DEMOGRAPHY: DEMOGRAPHIC TRANSITION

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LECTURE OBJECTIVES:

By the end of the lecture the student should be able to:

- **Calculate rates measuring population growth**
- **Determine population doubling time.**
- **Understand stages of demographic transition**
- **List factors affecting Population Dynamics**
- **Calculate fertility rates.**

RATES MEASURING POPULATION GROWTH:

1. **Rate Of Natural Increase (RNI)**
2. **Annual Growth Rate**
3. **Population Doubling Time**

1. Rate Of Natural Increase(RNI)

Rate Of Natural Increase is the natural increase in the size of any population. It is the product of subtraction of deaths from births.

- It is the increase in % in a specific year or amount of time.
- It is simply calculated by dividing the **net change** in population by the **mid-population** and to make it a percentage we multiply by **100**.
- To calculate the **net change** we take all the number of births and the number of deaths. (The number of births adds to the population while the number of deaths decreases the population.) If the net change is positive the population is growing, if negative the population is shrinking. (Rate of natural increase generally means growth).

Rate of natural increase (RNI) % =

$$RNI = \frac{No.\ of\ births - No.\ of\ deaths\ in\ a\ locality\ and\ year}{Estimated\ mid-year\ population\ of\ same\ locality\ and\ year} \times 100$$

Another way of calculating it is by subtracting the **crude death rate** from the **crude birth rate** then dividing that by **10**. (Extra explanation about the **denominator 10** will be after explaining the crude birth and death rates.)

$$RNI = \frac{Crude\ birth\ rate - Crude\ death\ rate}{10}$$

*crude means: unrefined or natural (خام)

- **<u>Crude Birth Rate (CBR)</u>** (معدل المولید في الألف)

  It is defined as the number of live births per 1000 mid-year population in a given year and locality.

  How many births are there in every 1000 persons of a population

$$CBR = \frac{Total\ number\ of\ live\ births\ in\ a\ certain\ year\ and\ locality}{Estimated\ midyear\ population\ (same\ year\ and\ locality)} \times 1000$$

=... Live Births/ 1000 population in a year.

- **<u>Crude Death Rate (CDR)</u>** (معدل الوفیات في الألف)

  The crude mortality rate is the mortality rate from all causes of death for an entire population.

  We usually multiply by 1000.

$$Crude\ Death\ Rate = \frac{Total\ number\ of\ deaths\ in\ a\ certain\ year\ and\ locality}{Estimated\ mid-year\ population\ (Same\ year\ and\ locality)} \times 1000$$

= ... Deaths/1000 individual in the specified year and locality.

Example: In Saudi Arabia (2006 est.)

Crude Birth rate: 29.34 births/1,000 population

Crude Death rate: 2.58 deaths/1,000 population

<u>Calculate RNI?</u>

- RNI: CBR-CDR/10= (29.34 - 2.58) /10= 2.676%
- or RNI: (lives-deaths)/populationx100= (29.34-2.58)/1000 x 100= 2.676%

2. Annual Growth Rate

- The growth rate takes into consideration not only births and deaths but also migration.
- Growth rate (GR) = RNI + Net migration rate
- In Saudi Arabia (2006): Population annual growth rate (%) 2.4

The net migration = immigration (coming) –emigration(leaving)

If the net migration is negative it means higher emigration.

If the net migration is positive it means there is higher immigration.

In the example above: KSA in 2006, the RNI: 2.676 %

To calculate the GR: 2.676 + net migration

The GR is 2.4 which means that the net migration was negation (more people leave the country.

POPULATION DOUBLING TIME: LAW OF 70

- If a population is growing at a constant rate of **1%** per year it would be expected to double in 69.3 years (approximately every 70 years). A Law of 70 is much simpler to remember than a Law of 69.3
- If the rate of growth is 2% then the expected doubling time is 70/2 or 35 years.
- The higher the growth rate (the faster the growth) the less time it takes to double the population.

