Birth: It is process of bringing forth a child from the uterus, or womb.

Live Birth: According to World Health Organization, a live birth occurs when a fetus, whatever its gestational age, exits the maternal body and subsequently shows any sign of life, such as voluntary movement, heartbeat, or pulsation of the umbilical cord, for however brief a time and regardless of whether the umbilical cord or placenta are intact.

Still Birth: Stillbirth is typically defined as fetal death at or after 20 or 28 weeks of pregnancy, depending on the source. It results in a baby born without signs of life.

Crude Birth Rate: The number of births per thousand in a given year is called crude birth rate, which is related to the total population. In the words of Thomson and Lewis, "The crude birth rate for any specified population is obtained by dividing the number of births recorded in that population during a specified year by its total numbers, which gives a fraction of birth per person."

Thus, Crude Birth Rate or CBR = $\frac{B}{P} \times 1000$

B -Total live births during a given year, P - Total population at the middle of the same year

Mortality or Death Rate: A mortality rate is a measure of the frequency of occurrence of death in a defined population during a specified interval. The formula for the mortality of a defined population, over a specified period of time, is:

$$\frac{D}{P} \times 1000$$

D -Total death during a given year, P - Size of the population among which the deaths occurred

Types of mortality rates

There are several different mortality rates used to monitor the level of mortality in populations. In humanitarian emergencies, the following are most commonly used:

Crude mortality rate

- Counts all deaths
    - All causes
    - All ages and both sexes
- Denominator includes entire population
    - All ages and both sexes

Age-specific mortality rate

- Counts only deaths in specific age group
    - Usually calculated for children less than 5 years of age
- Denominator includes only persons in that age group

There are also mortality rates which are not really rates. They use live births as the denominator instead of the actual group in which deaths are counted:

Infant mortality rate

Counts deaths in children less than 12 months of age, divides by number of live births in same time period

Maternal mortality rate

Counts deaths in women due to pregnancy or child birth, divides by number of live births in same time period

Under-5 mortality rate

Counts deaths in the first 5 years of life, divides by number of live births in the hypothetical cohort of newborns.

Method # 3. General Fertility Rate:

The number of children born per year per thousand females in the age group of 15-49 years, is called the General Fertility Rate. In the words of Thomson and Lewis, "General Fertility Rate denotes the number of births per thousand women of child bearing age."

It is calculated as follows:

General Fertility Rate or GFR= $\frac{B}{Pf} \times 1000$

where,

B = Total live births during a given year.

P_f= Number of females of age group 15-49 years.

In other words,

General Fertility Rate = $\frac{Number\ of\ children\ born\ during\ a\ year}{Number\ of\ females\ of\ age\ group\ 15-49}$ x 1000

If the number of females of age group 15-49 years in an area is 5000 and the total of live births is 200 in a year, then

GFR = $\frac{200}{5000}$x 1000 = 40

It indicates that there are 40 births per 1000 women in the child bearing age group.

Thomson and Lewis regard this measure better than the crude birth rate on two counts:

i) it eliminates the influence of differences between males and females in the total population;

ii) eliminates differences in the proportion of women in 15-49 age group.

But this measure of birth rate has also certain weaknesses. The general fertility rate ignores the different child-bearing ages of women. In fact, the fecundity of women is low in the age group 15-19 years, high in the age group 20-29 when they are married and then starts declining till they reach 45 or 49.

Moreover, all women do not give birth to a child. In a country like India, some are widows and a few barren. Many prefer to remain unmarried or do not want to have a child in developed countries. According to Thomson and Lewis, the general fertility rate is usually four to five times high where the number of women in the child-bearing age is more. For the above reasons, this is not a true measure of birth rate.

Age Specific Fertility:

Age specific fertility rate is another refinement of birth rate. When the number of live births to women of definite age group per year is divided by the total number of females of that age group only and multiplied by 1000, we get the age specific fertility rate. It can be shown in formula as

Age Specific Fertility Rate (ASFR) = $\frac{Bf}{Pf} \times 1000$

where

B_f = Number of live births to women of a specific age group

P_F = Mid-year women population in the same age group

K = 1000

In other words,

ASFR = $\frac{No.of\ live\ births\ to\ women\ of\ specific\ age\ group}{Mid-year\ women\ population\ of\ that\ age\ group}$ X 1000

If the number of live births to women in the age group 25-29 is = 200 and the number of women in this age group is — 1200

Then the Age Specific Fertility Rate = $\frac{200}{1200}$ x 1000 = 166.7

In computing the age specific fertility rate, the age group of 5 years interval is taken.

