

Technical notes¹

Table 4 (**Selected derived measures of natality: 1948–1997**) presents selected derived measures of natality for as many years as possible between 1948 and 1996. These measures are the child–woman ratio, the total fertility rate and the gross and net reproduction rates.

Description of variables: *The child–woman ratio is the number of children under five–years of age per 1 000 women aged 15–49 at a given moment of time.* Because the calculation of this ratio only requires census–type data on the population by age and sex, it provides an index of fertility when reliable birth statistics are not available.

The child–woman ratio may be thought of as an indicator of recent fertility net of child mortality. The child–woman ratio is, in effect, the number of surviving births from the five years prior to the reference date, often the time of a population census, per 1 000 women of reproductive age, regardless of marital status, alive at the reference date. Because the denominator of this ratio is limited to females and, in particular, to females of reproductive age (that is, women aged 15–49), the child–women ratio is particularly standardized for variation in the age and sex composition of the population. In this respect it differs from the crude birth rate which is particularly sensitive to variations in distribution of the population by age and sex.

The total fertility rate is the average number of children that would be born alive to hypothetical cohort of women if, throughout their reproductive years, the age–specific fertility rates for the specified year remain unchanged. The total fertility rate is the sum of the age –specific fertility rates per woman. The structure of the population does not affect the total fertility rate because each age group is weighted equally.

The gross reproduction rate is the average number of daughters that would be born alive to a hypothetical cohort of women if they lived to the end of their reproductive years and if they experienced the some age –specific fertility throughout their lives that women in each age group experience in a given year or period of years. Although the gross reproduction rate purports to describe the fertility experience of a generation of women, the rates presented in this table are actually based on the fertility reported or estimated for a given reference period, usually a single year or a five–year period.

The gross reproduction rate is not affected by the age structure of the population because it is, in effect, an age–standardized fertility rate with each age given a weight of

¹ Demographic Yearbook Historical Supplement 1948–1997, United Nations DYB–CD, Sales No.: E/F.99.XIII.12, United Nations Publications New York, Geneva

one. In addition, it can also be thought of as the ratio between female births in two successive generations assuming that there are no deaths before the end of the reproductive period, or it may be considered as the ratio between the number of females in one generation at a given age and the number of their daughters at the same age, assuming that there is no mortality during the child-bearing years.

In a female population unaffected by mortality and migration, and assuming the age-specific fertility rates of the reference period do not change, a gross reproduction rate of one indicates exact replacement, a rate of less than one indicates that the population is not replacing itself while a rate of more than one means that the population is more than replacing itself. Because of the impact of mortality, gross reproduction rates somewhat in excess of one are needed to achieve replacement.

The net reproduction rate is the average number of daughters that would be born alive to a hypothetical cohort of women if they experienced the same age-specific fertility throughout their lives that women in each age group experienced in a given year, or period of years, and if they were also subjected to the mortality rates of the same year or period of years. Although the net reproduction rate purports to describe the fertility and mortality experience of a generation of women, the rates presented in this table are actually based on the fertility and mortality reported or estimated for a given reference period, usually a single year or a five-year period.

Like the gross reproduction rate, the net reproduction rate is not affected by the age structure of the population. However, it differs from the gross reproduction rate because it takes mortality into account.

The net reproduction rate can also be thought of as the ratio between female births in two successive generations taking mortality into account, or it may be considered as the ratio between the number of females in one generation at a given age and the number of their daughters of at the same age, again taking mortality into account.

In a female population unaffected by migration and assuming the age-specific fertility and mortality rates of the reference period do not change, a net reproduction rate of one indicates exact replacement, a rate of less than one indicates that the population is not replacing itself while a rate of more than one means that the population is more than replacing itself. A net reproduction rate of one is roughly equivalent to a two-child family.

Ratio and rate computation: Child-woman ratios are the number of children of both sexes 0-4 years of age per 1 000 female population aged 15-49 years. These ratios were calculated using data from population censuses or sample survey or using estimates of population by age and sex.

The child–woman ratios have been calculated by the Statistics Division of the United Nations unless otherwise noted. When the basic official data with which to calculate these ratios have not been available, estimates prepared by the Population Division of the United Nations Secretariat^[21] have been included; these are indicated by footnotes.