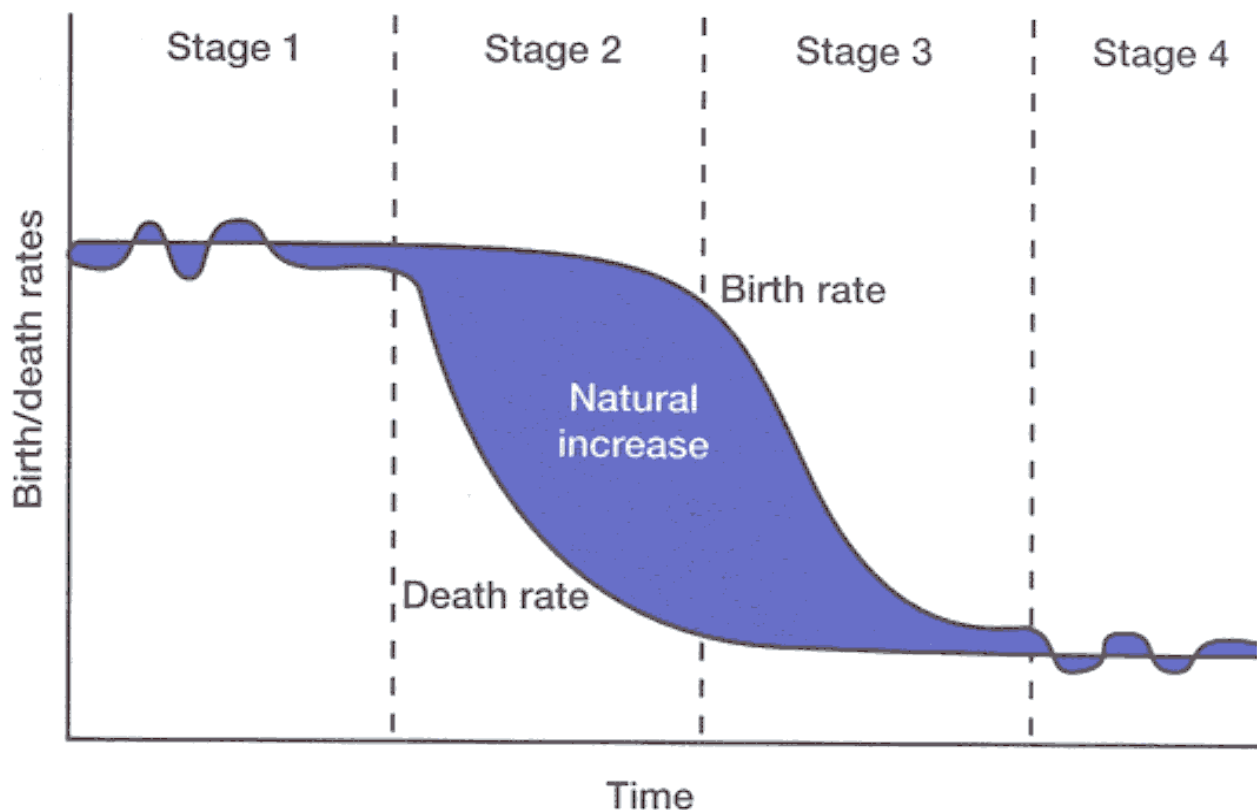REMEMBER: 7O IS A CONSTANT REGARDLESS OF THE RATE GROWTH.

To calculate the population **doubling time: 70/GR**

Doubling time is measured by years.

3. **The Demographic Transition**

- The demographic transition is the description of secular trends (long-time trend over many) in population growth in relation to **changes over time** in **death** or **mortality rates and birth** or **fertility rates.**

- Demographic transition describes the major demographic trends that happened to Western countries in the past two centuries.

- There are 5 stages, the below chart shows only 4, but the 5 will be explained in detail further down.

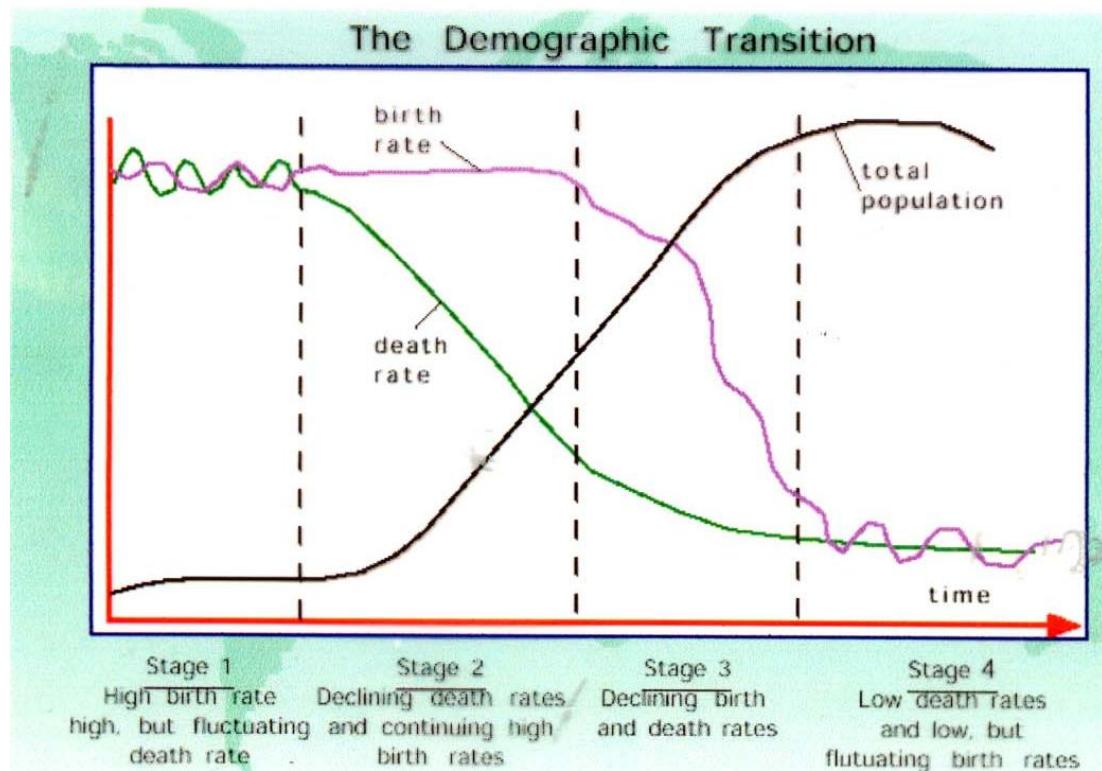## The Classic Stages of Demographic Transition