This measure of fertility rate is considered better than other measures because

(i) it provides age specific fertility rates for different age groups;

(ii) it shows changes in the reproductive capacity of women in different age groups;

(iii) it helps in analysing the frequency distribution of births among women in age specific groups;

(iv) a few stages can be outlined in the reproductive capacity of different age groups of women;

(v) we can also calculate age specific fertility rate in relation to only married women which is called age specific marital fertility rate;

(vi) it is the basis of calculating the total fertility rate; and

(vii) it helps the state in formulating policy with regard to the female marriage age.

Total Fertility Rate:

The total fertility rate is the sum of age specific fertility rates of women in all age specific groups. The formula is

Sum of age specific fertility rate x Magnitude of the age group

$$\text{Total Fertility Rate} = \frac{\textit{Sum of age specific fertility rate x Magnitude of the age group}}{1000}$$

It can be understood with the help of the following hypothetical table.

TABLE 1
Age Specific Fertility Rates and Total Fertility Rate

Age group	*No. of Births*	*No. of Women*	*Age Specific Fertility Rate*
(1)	*(2)*	*(3)*	*(4)* $[(2) \div (3)] \times 1000$
15-19	20	100	20.0
20-24	80	200	400.0
25-29	90	220	409.1
30-34	85	210	404.8
35-39	75	190	394.7
40-44	50	170	294.1
45-49	5	150	33.3
Total of Column (4)			1956.0

Total fertility Rate = 1956x 5 $\div$1000= 9.78

The total fertility rate is a hypothetical rate that indicates "the total number of children that would ever be born to a group of women, if the group passed through its reproductive span of life with these birth rates in each year of age."

This rate is based on the assumption that women in the hypothetical age group would live till they reach the end of the reproductive period. It is a useful device for comparing the reproductive capacity of women in different age groups.

Gross Reproduction Rate:

The gross reproduction rate relates the fertility rate to female births only. It is defined as the number of girls which are expected to be born to 1000 females passing through their child bearing years.

The gross reproduction rate is calculated from the total fertility rate in the following manner:

Gross Reproduction Rate (GPR) = $\frac{No.of\ females\ brith}{Total\ number\ of\ births}$ x Total fertility rate.

If the number of live births in a year is 25 crore, out of this 12 crore are female births and the total fertility rate is 9.78, then

Gross Reproduction Rate = $\frac{12}{25}$x9.78= 4.69

This measure of fertility is based on the following assumptions:

(a) the age specific birth rates are constant for a given year;

(b) no woman dies during the child bearing age; and

(c) all girls survive.

These are unrealistic assumptions which ignore the current mortality rates of both present mothers and potential mothers. The net reproduction rate tries to remove these defects.

Net Reproduction Rate:

The net reproduction rate takes into account the complete reproduction period. The net reproduction rate is a good method of measuring birth rate which is based on reality. For the net increase in population growth, generally we consider factors responsible for increase in birth rate and decrease in death rate, but many a time, it also happens that if the girl dies before attaining maternity, the population will not increase.

Similarly, if the death rate is higher than the birth rate, even then there will be no increase in population. To understand this, it is necessary to know the net reproduction rate.

The net reproduction rate is the rate at which the newly born girls replace their mothers. It can be expressed as

No. of females expected to be born to 1000 newly born girls

Net Reproduction Rate = $\frac{No.of\ females\ expected\ to\ be\ born\ to\ 1000\ newly\ born\ girls}{1000}$

For example, if 1000 females give birth to 1 girl each and 1000 girls are born and if these girls live till fertility, the net reproduction rate becomes 1000/1000 = 1.

Now, if the number of girls comes to 1200, this rate will be 1200/1000 = 12.

Against this, if this number becomes 800, then the net reproduction rate will become 800/1000 = 0.8 which means that the fertility rate is decreasing in the country.

This measure of fertility is also defective because it assumes that both birth and death rates remain constant during a generation. This is unrealistic. In fact, both birth and death rates are liable to change. Therefore, Thomson and Lewis opine that "these rates should not be used in making a prognosis of probable future growth of population."

