDHS 2005; 2005.8: the present estimate from 2008 census.

In terms of the estimates of infant mortality rates (IMR) most of the provinces appear to have experienced a declining trend from the estimates derived by the Cambodia Demographic and Health Survey 2005 consistent with the trend for the country as a whole, but a few provinces appear to have recorded an increase. This could have been due to sampling fluctuations, inapplicability of assumptions or both. An increasing trend in the IMR is not uncommon as it has also been observed between Cambodia Demographic and Health Survey 2000 and 2005.

With respect to maternal mortality ratio (MMR), the estimates at the national level compare fairly well with the estimates from past surveys such as CDHS 2000, CDHS 2005 and the 2004 Intercensal Population Survey, although all these estimates point to a near stagnation in MMR over the last five years or so. There is no way of comparing the provincial estimates of MMR with any previous estimate, as the Demographic and Health Surveys did not include large enough samples for the estimation of provincial MMRs.

Estimates of infant mortality rate (IMR) and maternal mortality ratio (MMR) for the natural regions of the country show that the Plateau and Mountain region has the highest levels of IMR and MMR and the Tonle Sap region has the lowest IMR and MMR.

An analysis of the cause of death structure shows the predominance of infectious and parasitic diseases in the causation of death of children under five years of age. The cause of death structure among older males and females is different from that of children under five, with accidents and degenerative diseases playing major roles in the deaths of men and women above the age of five years, although the infectious and parasitic diseases are still found to be very prominent.

Collection of data on maternal mortality in censuses has been introduced only recently, and has been advocated by demographers as a way of capturing the relatively rare event of maternal deaths adequately because a census provides for a universal coverage of the population of a country (See for example: Stanton et al. 2001). However, there is no doubt that under-reporting of deaths do happen. But, if the under-reporting of maternal

deaths and live births are of similar order, then the resulting maternal mortality ratio would give a reasonable estimate of maternal mortality, as it is believed to have happened in Cambodia at the national level. This can not be guaranteed for provincial level estimates, where the reported number of maternal deaths in some provinces may be too small to produce reliable estimates of MMR. Nevertheless, we believe that the collection of information about maternal deaths should be continued with better training of enumerators so that better quality data can be collected in the future censuses.

Finally, a word about the Cambodian Millennium Development Goals (CMDG) on child health and maternal health. The estimates of fertility and infant mortality appear to be on course for meeting the target set for 2015; in fact the target for total fertility rate (TFR) appears to have been already achieved. In this respect, perhaps the target for the TFR needs to be reviewed and a new target aiming for a TFR of 2.5 for the year 2015 should be set. In terms of maternal health, 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 eight years. The MMR is not a sensitive index to detect a change over a short period. Therefore, as indicators for achieving the CMDG goals on maternal health, more reliance should be placed on skilled birth attendance, deliveries in hospitals and provision of emergency obstetric care.

GLOSSARY

Adult Literacy Rate
Percentage of literate population aged 15 and more to total population aged 15 and more in a given area.

Age
Total years completed by a person on his/her last birthday.

Age Dependency Ratio
The percentage of population in the younger (0-14) and older (65 +) age groups to population in the age group 15-64.

Age-Specific Economic Activity Rate
Percentage of economically active population in an age group to total population in that age group

Age-Specific Fertility Rate
The number of births to women of a given age group per 1,000 women in that age group

Annual Exponential Growth Rate

$$r = \frac{\log_e P_t - \log_e P_o}{t}$$

$$P_t = P_o e^{rt}$$

Where, Po is the population at the base year, Pt is the population at the year 't' and 't' is the number of years between Po and Pt. Here the compounding with the rate of growth 'r' is done on a continuous basis.

Average Household Size
This is the average number of persons in normal or regular households (i.e. excluding institutional and homeless households and households of boat and transient population).

