

Fertility Trends in Cambodia

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Paper presented at the 2002 IUSSP Regional Population Conference held in
Bangkok, Thailand, 10-13 June, 2002 Fertility Trends in Cambodia

Abstract.

A few demographic inquiries in the recent past have produced estimates of fertility and mortality in Cambodia. Data on fertility in Cambodia are available with a greater degree of frequency since 1990, but were scanty before that period.

Because of the unsatisfactory vital registration system in Cambodia, indirect techniques are employed to estimate fertility and mortality in the country. The most recent estimates of fertility in Cambodia range between a total fertility rate (TFR) of 5.3 in 1993-1998 (NIS 1999a) and 4.0 in 1995-2000 (NIS et al., 2001). This would imply a decline by more than 24% in about two years. Questions arise whether such a large-scale decline has really happened, particularly when the contraceptive prevalence among married women has increased from 16.1% in 1998 (NIS 1996) to only 18.5% in 2000 (NIS et al., 2001). Is the TFR of 5.3 for 1993-1998 an over-estimate, or is that of 4.0 for 1995-2000 an under-estimate, or both?

This paper aims to examine trends in fertility in Cambodia based on available estimates and comment on their methods of estimation with particular reference to the most recent estimates. The consistency of the recent fertility estimates in relation to the proximate determinants of fertility is also discussed. Lastly, alternative estimates based on more appropriate indirect techniques are presented and discussed for the most recent periods. However, as background information, available evidence on the past trends in Cambodian fertility is presented first.

By using alternative methods of estimation the paper shows that after the post-Khmer Rouge recovery and "Baby Boom" fertility has started to decline in Cambodia from the early 1990s. It has not been possible to ascertain the magnitude or the speed of this decline, but more research is needed to identify the determinants of this decline, particularly when the use of contraception by married women is low. The paper recommends the collection additional data in order to facilitate the derivation of alternative estimates of fertility.

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1. Introduction.

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Because of the unsatisfactory vital registration system in Cambodia, indirect techniques are employed to estimate fertility and mortality in the country. The most recent estimates of fertility in Cambodia range between a total fertility rate (TFR) of 5.3 in 1993-1998 (NIS 1999a) and 4.0 in 1995-2000 (NIS et al., 2001). This would imply a decline by more than 24% in about two years. Questions arise whether such a large-scale decline has really happened, particularly when the contraceptive prevalence among married women has increased from 16.1% in 1998 (NIS 1996) to only 18.5% in 2000 (NIS et al., 2001). Is the TFR of 5.3 for 1993-1998 an over-estimate, or is that of 4.0 for 1995-2000 an under-estimate, or both?

This paper aims to examine trends in fertility in Cambodia based on available estimates and comment on their methods of estimation with particular reference to the most recent estimates. The consistency of the recent fertility estimates in relation to the proximate determinants of fertility is also discussed. Lastly, alternative estimates based on more appropriate indirect techniques are presented and discussed for the most recent periods. However, as background information, available evidence on the past trends in Cambodian fertility is presented first.

2. Past trends in fertility: 1958-1990

Referring to the important political periods in Cambodia's recent history, we will describe the past trends in fertility according to the following time periods: (i) 1958-1974, (ii) 1975-1979 and (iii) 1980-1990.

2.1. 1958-1975: In this period, Cambodia had high fertility with crude birth rates (CBR) above 40 per 1,000. Desbarats (1995:85-86) cites figures of CBR of around 42 and 47 per 1,000, based respectively on the 1958 Demographic Survey and the 1962 Census, and a total fertility rate (TFR) of 7 in 1962. The birth rate is said to have increased by one or two points during the early 1970s before starting to decline in 1973. These levels were typical of a traditional rural society. Later involvement of Cambodia in the Indochina war in the 1970s is said to have little effect on the country's fertility (Ea Meng-Try 1981, cited in Desbarats 1995). Siampos (1970) estimated Cambodia's TFR as 7.07, based on the adjusted number of live births during the past year before the 1962 Census by age group of women. Heuveline (1998) applied the Brass P/F ratio method to Siampos's tabulations of the number of children ever born by age group of women from the 1962 Census and obtained estimates of TFR for Cambodia for periods before the census as between 6.7 and 7.1. There are suggestions that suggested that fertility increased in Cambodia during the 1960s due improved health and a pro-natalist policy (Martin 1989, reported in Heuveline 1998).

2.2. 1975-1979: According to Desbarats (1995: 86-88) there is no clear information about fertility in Democratic Kampuchea under the Khmer Rouge during 1975-1979. However, the highly adverse conditions during this period are believed to have resulted in large-scale declines in fertility in the country. According to the estimates of the United States Central Intelligence Agency cited by Desbarats (1995), fertility in Cambodia is believed to have declined dramatically during this period. The CBR is estimated to have declined from 43 per 1,000 in April 1975 to 30 in late 1975 and levelled off at about 28 per 1,000 in late 1978 for a population group known as the "People of 18 March" (or "Old People"), who were predominantly rural dwellers. For the other group, known as "People of 17 April" (or "New People") the CBR declined from 32 per 1,000 in April 1975 to 15 in late 1975 and stabilized at around 10 per 1,000 by late 1978. However, these estimates are regarded as underestimates. On the other hand, the "politically motivated" estimate of a CBR of 50 per 1,000 for the whole country in the period 1978-1979 is regarded as an overestimate. More plausible is the middle range estimate of a CBR of between 20 and 25 per 1,000 during 1976-1978 obtained by Ea Meng-Try (Desbarats 1995:88).