Completed Fertility Rate:

Generally, 15-49 years are considered to be the age of female fertility. But many a time a girl below 15 years of age and a women of more than 49 years may give birth to a child. Thus completed fertility rate measures the total number of live births per 1000 women of child bearing age, including widows and unmarried women. Thus

$$\text{Completed Fertility Rate (CFR)} = \frac{\text{Number of live births}}{\text{Females of child bearing age}} \times 1000$$

Standardized Fertility Rate (SFR):

The standardised fertility rate measures the age specific birth rates of two populations of different areas in order to convert them into a common standard. To calculate SFR, the number of females in one million population in a specific year is multiplied by their age specific birth rates which are then added to calculate the total number of births in all age groups 15-49 years.

This number is then multiplied by 1000 and divided by 10, 00,000 (1 million) which gives the standard fertility rate.

Suppose we want to find out SFRs of two towns A and B. The total calculated number of births of A town are 26,500 and of town B are 24,100, their standard fertility rates as per the following formula are

$$\text{SFR} = \frac{\textit{Total calculated number of births } x\ 1000}{10,00,000}$$

$$\text{SFR of Town A} = \frac{26,500x\ 1000}{10,00,000} = 26.5$$

$$\text{SFR of Town B} = \frac{24,100\ x\ 1000}{10,00,000} = 24.1$$

SFR reveals that the fertility in town A is 9.96% higher than in town B.

Cohort Fertility Rate (CFR):

The cohort fertility rate measures the average number of children who would be born to a cohort of women during their child bearing years 15-49 in a given year. To find CFR, the number of births occurring to women in each age group in the cohort are required.

This is calculated in the same manner as the age specific birth rate. If/f(n) is the ability of a woman of a given cohort to give birth at age n, then the average number of births for that cohort is

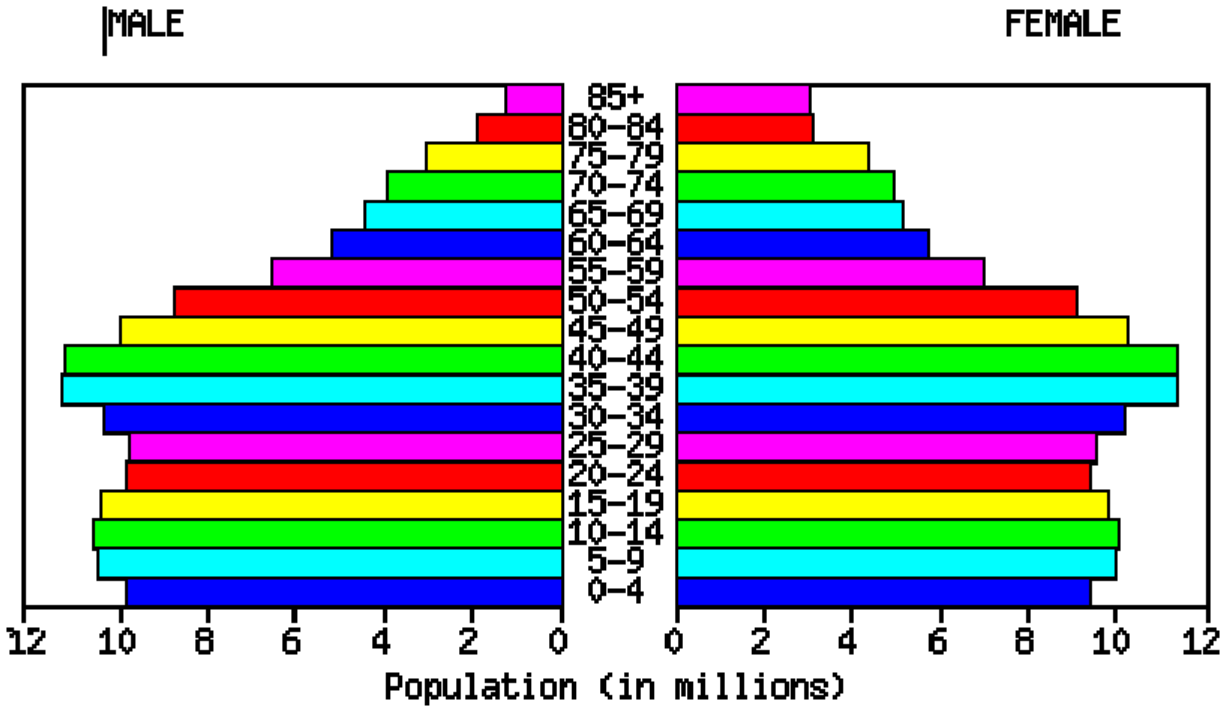
$$\text{CFR} = \sum_{n-15}^{49} f(n)$$

where Σ (sigma) denotes the summing of age specific birth rates for ages 15 through 49. If CFR = 4.5, it means that women of that cohort would have an average of 4.5 births, had they lived through the age of 49 years.