Building
Building refers generally to a single structure on the ground. Sometimes it is made up of more than one component unit which are used or likely to be used as dwelling (residence) or establishments such as shops, business houses, offices, factories, workshops, work sheds, schools, place of entertainments, place of worship, stores, etc. It is also possible that buildings, which have components units, may be used for a combination of purpose such as shop-cum-residence, workshop-cum-residence, office-cum-residence, etc.

Child-Woman Ratio
This is the ratio of children under 5 years old in a population to women in the age group 15-49. It is computed by dividing the number of children aged 0-4 in the population by the number of women aged 15-49.

Crude Birth Rate (CBR)
The number of live births in a year per 1,000 population

Crude Death Rate
The number of deaths per 1,000 population in a given year

Crude Economic Activity Rate
The percentage of economic active population to total population

Dwelling
The room or the set of rooms in a building in which household resides

Educational Level
Educational level refers to completed level. The classification of educational level adopted in the 1998 and 2008 censuses are shown below along with the corresponding grades completed within brackets:

1998 Census
Primary Not Completed (1 to 5), Primary (6 to 8), Lower Secondary (9 to11), Secondary School /Diploma (12 to 13), Undergraduate (14), Graduate/Degree Holder (15) and Post Graduate (16)

2008 Census
Primary Not Completed (1 to 5), Primary (6 to 8), Lower Secondary (9 to13), Secondary School/Baccalaureate (14), Technical Diploma/Pre-Secondary (15), Technical Diploma/Post-Secondary (16), Undergraduate (17), Graduate/Degree Holder (18 to 19) and other (20)

Economically Active Population (or labour force)
Persons with main activity as employed or unemployed during the reference period of one year preceding the census date.

Economically Inactive (or not active) Population
Persons other than the economically active during the reference period of one year preceding the census date.

Employed
Comprises persons who were in the following categories for 6 months (183 days) or more during the one year preceding the census date:
(i) Persons who were in paid employment (e.g. working in public or private organization etc). (ii) Persons who, during the reference period, performed some work for wage, salary, profit or family gain in cash or kind. (iii) Persons who did not do any work for pay or profit during the reference period although they had a job to which they could return. (e.g. off season workers like farmers or fishermen), those on sick leave or leave without pay, those who could not work due to strike or lockout in the organization they were working. (iv) Persons who were self-employed (e.g. Running a shop by himself or herself, selling eatables, practicing as doctors, lawyer etc)

Fertility
Fertility is defined as the childbearing performance of a woman or group of women measured in terms of the actual number of children born.

Gender
Refers to roles, attitudes and values assigned by culture and society to women and men

Gender Equity
Means fair treatment of women and men

General Literacy Rate
This is calculated as percentage of literate persons to total population excluding children aged 0 to 6.

Head of Household
For census purposes he or she is a person who is recognized as such in household. He or she is generally the person who bears the chief responsibility for management of the household and takes decisions on behalf of the household. The head of household need not necessarily be the oldest member, but may be a female member or a younger member of either sex. The name of the person who is recognized by the household as its head was recorded in the census. In the case of an absentee *de jure* "Head", the person who was responsible for managing the affairs of the household was regarded as the Head for the census purpose.

Household
A group of persons who commonly live together and would take meals from a common kitchen unless the exigencies of work prevented any of them from doing so. There may be a household of persons related by blood or a household of unrelated persons or having

a mix of both. Examples of unrelated households are boarding houses, messes, residential hotels, rescue homes, jails, pagodas, etc. These are called institutional households.

Infant Mortality Rate
Infant Mortality Rate is the number of deaths of infants under age one year per 1,000 live births in a given year.

Lifetime Migration
Migration status of persons as determined by comparing the place of birth with place of residence

Literacy
Refers to the ability to read and write with understanding in any language. In the 2008 Census, information on literacy in Khmer language and literacy in any other language was ascertained from respondent. By definition all children of the age of 6 years or less are treated as illiterate.