2.3. 1980-1990: This period, providing more stable conditions favouring normal family life saw a dramatic increase in fertility as a reaction to the harsh conditions faced by Cambodian families in the Khmer Rouge period. Propped up by a "Baby Boom" in the early 1980s, the country's CBR was estimated to be between 35 per 1,000 and 48 per 1,000 depending on the source and method of estimation. Consensus among international organisations working in Cambodia was that the country had a CBR of about 44 per 1,000 in the mid-1980s. Fertility is reported to have started to decline thereafter, with CBR of 40.4 in 1987, 40 in 1988 and 38 in 1990. The corresponding TFR for 1990 was around 6 (Desbarats 1995: 88-89).

In short, the past trends in fertility indicate an increasing trend between the late 1950s and early 1970s, considerable, sharp declines between the mid to the end of 1970s, and recovery with a “baby boom” in the 1980s.

3. Recent trends in fertility: 1991 and after

The frequency and number of population surveys in Cambodia has increased since 1991 providing more information for assessing the demographic trends in the country.

A second baby boom appears to have occurred after the 1991 Paris Peace Accord (Desbarats 1995:90), which resulted in a CBR of between 48 and 49 per 1,000 during 1992-1993. Another fertility estimate from the World Bank shows a TFR of 4.2 in 1992.

A Socio-Economic Survey was conducted in 1993-94, which was done in four rounds to capture seasonality. The total sample size from all the rounds consisted of 5,578 households selected from 15 of the then 21 provinces including Phnom Penh. The exclusion of six provinces and a number of villages from the selected provinces was done due to security, cost and logistical reasons (Royal Government of Cambodia 1995). While no data on fertility or mortality were collected in this survey, information on child woman ratio obtained from the age-sex distribution of the population can be used to estimate total fertility rate by using the Rele method (See Section 5.1 below)

The KAP Survey on Fertility and Contraception in Cambodia conducted in 1994-1995 (Chhun Long et al., 1995) produced an estimated TFR of 4.9, 4.1 and 5.1 respectively for total, urban and rural areas for 1990-1994. The mid-point of the reference period is 30 June 1993. The fertility estimates are based on birth history during the past five years, and therefore, can be regarded as direct estimates. Due to security reasons, the sample for the KAP Survey was drawn from the secure communes of 10 provinces and the city of Phnom Penh. Information on fertility and contraception was obtained from interviews of 4,544 currently married women living in the 6,000 households selected in the sample. The selected provinces from which the sample was drawn covered 67% of Cambodia’s population (Chhun Long et al. 1995:6). However, the sample may not be strictly representative of the entire country (MOH 1999:1).

The Demographic Survey of Cambodia 1996 (DSC 1996) produced an estimated TFR of 5.2, 4.2 and 5.3 for total, urban and rural areas respectively. The corresponding CBRs were 38.0, 31.8 and 38.8 per 1,000 respectively. The estimates are derived by using an indirect technique, namely the Arriaga variant of the Brass P/F Ratio method (NIS 1996: 9). These estimates have a reference period of five years prior to the time of data collection. The reference time of the survey was midnight of 20 March 1996 (NIS, 1996:xiv). Thus the reference point

of the fertility estimates would be 20 September 1993. Compared to the KAP Survey 1995, the DSC 1996 was a larger survey in scope and coverage. Data were collected from 20,000 households in 21 of the 23 provinces (Preah Vihear and Oddar Mean Cheay provinces were excluded due to security reasons). In addition to excluding all the villages of these two provinces, a number of villages from the other provinces were also excluded for security reasons. The total number of villages thus excluded was 1,645 (NIS 1996: 1-5).

The most recent estimates of fertility in Cambodia are those based on the Cambodia Population Census 1998, National Health Survey 1998 and the Cambodia Demographic and Health Survey 2000. The estimates based on the 1998 census have produced TFRs of 5.3, 4.4 and 5.5 for total, urban and rural Cambodia respectively (NIS 1999a:132). These estimates are also derived by using an indirect technique, namely the Arriaga variant of the Brass P/F ratio method (NIS, 1999a: 5). As such, the reference period of these estimates would be five years prior to the time of data collection, which in this case was the midnight of 3 March 1998 (NIS 1999a: 2) or a reference point of 3 September 1995.

The estimates of TFR obtained from the National Health Survey 1998 are 4.1, 3.3 and 4.3 for total, urban and rural areas respectively. This survey was conducted on a nationally representative sample of 6,219 households and 7,654 eligible women from 21 of the 23 provinces. The two provinces excluded from the survey were Preah Vihear and Oddar Mean Cheay, as in DSC 1996. The estimates TFR are were based on birth history and therefore can be regarded as direct estimates. The estimates refer to 1 to 36 months before the interview, which was completed between mid-May and mid-July 1998 (MOH 1999:6, 79, A9-A10). Thus the reference point for the estimates is 31 December 1996.

The Cambodia Socio-Economic Survey of 1999 or CSES 1999, like the socio-economic survey of 1993/94 did not collect data on fertility or mortality, but information on child woman ratio obtained from the age-sex distribution of the surveyed population can be used for estimating fertility by using the Rele method (see Section 5.1). CSES 1999 had a sample size of 6,000 households distributed in 600 selected villages of all the current 24 provinces of the country (NIS 2000a:1-2).

Values of TFR estimated from the Demographic and Health Survey of 2000 are 4.0, 3.1 and 4.2 for total, urban and rural areas respectively (NIS et al., 2001: 58). These estimates are based on the number of births occurring to women during the previous five years, obtained from birth histories collected during the survey. As such, these can be regarded as direct estimates. The reference period for these estimates is five years prior to the survey, i.e., giving a reference point two and half years before the survey date. Given that data collection was spread over a six-month period February-July 2000 (NIS, 2001: 6) the mid-point

of data collection would be end of April 2000. As such the reference point for the fertility estimates would be end November 1997. DHS 2000 was conducted on a nationally representative sample of 15,3000 women selected from all provinces of the country² and it is the most comprehensive demographic inquiry in Cambodia to date. Estimates of TFR from the five most recent sources are given in Table 1.