As in the case of age specific fertility rate, this measure also assumes that the cohort of women does not experience any mortality and females of ages below 15 years and above 49 years do not give births.

Population: Age Structure

One of the tools that demographers use to understand population is the age structure diagram (it is sometimes called a population pyramid, but it is not always pyramidal in shape). This diagram shows the distribution by ages of females and males within a certain population in graphic form. Figure below shows a diagram in which the ages and sexes for the United States population are arranged so that ages are grouped together such as 0 – 4 years, 5 – 9 years, and so on. The population of each is group is represented as a bar extending from a central vertical line, with the length of each bar dependent upon the population total for that particular group. The centerline separates the females from the males. The female and male populations for each group are represented by the distance from the centerline, with females on the right and males on the left.



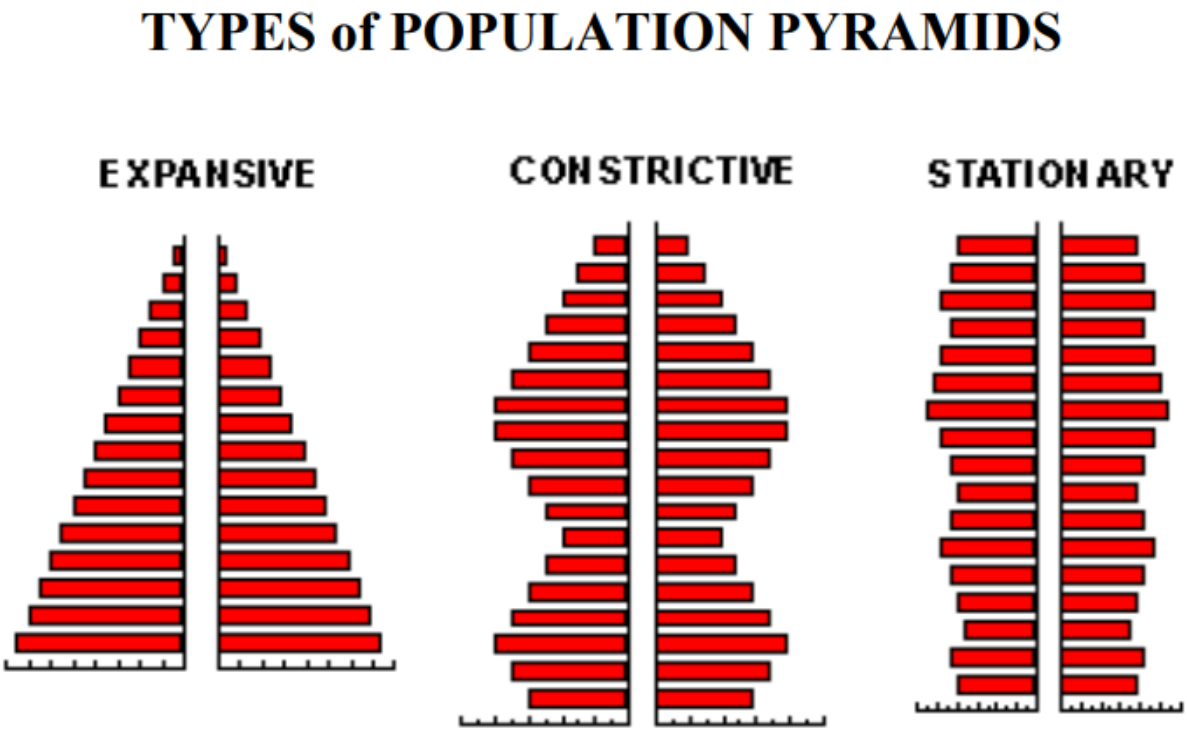
Types of Population Pyramid

There are generally three types of population pyramids created from age-sex distributions--expansive, constrictive and stationary.

EXPANSIVE population pyramids show larger numbers or percentages of the population in the younger age groups, usually with each age group smaller in size or proportion than the one born before it. These types of pyramids are usually found in populations with very large fertility rates and lower than average life expectancies. The age-sex distributions of Latin American and many Third World countries would probably display expansive population pyramids.