Note: Natural increase is produced from the excess of births over deaths.

Source: Joseph A. McFalls, Jr. Population: A Lively Introduction. Third edition. Population Bulletin 53(3); 1998: 39.

- X-axis is the time, Y-axis shows both the birth and death rates
- This shows the 4 stages that a population can go through:
- In the first stage the birth and death rates are nearly equal keeping the population almost stable in number this is called **stationary population**. Both are high therefore it is called a **high stationary population**.
- In stage 2 the birth rate stays almost the same while death rate drops causing a rise in the population number (the rate of natural increase increases).
- Stage 3: the death rate doesn't change but the birth rate drops severely reaching close to the death rate.
- Stage 4 stationary populations. Both the death and birth rates are low therefore it is called **low stationary.**

The Demographic Transition

birth rate

total population

death rate

time

| Stage 1 | Stage 2 | Stage 3 | Stage 4 |
| High birth rate high, but fluctuating death rate | Declining death rates and continuing high birth rates | Declining birth and death rates | Low death rates and low, but flutuating birth rates |

THE STAGES OF THE DEMOGRAPHIC TRANSITION

STAGE 1 (HIGH STATIONARY)

- **STATIONARY POPULATION** A stable population that has a zero growth rate with constant numbers of births and deaths each year.

- During stage 1, both the death rate and the birth rate are high. The birth rate is constant, while the death rate fluctuates in the face of natural disasters as famines, floods, epidemics, and wars.
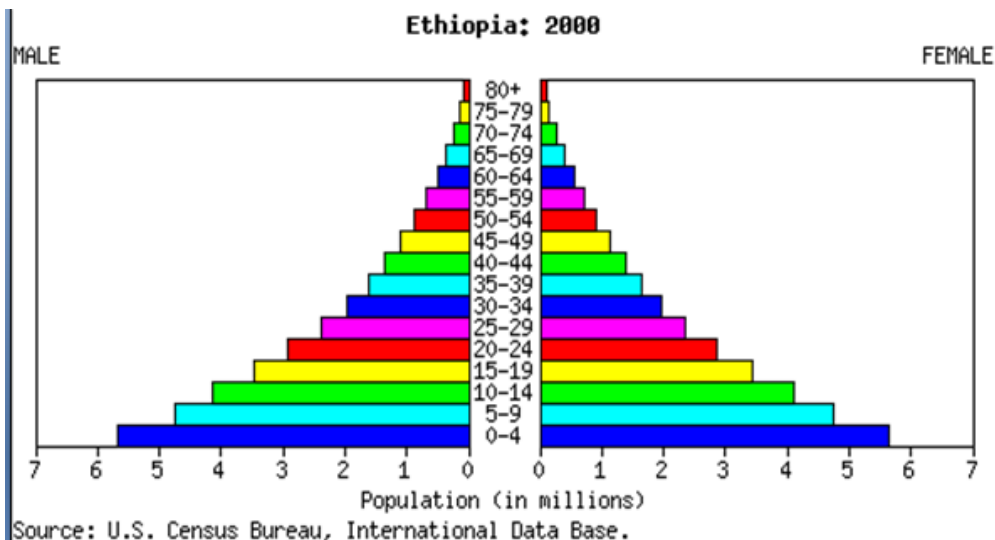
Explanation for stage 1:
- High death rates especially in infants and children because of epidemics, famines, poor nutrition poor hygiene and little medical care.
- High fertility because of high infant mortality, so parents tend to have more children to compensate for deaths
- Children are also needed to work on the land to grow food and for family support
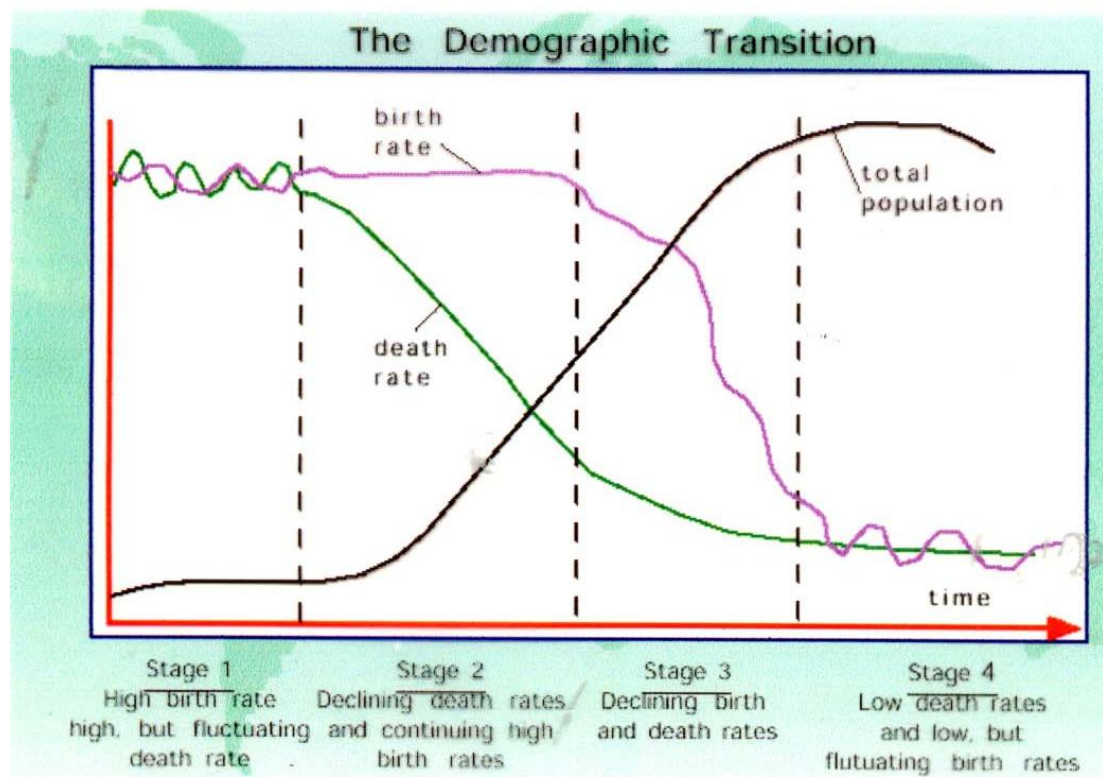
Stage (1) High stationary:
High birth rate and high death rate

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High stationary e.g. central Africa
(Slow population growth)

Ethiopia: 2000

MALE / FEMALE

Population (in millions)

Source: U.S. Census Bureau, International Data Base.

Ethiopia has a very wide base and has a very small apex, it is also very steep which means the mortality is very high

The Demographic Transition

birth rate

death rate

total population

time

Stage 1	Stage 2	Stage 3	Stage 4
High birth rate high, but fluctuating death rate	Declining death rates and continuing high birth rates	Declining birth and death rates	Low death rates and low, but flutuating birth rates

STAGE 2 (EARLY EXPANDING)

During stage 2, Birth rate remains high but the death rate begins a sharp **decline** due to major improvements in living standards attributable to industrialization.

The large gap between the birth rate and the death rate accounts for the population explosion.