The estimates shown in the shaded portion of Table 1 are derived by using the Arriaga variation of the P/F ratio method, while those in the unshaded parts are direct estimates based on birth histories of the interviewed women. According to Table 1, fertility in Cambodia appears to have remained unchanged during 1993-1995 and 1996-1997. However, a comparison of the direct estimates based on the KAP Survey of 1995 and the Demographic and Health Survey of 2000 (DHS) reveals that fertility has declined by almost one child between June 1993 and November 1997, or in this case a decline by 18% in almost four and a half years.

Fertility was estimated from the 1996 survey and the 1998 census by an indirect technique. As mentioned earlier, the indirect technique used in this instance is the Arriaga variation of Brass's P/F ratio method. If the trend implied by the direct estimates of the KAP Survey, National Health Survey and the Demographic and Health Survey are true, then the P/F ratio method would over estimate fertility from the Demographic Survey and the 1998 Census.

The P/F ratio method uses two types of data, namely, (i) the number of children borne by women of each age group during the 12 months prior to the survey, which provides the age-pattern of current fertility, and (ii) number of children ever born classified by age group of women. Because current fertility data as given in first type of data are generally considered to be underestimates, data on cumulative fertility as given in the second type of data are used as a basis for selecting the multiplier to scale up the current fertility data.

A major assumption of this method is that fertility has remained constant in the past 10 to 15 years (Arriaga 1994: 207). If fertility has been declining (which is the most frequent situation in countries with deficient vital registration data, then the P/F ratio techniques give overestimates of current fertility. There are reasons to believe that fertility in Cambodia has been declining. The use of the Trussell variant of the P/F ratio technique in other countries such as Paraguay, Mongolia and Mozambique have clearly produced questionable results. In Cambodia, the TFR of 5.3 obtained from the 1998 census (Table 1) is quite high considering the results of the National Health Survey 1998 and the Demographic and Health Survey 2000 (Table 1). Of course, one cannot expect to get the same estimate of fertility from a census and a survey, but the difference in this case is too large.

Calculations based on data from the Demographic and Health Survey 2000 (NIS et al. 2001) shows the trends in fertility for five-year periods 0-4, 5-9, 10-14 and

15-19 years prior to the survey, estimated from birth histories of women aged 15-49 years. Huguet (2001) estimated *censored* total fertility rates (TFR) from data for the five-year periods mentioned above. These TFRs are 3.99 during 1996-2000, at least 5.7 during 1991-1995, at least 5.9 during 1986-1990 and at least 6.5 during 1981-1985, confirming the baby boom after the end of the Khmer Rouge period, which kept the TFR above 5 until 1995 (Huguet 2001). But these figures also provide evidence of a definite decline in fertility since 1985, a condition that seriously violates the basic assumption of the P/F ratio method.

Huguet advises caution in using these trends because

it is common for fertility surveys to report fertility lower than the actual level for the most recent period, whether the past one year or the past five years, probably because of some displacement of birth dates when mothers respond to the questionnaire. If a significant number of children born between 4 and 5 years ago prior to the survey are reported to have been born more than 5 years ago, the TFR for the 0-4 years prior to the survey will be biased downward and that for the period 5-9 years prior to the survey will be biased upward.

However, if there is a systematic displacement of birth dates, then except for the most recent period, the TFRs of all other periods would remain unchanged because the gain from the previous period would be off set by the loss to the next period.

As mentioned above, the TFR of 5.3 obtained by the P/F ratio method may indicate Cambodia's fertility level in the late 1980s. Huguet (2001) examined the increasing trend in contraceptive prevalence among currently married women and the stable proportions currently married among all women, but could not find any conclusive evidence of the extent of fertility decline in the recent past. Applying the Arriaga variation of the P/F ratio method to the DHS 2000 data (again violating the assumption of the method), Huguet (2001) obtained a TFR of between 4.5 and 4.6, which refer to five years prior to the survey. This, compared with a TFR of 4.0 derived directly for the same period from birth histories implies that the P/F ratio has over estimated fertility.

Moreover, the TFR of 4.6 obtained from the DHS 2000 data by the Arriaga method, when compared with the TFR of 5.3 obtained from the 1998 Census by the same method indicates a decline in fertility of nearly 25% in only two years.

The most important proximate determinant of fertility, namely contraceptive prevalence among currently married women has increased, for any modern method, from 6.9% in 1995 through 16.1% in 1998 to 18.5% in 2000 and that for any method from 12.6% through 21.8% to 23.8% in the same period (See Table 2).

The proportion of women currently married has remained almost stable at about 61% between the 1995 KAP and the 1998 NHS, but shows a slight declining trend between 1998 census and the 2000 DHS (Table 2).

The percentage of women who have breastfed their children during the past five years remains high at 96% attesting to the universality of breastfeeding in Cambodia, although the 2000 DHS shows a slight declining tendency in this practice (Table 2).

Data on abortion are available only from the 1995 KAP and the 2000 DHS, which show the overall prevalence of abortion among women of reproductive ages to be stable at 5%, although women of ages 30 to 44 appear to have resorted to abortion more in the recent period, while women of other age groups appear to have reduced this practice (Table 2).

Unfortunately, information about these proximate determinants of fertility does not provide much insight into the trend of fertility in Cambodia. The only discernible trend is the rise in contraceptive use, which can be seen to be associated with declining fertility. However, this increase in contraceptive prevalence is associated with an increase only in short term spacing methods such as injectable, pill and monthly pill; the use of long acting or permanent contraceptives such as IUD and female sterilisation has either decreased or remained unchanged (Table 3).