Live Birth
This refers to the complete expulsion (delivery) or extraction from its mother of a product of conception (baby), irrespective of the duration of pregnancy. The baby after such separation breathes or shows other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached. Each product of such birth is considered as live birth.

Main Activity during Last Year
The activity of a person during 6 months (183 days) or more in the one year preceding the reference date of the census.

Maternal Mortality
This refers to the number of women who die while pregnant, during delivery or within 42 days after delivery.

Median Age
It is defined as the age, which divides the population into two equal size groups, one of which is younger and the other of which older than the median.

Migration
This is the process of changing residence from one geographical location to another. In the 2008 Census it meant shifting residence by the person enumerated from another village or country (which was his/her previous residence) to the village in which he/she was enumerated.

Mortality
Deaths in a population; one of the three basic demographic processes.

Myer's Index

This is a measure of heaping on individual ages or terminal digits. The tendency of enumerators or respondents to report certain ages at the expense of others is called age heaping, age preference or digit preference (e.g. ages ending in 0 or 5). The theoretical range of Myer's index extends from the minimum of 0, when there is neither preference nor avoidance of any particular digit at all, to the maximum of 90 when all ages are reported in a single terminal digit.

Nature of Industry, Trade or Service

Refers to the sector of economy in which a person worked. Examples are: Cultivation, fishing, livestock rearing, selling of vegetables, automobile repairs, manufacture of toys, transport service, school or educational service, sale of clothes (retail), manufacture of eatables etc. If a person works as sales assistant in a Gas Station his occupation is sales person and the nature of his trade is retail sale of petrol.

Occupation

The name of the job a person does (e.g. cashier, primary school teacher, nurse, blacksmith, watchman, manager etc.)

Physical/Mental Disability

This information was collected in the census in case the respondent suffered from any one of the following disabilities: In seeing, in speech, in hearing, in movement or mental. For definition adopted in respect of each of these disabilities, see Chapter 8 Population with Disability. For an individual who had two or more types of disability, only one of them was recorded as decided by him/her.

Population Density

Number of persons per sq.km

Rural

Areas other than urban are treated as Rural.

Secondary Economic Activity

(i) For persons employed for the major part of the year preceding the census (i.e. main activity employed) this refers to a second job or activity which gave him/her additional income in cash or kind.

(ii) In respect of others (i.e. unemployed or economically inactive for the major part of the year preceding the census date) it refers to some job or activity undertaken to earn income in cash or kind. In other words it is their marginal work.

Sex Ratio

The number of males per 100 females in a population

Total Fertility Rate (TFR)

The total fertility rate is the number of children which a woman of hypothetical cohort would bear during her life time if she were to bear children throughout her life at the rates specified by the schedule of age specific fertility rates for the particular year and if none of them dies before crossing the age of reproduction. Therefore Total fertility rate is the

number of births a woman would have if she experienced a given set of age specific birth rates throughout her reproductive span. It is the sum of age-specific fertility rates.

UN Age accuracy Index: is the sum of (i) the mean deviation of the age ratio for males from 100 (ii) the mean deviation of the age ratios for females from 100 and (iii) three times the mean of the age-to-age differences in reported sex ratios. In this procedure the age ratio is defined as the ratio of the population in a given age group to one-half the sum of population in the preceding and following groups.

Unemployed
Persons who were without employment, but were seeking employment or available for employment, for 6 months (183 days) or more during the one year preceding the census date.

Urban
Urban areas are based on the criteria adopted in the "Reclassification of Urban Areas in Cambodia" (November 2004). Please see Chapter I, Introduction, for details.

Usual Activity Status of population
This refers to the main activity status of a person during the one year preceding the census date as employed, unemployed or economically not active.

Whipple's Index
Whipple's Index is a measure of preference for ages ending in 0 and 5. Its range is from 100, indicating no preference for 0 and 5, up to 500 indicating that only 0 and 5 were reported.

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