The reasons for declining death rate in stage2 are:
  • Improvements in sanitation and water supply
  • Better quality and quantity of food produced
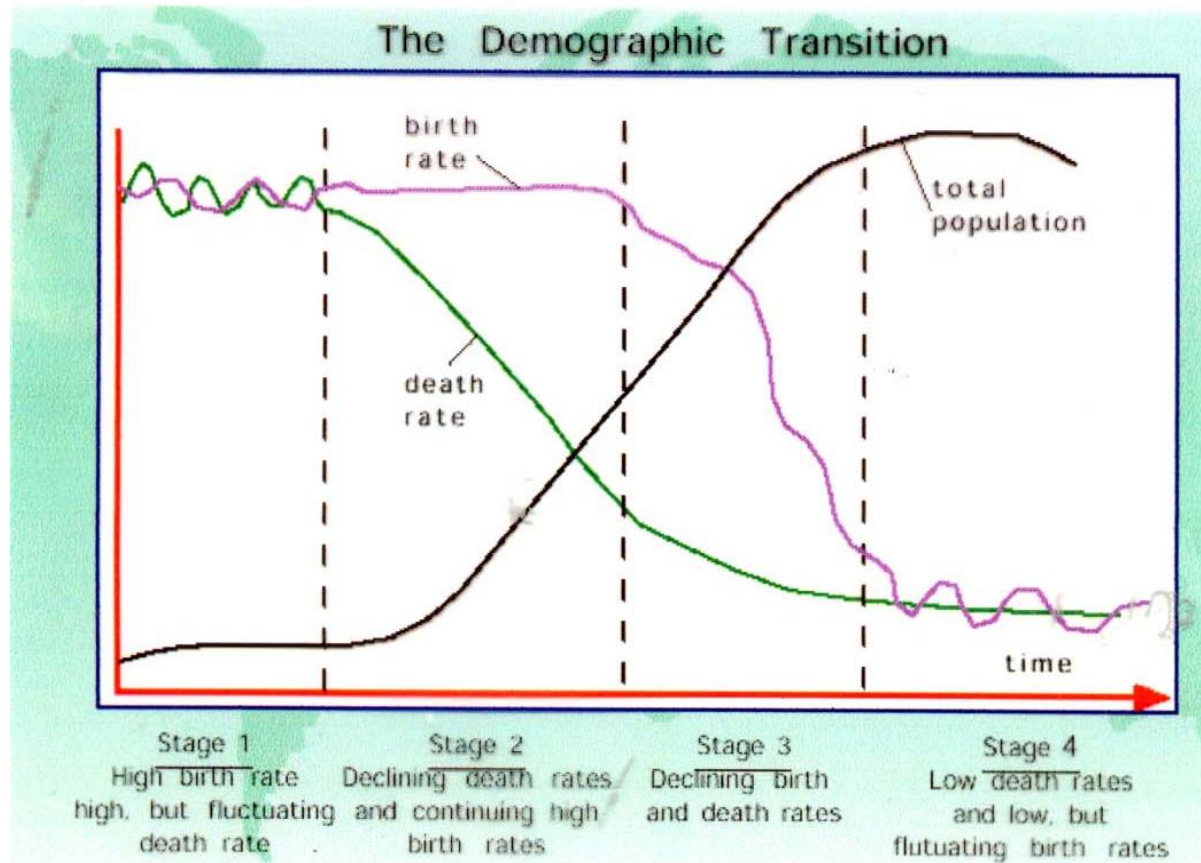 • Transport and communications improve the movements of food and medical supplies

Stage (2) Early expanding:

High birth rate and rapid fall of death rate.

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Rapid population growth

(Population explosion) e.g. India.

The Demographic Transition

Stage 1	Stage 2	Stage 3	Stage 4
High birth rate high, but fluctuating death rate	Declining death rates and continuing high birth rates	Declining birth and death rates	Low death rates and low, but flutuating birth rates

STAGE 3 (LATE EXPANDING)

- During stage 3, Birth rates fall rapidly as people start controlling their fertility and limiting family size.