By comparing the level of TFR and the associated levels of contraceptive prevalence in various parts of the world (Table 4), it is seen that the current contraceptive prevalence of 23.8% for any method in Cambodia places this country in league with Sub-Saharan Africa, where contraceptive prevalence is 23% and the TFR is estimated to be 5.7. However, reported contraceptive prevalence may not be the only indicator or determinant of TFR, and a number of other determinants need to be looked into to arrive at a conclusive figure about the fertility level of a country.

5. Alternative estimates

Since one of the aims of the paper is to obtain an estimate of the fertility trends in Cambodia, an attempt is made here to apply a uniform method of fertility estimation to all available data. There are several indirect techniques that can be applied to situations where vital registration data are not available with the required level of accuracy and coverage, such as in Cambodia. Two such techniques are applied here, namely the Rele method (Arriaga 1994:204, Rele 1967) to data from the 1962 census through the DHS 2000, and the Own Children method (Arriaga 1994, Cho 1973) to data from the 1998 Census.

5.1 Estimates based on the Rele method (1962 - 2000)

Rele (1967) found that in any population, the child-woman ratio (CWR) and the gross reproduction rate (GRR) are linearly related for given levels of expectation of life at birth (e_0^0). Thus, an estimate of GRR can be obtained from information about the CWR and e_0^0 . The total fertility rate (TFR) can be estimated from the GRR with information about the sex ratio at birth, which is generally assumed as 105 male births to 100 female births. Information about the age-distribution of a population, the basis for calculating CWR is more easily available than the more specific information about fertility variables. In the Rele method two types of CWR can be used, namely (i) the ratio of the number of children (both sexes) aged 0-4 to the number of women aged 15-44 or 15-49, i.e., CWR (0-4), and (ii) the ratio of the number of children (both sexes) aged 5-9 to the number of women aged 20-49 or 20-54, i.e., CWR (5-9). The upper age limit of women depends on the extent to which women bear children at the oldest reproductive age group. The first type of CWR provides estimates of fertility during the five years preceding the survey or census, while the second type of CWR provides estimates of fertility during the past 5 to 9 years preceding the survey. Of the two parameters, CWR and e_0^0 , CWR influences the accuracy of the fertility estimate more than does e_0^0 . Information about e_0^0 needs only to be known to within a range of five years of the actual value. Thus, we see that the Rele method does not have restrictive assumptions about constant fertility or mortality. The only requirement in this method is that CWR should be as accurate as possible. In other words, the accuracy or reliability of the TFR estimated by this method depends to a large extent on the accuracy of age reporting, particularly that of children aged 0-4 and 5-9. In many situations, children aged 0-4 are considered to be under-reported, while those aged 5-9 over-reported. Thus TFR based on CWR (0-4) would be under-estimated, while that based on CWR (5-9) would be over-estimated. The method is sensitive to differential under-enumeration of children and women, but it is less sensitive to errors in e_0^0 (Arriaga 1994: 205). The estimated TFRs are given in Table 5.

Two sets of estimates of TFR have been derived from information on child woman ratio as shown in Table 5. The estimates based on children aged 0-4 refers to the five years immediately preceding the survey/ census, while that based on children 5-aged 9 refers to a period between five and ten years preceding the survey/ census. The TFRs estimated from children aged 0-4 shown in Table 5 show an overall declining trend in fertility in Cambodia from the late 1950s, from a level of more than 5 in 1958-62 to 3.5 in 1996-2000. There are two minor inconsistencies in this trend, namely the rise in the TFR produced by data from the 1996 Demographic Survey and the 2000 DHS. Similarly, the TFRs based on children aged 5-9, which refer to periods five years before those of the TFRS based on children 0-4, also show an overall declining trend in fertility, but with increases corresponding to the 1998 National Health Survey produced and the 2000 DHS. The average of the two estimates also show a

declining trend, but with similar fluctuations as before. If only the nationally representative data are taken into account, namely the 1962 Census, the 1998 Census and the 2000 DHS, then there is a clear declining trend in fertility.

However, as discussed before, the TFR estimated by the Rele method are sensitive to misreporting of the ages of children and women and more particularly on the differential misreporting of ages between children and women. Moreover, the sampling design and sampling coverage of the surveys on which the TFR calculations are based would also affect the estimates. Age misreporting is recognised as a problem in Cambodian censuses or surveys.

Underreporting of children aged 0-4 appears to have become chronic in Cambodian censuses and surveys. In traditional Cambodian culture, an infant is considered to be one year old at the time of birth. At the next Khmer New Year she/he automatically becomes two years old and continues to advance one year at each subsequent Khmer New Year (Siampos 1970).

Several precautions have been taken to record age in Cambodian demographic inquiries, particularly that of young children. These precautions include recording the date of birth and converting traditional ages given in animal calendar to completed years. Further, enumerators were “exhorted to bestow utmost care in recoding age and were warned against omission of infants and children” (NIS 1996: 14). In spite of all these precautions, age misreporting appears to continue in Cambodian demographic inquiries. In most population inquiries in the country, the enumerated population in the age group 0-4 is found to be less than that of the age group 5-9. For example, the Population Census of 1962 (Siampos, 1970), Socio-Economic Survey of Cambodia 1993/94 (NIS 1995), the National Health Survey 1998 (MOH 1999), Demographic Survey of Cambodia 1996 (NIS 1996), Population Census of 1998 (NIS 1999), Cambodia Socio-Economic Survey 1999 (NIS 2000a) and the Cambodia Demographic and Health Survey 2000 (NIS et al., 2001) have all produced age pyramids in which the base (i.e., 0-4 age segment) is narrower than the 5-9 age segment.