Child–woman ratios presented in this table have not been limited to those countries or areas having a minimum number of children under 5 years of age. However, ratios shown in this table based on 30 or fewer children under 5 years of age are identified by the symbol (●).

Total fertility rates are the sum of age–specific fertility rates. The standard method of calculating the total fertility rate is to sum the age–specific fertility rates. However, if the rates used are fertility rates for 5–year age groups, they must be multiplied by 5. The total fertility rates have been calculated by the Statistics Division of the United Nations unless otherwise noted. When the basic official data with which to calculate these rates have not been available, estimates prepared by the Population Division of the United Nations Secretariat^[22] have been included; these are indicated by footnotes.

Total fertility rates presented in this table have not been limited to those countries or areas having a minimum number of live births in a given year. However, rates based on 30 or fewer live births shown in this table are identified by the symbol (●).

The gross and net reproduction rates were calculated by the various national statistical offices.

The standard method of calculating the gross reproduction rate is to sum the age–specific fertility rates for female live births. If the rates used are for other than single years of age, for example, if they are for 5–year age groups, they must be multiplied by 5. The sum of these rates is the gross reproduction rate.

An alternative method of calculating the gross reproduction rate is to multiply the total fertility rate by a factor (0.484 or 0.488 are commonly used), which approximates the proportion of female to total births.

The net reproduction rate is calculated the same way as the gross reproduction rate, but with additional steps to take mortality into account. Before summing, the individual age–specific fertility rates are multiplied by the proportion of females surviving from birth to the midpoint of the corresponding age interval. These proportions can be calculated using the following functions from a life table for females: (L_x/l_0) , l_0 being the radix of the table. The life table should be for the same year or period of years to which the age–specific fertility rates pertain.

An alternative method of calculating the net reproduction rate is to take the gross reproduction rate and then simply multiply it by the probability of female surviving from birth to the mean age of maternity, calculated in the absence of mortality.

The gross and net reproduction rates shown in this table are based on female fertility and female fertility and mortality, respectively. It is also possible, but by no means the standard practice, to calculate analogous rates for the male population. In addition, as presented here, these rates refer to a hypothetical cohort based on fertility schedules for a given year or period of years. These rates can also be calculated for a real cohort, representing their fertility (and mortality).

Gross and net reproduction rate presented in this table have not been limited to those countries or areas having a minimum number of live births in a given year.

Reliability of data: Child–woman ratios calculated using estimates which are believed to be less reliable are set in italics rather than in roman type. Classification in terms of reliability is based on the method of construction of the total population estimate as shown in table 3 in the volume containing the general tables and discussed in the Technical Notes for the table. No attempt has been made to take account of age–reporting accuracy, the evaluation of which has been described in section 3.1.3 of the Technical notes.

Total fertility rates calculates using data from civil registers of live births which are reported as incomplete (less than 90 per cent completeness) or of unknown completeness are considered unreliable and are replaced by estimates prepared by the Population Division of the United Nations Secretariat.[23] Table 9 in the volumes containing the general tables and the Technical Notes for that table provide more detailed information on the completeness of live–birth registration. For more information about the quality of vital statistics data in general, and the information available on the basis of the completeness estimates in particular, see section 4.2 of the Technical Notes.

Limitations: Child–woman ratios shown in this table are subject to all of the same limitations which affect the data on population by age and sex from which they have been calculated. These limitations have been set forth in the Technical Notes for table 3. Although the interpretation of child–woman ratios is usually based on the presumption that differences between countries or areas reflect differences in the rates of which births occurred to women of child–bearing age in the five years preceding the census, these ratios are strongly influenced by other factors, the most important of which are deficiencies and irregularities in the census results.

Although under enumeration at the census may occur in any age group and hence may affect both the numerator and the denominator of the ratio, it appears that in most censuses, a greater proportion of young children is omitted from the count than of older persons. The number of young children recorded in the census is also affected by the tendency to give rounded statements of age, with the result that some children under 5 may be mistakenly included among those who are 5 or over. Moreover, in countries or areas where the Chinese method of counting age is traditional, census returns will reflect the fact that infants are considered to be one year of age at birth and gain one additional year at the Chinese New Year. Adjustments can be made in these data to bring them approximately into accord with results of the Western-type question, but failing this, the child-woman ratios will tend to be understated.