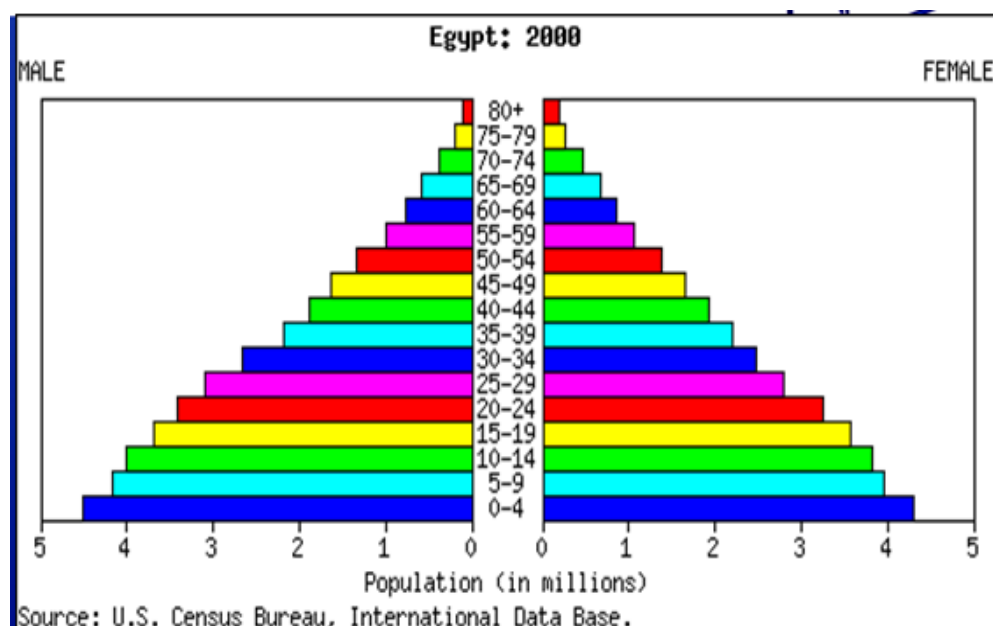**The fall in birth rate is due to:**

- Lower infant mortality rate so, most of the children will actually survive into adulthood, so no need for more children.
- Children become more expensive to raise largely because of increasing educational demands.
- A declining need for children as farm labors due to industrialization and mechanization
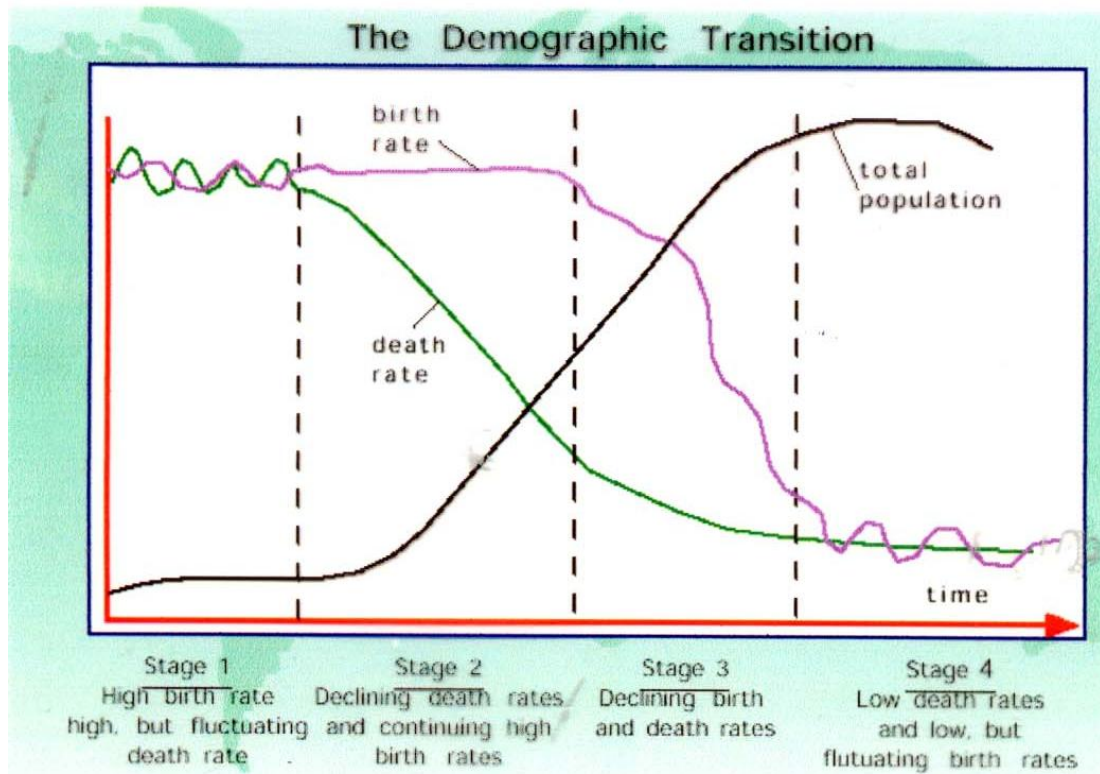- Increased access to contraception

Stage (3) Late expanding:
High fall of birth rate and rapid fall of death rate.

Moderate population growth e.g. Egypt.

The Demographic Transition

Stage 1	Stage 2	Stage 3	Stage 4
High birth rate high, but fluctuating death rate	Declining death rates and continuing high birth rates	Declining birth and death rates	Low death rates and low, but flutuating birth rates

STAGE 4 (LOW STATIONARY)