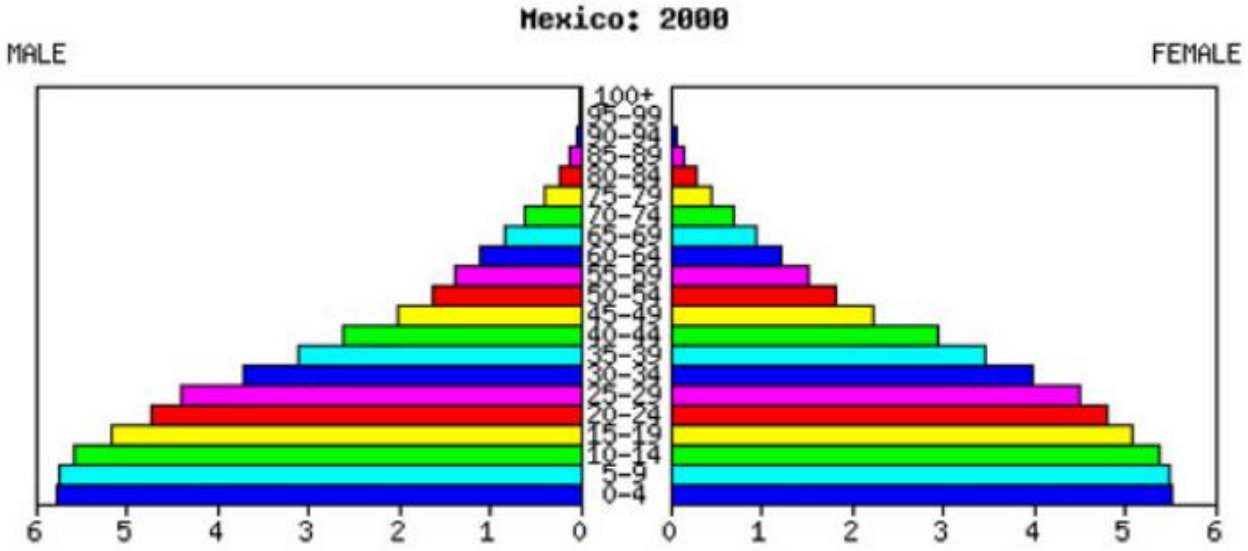
CONSTRICTIVE population pyramids display lower numbers or percentages of younger people. The age-sex distributions of the United States and Pennsylvania fall into this type of pyramid.

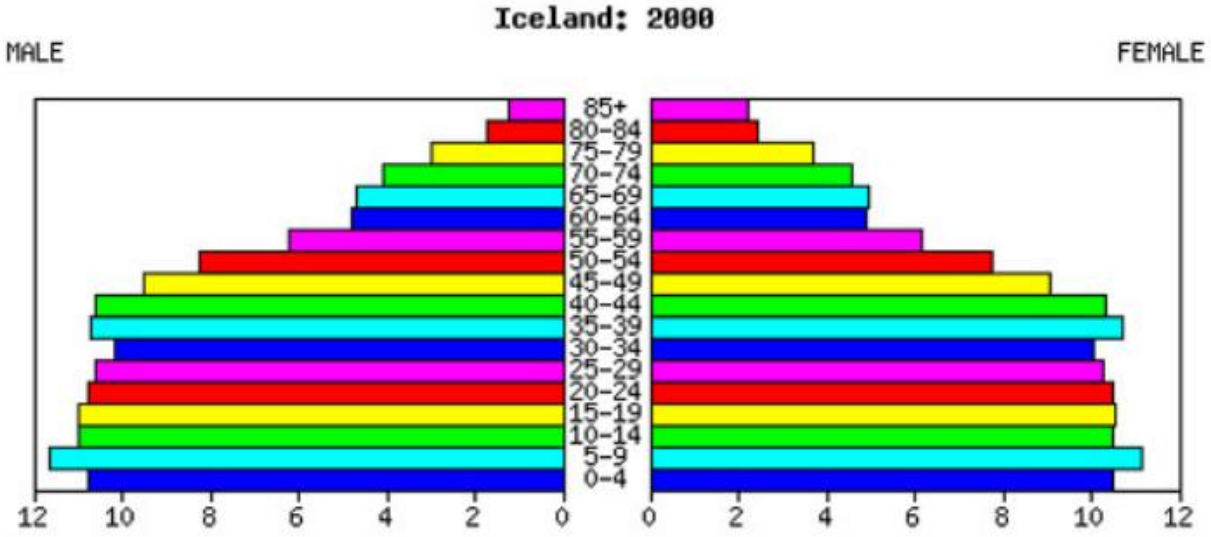
STATIONARY or near-stationary population pyramids display somewhat equal numbers or percentages for almost all age groups. Of course, smaller figures are still to be expected at the oldest age groups. The age-sex distributions of some European countries, especially Scandinavian ones, will tend to fall into this category.