The shrinking of the 0-4 age segment could either be a real phenomenon due to fertility decline in the recent past (and/or an unusually high mortality of children under five), or could be due to omission, or exaggeration of ages, of children under five. The report on the Cambodia Socio-Economic Survey 1999 states that the narrow base of the age pyramid reflects under-enumeration and age misstatement among persons 0-4 years rather than any significant decline in fertility (NIS 2000a: 8). Age misreporting could affect the other age segments of the population as well, such as women in ages 15 to 54, which combined with errors in the 0-4 or 5-9 age segment could produce erroneous values of child woman ratio that could in turn produce under or over estimates of TFR by the Rele method. The NIS (1999b: 14) recommends further investigation of the phenomenon of under reporting of children aged 0-4.

One way to get over the problem of under reporting of children is to use age distributions adjusted for misreporting and omissions. However, all of the available adjusted age data have used a method whereby the 0-4 age segment has been first inflated by estimating the number of births in the past five years by assuming a higher past fertility and surviving these births forward for five years (Siampos 1970; NIS 2000b: 6). Thus, the currently available adjusted age distributions are not suitable for estimating fertility by the Rele method.

5.2. Estimates based on the Own Children method

Indirect techniques of the Brass-type are based on the assumption (among others) of constant fertility and mortality. In spite of serious under or over estimates of fertility that may occur when this assumption is violated, they are freely used in most countries where lack of data prevent the use of direct methods regardless of the fact that their fertility is usually declining. The reason of the use and misuse of these type of indirect techniques is that they are statistically appealing. But they are proven to be quite weak to produce estimates that can provide reliable fertility levels or trends.

One indirect method that does not need the assumption of constant fertility is the own-children method. In addition, it provides a series of TFRs for a period of about 15 years. In other words, this technique is particularly useful to estimate fertility trends and patterns (for a description of the technique see Cho, 1973; United Nations, 1983, Arriaga, 1994).

The own-children method uses census data on children and women by single years of age. The method was applied here to the 1998 Census. This technique is based on the idea of rejuvenating a population of women and children. If both the current age of the mother and her children is known, it is possible to calculate the year of birth of each child and also the age of the mother at the birth of the child. With this information the number of births for each year before the census and the distribution of births by age of mother are calculated. The total number of females by single ages can also be rejuvenated for several years before the census. Thus, age-specific fertility rates can be estimated for a period of up to 15 years prior to the census with the data on children 0 to 15 years of age by age of their mothers and females by single ages. The method includes the mortality of both women and children during the period of rejuvenation.

The 1998 Census included the required basic questions to use this technique, although special tabulations had to be performed to get the required data. These tabulations were made by using a special dataset created by the Cambodian National Institute of Statistics in WinR+ format. The most important piece of information to apply this method is the number of children under 15 years of age living with their own mothers, classified by their own and their mother's single years of age. In this method, this group of children is called *matched children*.

The information to link directly the children with their mothers was not available in the 1998 Census as it is the case in most other censuses. Therefore, the following procedure was used to select the *matched children*: All children (population 14 years and younger) that were the son or the daughter of a male head of a household were considered as children of the wife of this head and linked to her as her biological children. Also were considered as *matched children* the sons and daughters of women heads of households. The rest of the population under 15 years of age was considered *unmatched children*, which were distributed by age of mother according to the pattern available for *matched children*.

The other information necessary to use this technique is the total number of women, by single years of age and life table survivorship ratios for up to 15 years before the census date. For the present study, this later information was obtained from life tables recently constructed for Cambodia (Neupert, 2002).

There are the two main assumptions of this technique. First, census coverage has to be the same for children as for women and, second, the age distribution of mothers of unmatched children is the same as the age distribution of mothers of matched children. These assumptions are frequently violated. It is well known that census undercount is usually higher among minors, especially babies, than adults. As a result fertility rates may be underestimated. In addition, in all societies there are children and mothers that live in different households. These are the *unmatched children*. Although it is assumed that the ages of mothers of *unmatched children* are the same as those of *matched children*, this is often not the case. It is also important to mention a problem of the particular procedure used here to match the children with their mothers: *matched children* may not be the children of the spouse of his or her father. The consequences of these problems are very difficult to evaluate because they depend at the same time on the age distribution of fertility, women, mothers and children. However, in general, in most cases this method results in an underestimation of fertility, especially for the years immediately before the census.

Table 6 and Figure 1 show the results of the application of this technique to the 1998 Census data. Except for the years 1987 and 1989, the trend is smooth and, what is more important, it shows a declining tendency of fertility. It is important to point out that, according to the arguments presented above, fertility rates are underestimated, especially for those years proximate to the census (for example 1995 to 1998) and the declining trend is not as rapid as the data reveal. However, it is unique that a declining trend did not take place in the second half of the 1990s, but it started before that. At the bottom of Table 6 the results are presented by quinquennium. The rates were grouped from single-year rates into rates corresponding to 5-years age group of women. This procedure can be considered as a form of adjustment of the data since it tends to neutralize

problems due to differential age misreporting. The results presented in this way are quite similar to those obtained in the CDHS.

To summarize, the own-children method provides additional evidence of a decline in fertility in Cambodia. The magnitude and speed of this decline may be overestimated but the direction of the trend is certainly reliable.

Figure 2 presents a graphic summary of all the estimates available from previous studies and calculated in the present paper. All the estimates consistently show a declining trend in fertility, which may be slow but it is sustained.

6. Conclusion

Recorded demographic history of Cambodia is rather short. The earliest demographic information about Cambodia goes back only to the late 1950s and early 1960s. From the review made above, fertility in Cambodia was high in the early 1960s with a crude birth rate over 40 per 1,000 and a total fertility rate of around 7. The Khmer Rouge period of 1975-1979 saw a drastic decline in fertility, with the crude birth rate dropping down to between 20 and 25 per 1,000 in 1976-1979. Return towards normalcy in life and in living conditions after the end of Khmer Rouge rule brought about a dramatic increase in fertility, with the estimated crude birth rate going up to as high as 44 per 1,000 in the mid-1980s, thereafter slowly declining to around 40 in 1988 and 38 in 1990. The estimated total fertility rate for 1990 was around 6. As mentioned earlier, fertility increased between the late 1950s and early 1970s, fell considerably between the mid to the end of 1970s, and recovered with a “baby boom” in the 1980s before starting to decline again.