In stage 4, the final stage, both birth rates and death rates are low. But in contrast to stage 1, birth rates fluctuate, indicative of fertility control as people alter their reproduction according to socioeconomic changes.
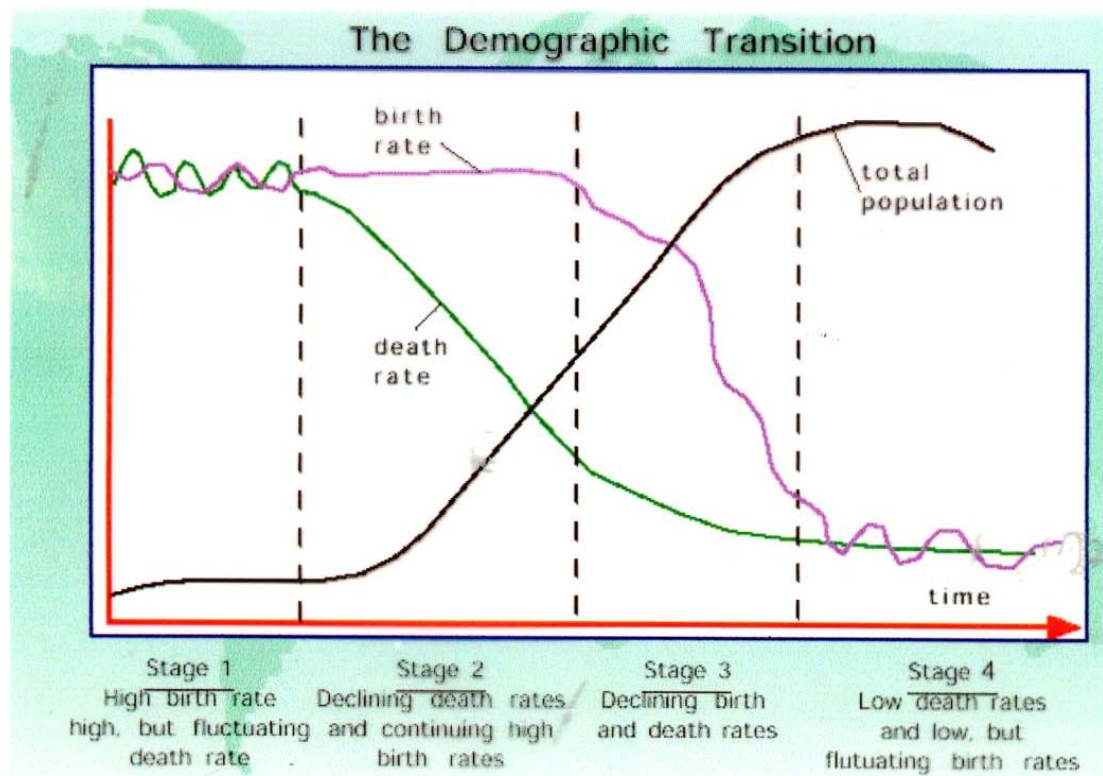
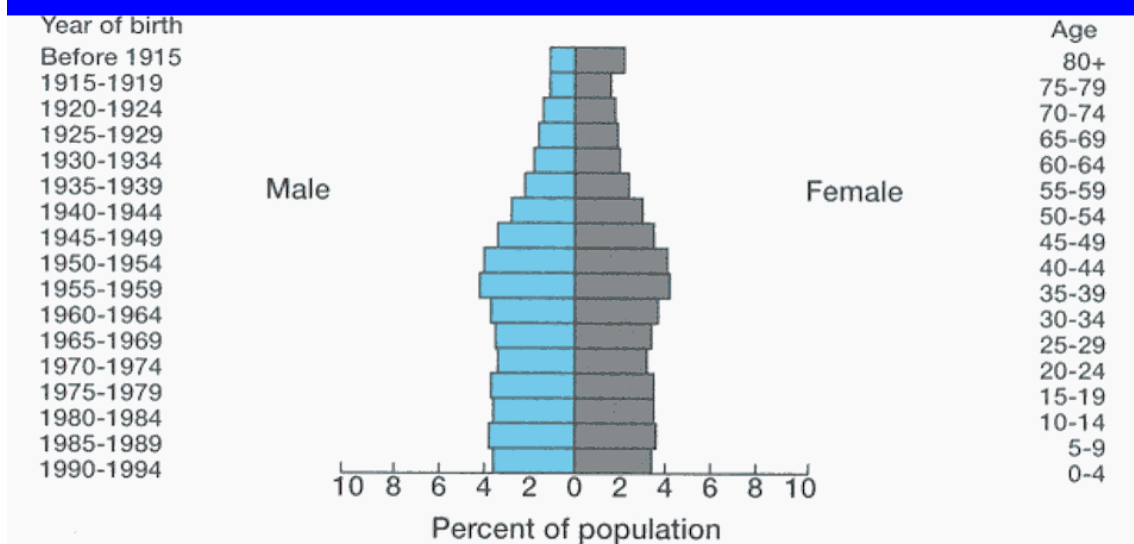**Stage (4) Low stationary:**
Low birth rate and low death rate.

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e.g. most industrialized countries
(Slow population growth)