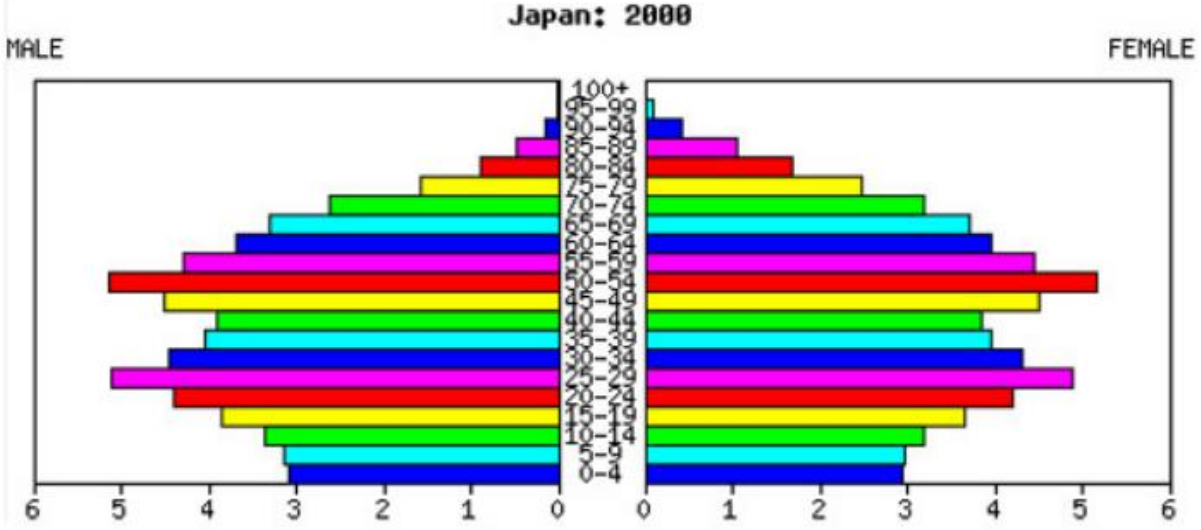


Constructing and Interpreting an Age Structure Diagram

With age and sex distribution data from a certain population, it is easy to construct an age structure diagram. Once the diagram is constructed, one can clearly see if the population will grow, decline, or experience no noticeable change in its population numbers; for example, if the diagram shows a pyramidal shape, then one can expect a rapid rise in population. If the diagram shows a generally straight up and down shape except for the older age groups, a stable population is thus revealed. If the diagram shows a top-heavy shape, then a decline is forecast for that population. Figures in the below show the age structure diagrams for Mexico, Iceland, and Japan. The different shapes seen in the diagrams reflect different population characteristics. The diagram for Mexico shows the unmistakable pyramidal shape caused by ever-increasing number of births. Japan's diagram has the classic shape of a shrinking population. In it, you should note how prereproductive age groups (0 – 14 years) have smaller populations than the reproductive age groups (15 - 44 years). Iceland shows a more stable population. Except for the post-reproductive groups (45+ years), the populations for the age groups extend generally the same lengths.


Mexico: 2000
MALE
FEMALE
100+
95-99
90-94
85-89
80-84
75-79
70-74
65-69
60-64
55-59
50-54
45-49
40-44
35-39
30-34
25-29
20-24
15-19
10-14
5-9
0-4
6 5 4 3 2 1 0
0 1 2 3 4 5 6


Iceland: 2000
Iceland: 2000
MALE
FEMALE
85+
80-84
75-79
70-74
65-69
60-64
55-59
50-54
45-49
40-44
35-39
30-34
25-29
20-24
15-19
10-14
5-9
0-4
12 10 8 6 4 2 0
0 2 4 6 8 10 12


Japan: 2000
MALE
FEMALE
100+
95-99
90-94
85-89
80-84
75-79
70-74
65-69
60-64
55-59
50-54
45-49
40-44
35-39
30-34
25-29
20-24
15-19
10-14
5-9
0-4
6 5 4 3 2 1 0
0 1 2 3 4 5 6