For the more recent periods, available estimates of TFR shown in Table 1 indicate an overall decline in fertility from around mid 1993 to the end of 1997, with some fluctuation in between. The main cause of this discrepancy is the difference in the methods of estimation. While the estimates for June 1993, December 1996 and November 1997 are based on birth history (and hence akin to direct estimation), those of the other periods are derived by applying the P/F ratio method, which produces higher estimates of TFR when fertility is declining. Thus, if the estimates of TFR obtained from birth histories are compared, there is a clear declining trend in fertility, although the estimates from the 1995 KAP Survey are strictly not nationally representative.

Estimates of total fertility rate derived by applying the Rele method to several census and survey data in Cambodia also show a picture of an overall decline, but there are some fluctuations (Table 5). It cannot be ascertained whether the fluctuations are due to real increase in fertility because the surveys, which produced the data for these estimates, are made did not cover the entire country, and hence might not be representative. But if the survey and censuses which did

cover the entire country namely. the 1962 Census, the 1998 Census and the 2000 DHS are taken into account, the decline is seen to be real. The Rele estimates of TFR based on children aged 0-4 appear to produce underestimates of fertility, mainly because of the under enumeration of children in this age group. On the other hand TFR estimated from children aged 5-9 appear to be overestimates. An attempt has been made to overcome this problem by averaging the two types of TFR estimates, which also show a declining trend in fertility.

Table 6 and Figure 1 show the results of the application of the Own-Children technique to the 1998 Census data. This method provides estimates for 15 years before the census. The trend in TFRs obtained by this method is smooth fertility is smooth with the exception of the years 1987 and 1989. But more importantly, it shows a declining trend in fertility. It is noted that the TFRs are underestimated, particularly for the years closest to the census. Further, the declining trend is not as rapid as the data reveal. It is also noted that the decline started in the first half of the 1990s. The TFRs for 5-year periods before the census given in the bottom half of Table 6 show trends similar to those obtained in the DHS 2000 (NIS et al., 2001). The own-children method provides additional evidence of a decline in fertility in Cambodia. The magnitude and speed of this decline may be overestimated but the direction of the trend is certainly reliable.

To conclude, there is no doubt that fertility has been declining in Cambodia and the onset of decline can be located in the early 1990s (See Figure 1). At this point it may not be a priority to measure the speed or the magnitude of decline, but certainly attempts should be made to identify and analyse the determinants of this decline. A major issue would be to find out how this decline has been possible with such a limited use of contraception. Women's fertility preference may provide some clue to this problem. The mean ideal number of children of Cambodian women is 3.6 (NIS et al, 2001: 109). For women who are at the beginning of their childbearing period (i.e., those aged 15-19 years) the mean ideal number of children is 3.1. But how these women are endeavouring to realise their ideals is a matter for further research.

When vital registration data are not available, demographic parameters are estimated by using indirect methods of estimation. Further, a number of indirect methods are employed to validate the estimate. For example, in Indonesian population censuses or surveys, the main method for estimating fertility is the Own-children method, but alternative estimates are routinely provided by using the Rele method and the Last Live Birth method (Dasvarma and Hull, 1984). The last method is based on information about the most recent births to women being interviewed. In the Cambodian case, lack of information, and to some extent, poor quality of data have prevented us from using different methods. We therefore strongly recommend that in future demographic inquiries, of which the

next immediate one is the inter-censal survey of 2003, the following types of data be collected:

- (i) Data that would make it possible to directly link the children under 15 living in a household to their mothers, and
- (ii) Data that would provide information about the age distribution of women classified by the year of their last live birth (i.e., their most recent birth).

Efforts should also be made to improve the quality of age data, particularly of children and women.

Footnotes:

1. The Population and Development Strategies Sub-Program is funded by the United Nations Population Fund and executed by the Australian National University. Dr. Dasvarma and Dr. Neupert are employed by the Australian National University and seconded to the Ministry of Planning and the Royal University of Phnom Penh respectively.
2. There are 24 provinces as of the 1998 Census (NIS 1999b:xi, 3)

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Table 1. Estimates of total fertility rate (TFR) for Cambodia by total, urban and rural areas from the five most recent sources

Survey/ Census	TFR			Reference point
	Total	Urban	Rural	
1. KAP Survey 1995	4.9	4.1 ^a	5.1 ^a	30 Jun 1993
2. Demographic Survey 1996	5.2	4.2	5.3	20 Sep 1993
3. Population Census 1998	5.3	4.4	5.5	3 Sep 1995
4. National Health Survey 1998	4.1	3.3	4.2	31 Dec 1996
5. Demog. & Health Survey 2000	4.0	3.1	4.2	30 Nov 1997

a. These values are estimated from the Total Marital Fertility Rates by using the proportions married in the entire sample.

Sources: 1-Chhun Long et al (1995), 2-NIS (1996), 3- NIS (1999a), 4- MOH (1999), 5-NIS (2001).