The Demographic Transition

United States Population, 1995

Source: Joseph A. McFalls, Jr. Population: A Lively Introduction. Population Bulletin 46(2); 1995: 22.
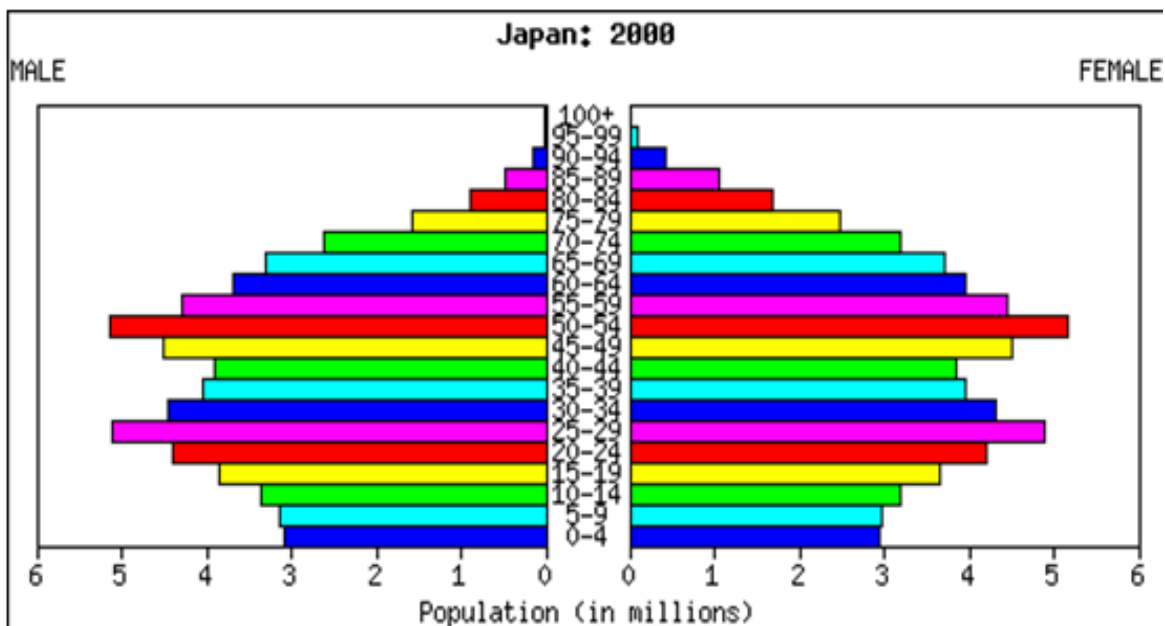
STAGE 5 (DECLINING)

- A new fifth stage is added to the model, due to some countries such as Germany, Japan,.. Having higher death rate than birth rate, so that their populations are actually falling.

The base here is smaller than the rest of the age groups (except the elderly). Here less births than previous years..

Stage (5) Declining:

Death rate > birth rate

↓

Decline e.g. Japan

Japan: 2000

MALE   FEMALE

Population (in millions)

Source: U.S. Census Bureau, International Data Base.

FACTORS AFFECTING POPULATION DYNAMICS

Factors that influence population dynamics:

1. **Fertility (births)**
2. **Mortality (deaths)**
3. **Migration**

1. **FERTILITY (NATALITY RATES)**
   - **Crude Birth Rate (CBR)**
   - **General fertility rate (GFR)**
   - **Age specific fertility rate**
   - **Total Fertility Rate (TFR)**
   - **Gross Reproduction Rate (GRR)**

○ **CBR:**   -   Is the simplest indicator of fertility.
      -   It is defined as the number of live births per 1000 mid-year population in a given year and locality.

○ **General Fertility Rate (GFR)**
The number of live births in a calendar year, divided by the number of women in the child bearing ages 15-49 at mid-year, multiplied by 1000**.**

$$GFR = \frac{Total \ number \ of \ live \ birth \ in \ a \ certain \ year \ and \ locality}{mid-year \ reproductive \ female \ population \ (aged \ 15-49)} \ x \ 1000$$

    = …Live birth/1000 female population aged 15-49.

○ **Age Specific Fertility Rate**

$$\frac{Total \text{ number of live births born by females in a specific age group in a certain year and locality}}{Female \text{ population in the same specific age group}} \times 1000$$

= …Live births/1000 female population in specified age group.

○ **Adolescent Fertility Rate**
It is the age-specific fertility rate for women aged 15-19.
The annual number of births to women aged 15-19 years per 1,000 women in that age group. You get the number from the table.

$$\frac{Total \text{ number of live births born by females in (15-19) age group in a certain year and locality}}{Female \text{ population in the (15-19) age group in the same year and locality}} \times 1000$$

= …Live births/1000 females in 15-19 age group.
Calculation of AFR is important because early pregnancy is related to higher risks of maternal and infant mortality

○ **Total Fertility Rate (Per Woman)**
TFR represents the average number of births that would be born to a woman throughout her reproductive period.
It is expressed as children per woman.
In Saudi Arabia, Total fertility rate (per woman) 3.5 (2006)
- In developing countries the TFR is over 6.0 children per woman.
- In most developed countries the TFR is under 2.0.
In this calculation we count all women including infertile women..

o **Gross Reproduction Rate (Per Woman)**

- GRR represents the average number of female births that would be born to a woman throughout her reproductive period. (it estimates the average number of female newborns as those will be fertile after a certain number of years and will be responsible for the fertility and reproduction rate for the next generation.)
- It is expressed as daughters per woman.
- It **predicts** the fertility of the next generation

REFERENCES

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- **Core Health Indicators, Health indicators WHO. Available at: http://apps.who.int/whosis/database/core/core_select.cfm?strISO3**