The ratios shown in the table are, therefore, without doubt somewhat lower than they would be if census data on age were fully accurate. On the other hand, in countries or areas where people generally do not know their ages, it is possible that the ratios may be too high. On the whole, they are probably less deficient in the countries or areas where they are low, since many of these have good statistics. In any case, regarding countries or areas with poor census data on age (and many of the countries or areas with high ratios fall into this category), even fairly large differences in the ratios may be due mainly or entirely to deficiencies in the data.

Unlike other derived measures of fertility shown in this table, it should be remembered that the child-woman ratio is an indicator of recent fertility net of child mortality. Therefore, another factor affecting the utility of the ratios as fertility measures, is mortality. Even if the data were completely accurate, the ratios would not necessarily correspond closely to the rate at which births have occurred to women of child-bearing age in the years just before the census. The number of children under five living at a given time is the number who have survived among children born during the preceding five years. The ratios, therefore, invariably understate actual fertility levels. Furthermore, death rates at these ages vary widely from one part of the world to another. Countries or areas with high fertility tend also to be those with high child mortality.

Consequently, the ratios for such places are more affected than those places with low fertility and mortality, and the gap between those with high and those with low ratios is narrower than the gap between them in the frequency of births. However, ratios of children to women of child-bearing age are more useful for some types of analysis than rates based on births and population. If one wishes to study the rate at which the older generation is likely to be replaced by its offspring, children who die in infancy are irrelevant. From this point of view, differences in infant mortality do not affect the comparability of the ratios shown.

Although the child–woman ratio is much less affected than the crude birth rate by the age and sex structure of the population, variations in the age structure of the female population in the reproductive years can affect the international comparability of these ratios.

Total fertility rates shown in this table are subject to all the same limitations which affect the data on live births by age of mother and the data on population by age and sex from which they have been calculated.

Gross and net reproduction rates shown in this table are subject to all the same limitations which affect data on live birth rates specific for age of mother and, in addition, for the net reproduction rates, those which affect life table values. These limitations have been set forth in the Technical Notes for tables 6 and 9 respectively.

In this connection, it should be borne in mind that the female age–specific fertility and mortality rates recorded in a given country or area at a given time do not actually represent the experience of any real generation of women, and that they may be influenced by factors which are by their nature, necessarily temporary. They are useful as a means of demonstrating the implications of fertility (and mortality) schedules pertaining to a given year or period of years assuming they were to continue unchanged.

Moreover, these rates do not take account of the fertility and mortality of the male population. There are important considerations in using gross and net reproduction rates as means of analysing the implications of observed fertility and mortality rates for future population development.

In the absence of information to the contrary, it is assumed that rates in this table were computed by the methods described above under "Ratio and rate computation". However, gross reproduction rates for the some countries or areas derived from the age–specific fertility rates given in table 6 may not be exactly the same as those found in this table. This is because the latter may have been computed on different estimates of the female population or they may have involved special adjustments for under–registration of birth or for treatment o births for which the age of mother was unknown.

The accuracy of net reproduction rates is affected also by the accuracy of the life tables used. Some special questions arise in net reproduction rate computation in regard to the period of time to which the life tables relate. The life table used is frequently that computed from the death rates of women in the year to which the fertility rates relate, but often life tables for other years are used. Since the value of a net reproduction rate is likely to fluctuate for more as a result of changes in fertility rates relate. This procedure has been followed in this table. Wherever the life tables are known to relate to

a different period from that of the fertility rates, the difference is indicated in the footnotes.

Coverage: Selected derived measures of natality are shown for 229 countries or areas.

Earlier data: Selected derived measures of natality have been shown in the *Demographic Yearbook: Historical Supplement* and 1975, 1981 and 1986 issues. Each of the measures included in this table may also be found in earlier issues of the *Demographic Yearbook* as indicated in the Index.

21. Source: *World Population Prospects: Estimates and Projections as Assessed in 1996*.

22. Ibid

23. Ibid