Table 2. Trends in proximate determinants of fertility 1995-2000

I. Contraceptive prevalence among currently married women aged 15-49 years

Year/Survey	Any modern method (%)	Any method (%)
KAP1995 (women aged 15-44 years)	6.9	12.6
NHS 1998	16.1	21.8
DHS 2000	18.5	23.8

II. Percentage currently married among women of reproductive ages

Age group	KAP 1995	DSC 1996	NHS 1998	Census 1998	DHS 2000
15-19	6.6	7.8	13.7	11.7	12.1
20-24	56.8	55.6	58.4	56.7	50.9
25-29	75.0	74.2	77.5	77.0	76.1
30-34	81.2	78.8	80.9	81.2	81.9
35-39	85.2	79.2	81.0	81.5	81.4
40-44	77.6	74.9	78.9	78.4	77.3
45-49	-	71.9	72.5	73.2	71.8
Total	60.6	-	60.6	59.7	59.1

III. Percentage of women aged 15 - 49 years who breast-fed their children in the past 5 years

96.2	-	96.6	-	95.7
(age 15+)				

IV. Percentage of women who had ever had an induced abortion

15-19	0.3	-	-	-	0
20-24	1.7	-	-	-	1.6
25-29	4.6	-	-	-	4.2
30-34	4.4	-	-	-	7.2
35-39	7.1	-	-	-	9.1
40-44	8.5	-	-	-	9.0
45-49	-	-	-	-	8.7
Total	5.1	-	-	-	5.0

Sources: KAP 1995: Chhun Long et al (1995); DSC 1996: NIS (1996); NHS 1998: MOH (1999); Census 1998: NIS (1999a); DHS 2000: NIS et al. (2001).

Table 3. Modern method mix of current use of contraception 1995-2000

Current use of modern methods (%)			
Method	KAP 1995	NHS 1998	DHS 2000
Injection	2.3	7.0	7.4
Pill	1.1	4.0	4.5
Monthly pill	0.2	1.8	2.7
IUD	1.6	1.8	1.3
Female sterilisation	1.3	0.9	1.5
Condom	0.3	0.6	0.9
Other	0.1	-	0.2
Total	6.9	16.1	18.5

Source: As in Table 2

Table 4. Contraceptive use and fertility: current status worldwide

Region	Contraceptive Prevalence ^a	Total fertility rate
Sub-Saharan Africa	23	5.7
Middle East/ North Africa	54	3.7
South Asia	48	3.5
East Asia/ Pacific	84	2.0
Latin America/ Caribbean	72	2.6
CEE/ CIS and Baltic States	66	1.6
Developing countries	65	3.0
Least Developed countries	32	5.4
Industrialised countries	78	1.6
World	67	2.7

a. Per cent of women in union aged 15-49 who are using contraception

Source: UN Population Division Database 2001/ Population Estimates and Projections, 2000

Table 5. Estimates of total fertility rate by using the Rele method 1962-2000
(based on uncorrected age distributions)

Census/ Survey	TFR ^a CWR1	Ref period	TFR ^b CWR2	Ref period	Average TFR	Ref period
1962 Census	5.28	1958-62	6.53	1953-57	5.91	1953-62
1993-1994 SES	3.89	1990-94	5.76	1986-90	4.82	1986-94
1996 DSC	4.11	1992-96	5.65	1987-91	4.88	1987-96
1998 NHS	4.37	1994-98	6.25	1989-93	5.31	1989-98
1998 Census	3.89	1994-98	5.79	1989-93	4.84	1989-98
1999 SES	3.14	1995-99	5.20	1990-94	4.17	1990-99
2000 DHS	3.54	1996-00	5.93	1991-95	4.73	1991-00

a. CWR1 = Ratio of children aged 0-4 to women aged 15-49.

b. CWR2 = Ratio of children aged 5-9 to women aged 20-54.

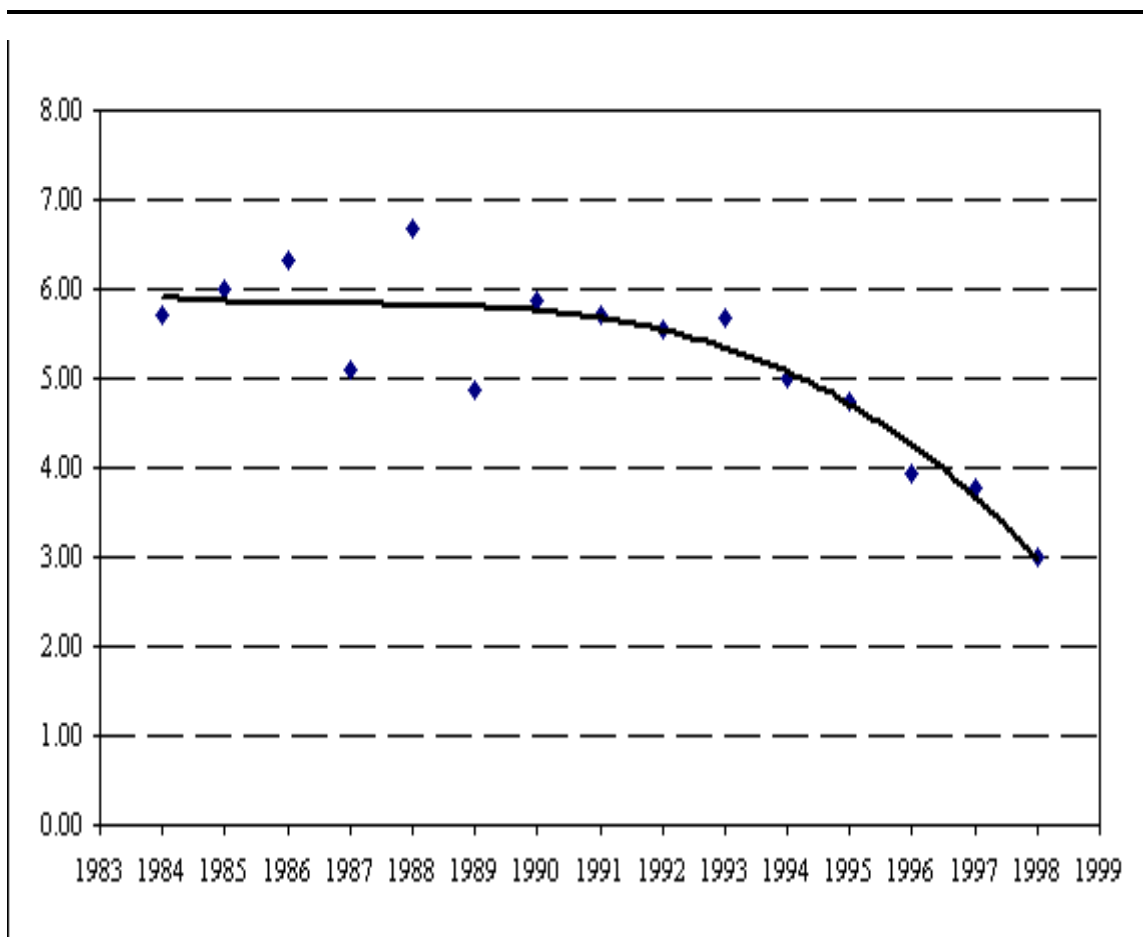
Source: Computed from data on age-sex distribution obtained at the respective surveys

Table 6. Estimates of total fertility rates from 1998 Census data by the Own Children method

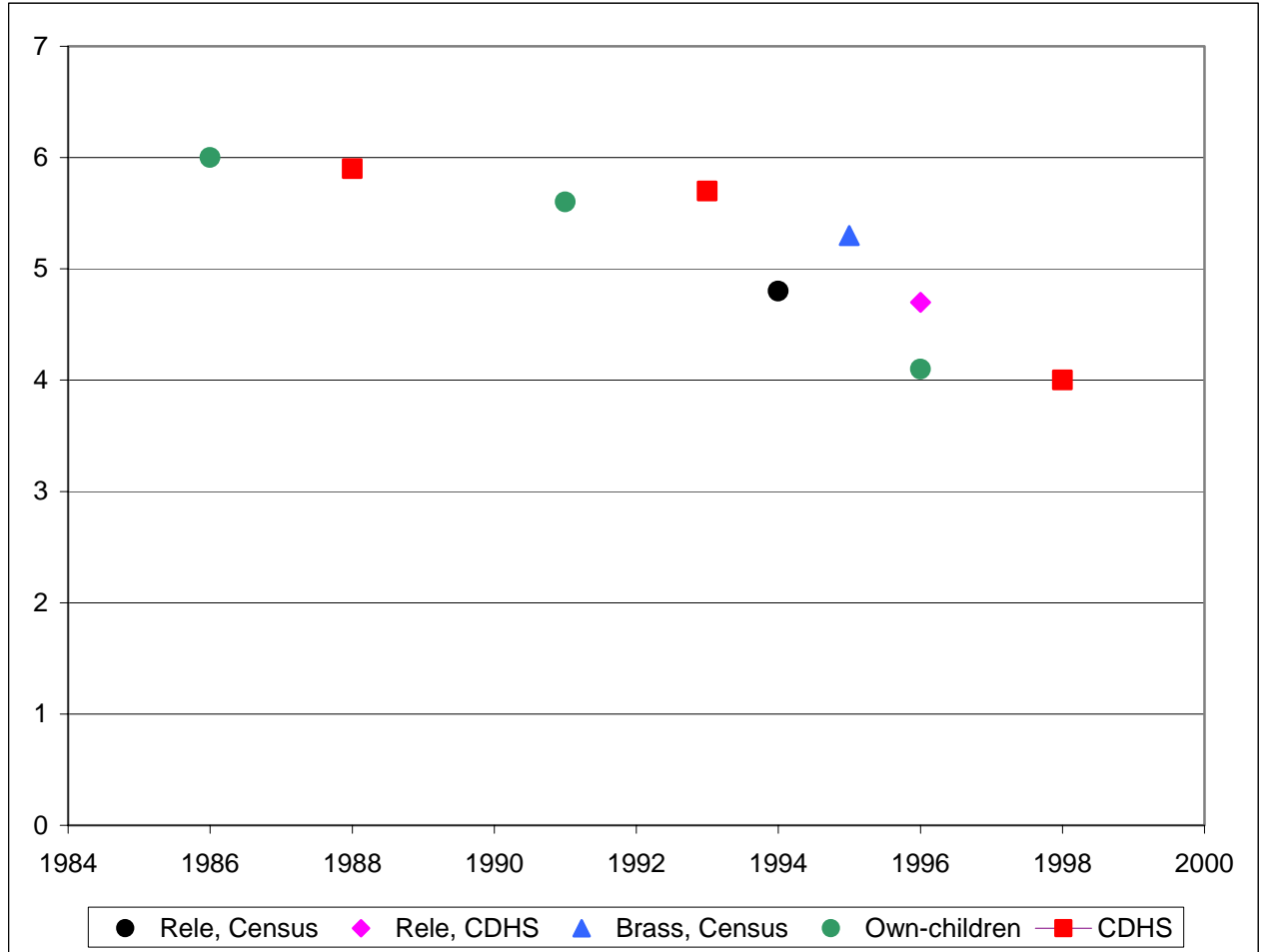
Year / Quinquennium	Total fertility rate
1984	5.72
1985	6.00
1986	6.33
1987	5.09
1988	6.69
1989	4.87
1990	5.88
1991	5.72
1992	5.56
1993	5.69
1994	5.01
1995	4.75
1996	3.94
1997	3.79
1998	3.01
1984-1988	5.97
1989-1993	5.55
1994-1998	4.08

Source: Computed from the 1998 Census data

Figure 1. Trend of fertility 1983-1999 implied by Own Children estimates of total fertility rate



Source: Table 6

Figure 2. Estimates of TFR by different methods

Source: Tables 1, 5 and 6