Principle of Demography

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Content

- Definition of demography
- Factors determine population size
- Relationship between demography & medicine

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What is Demography?

- Two Greek roots:
  - demos (people)
  - graphein (to write, draw, study)
  - → branch of knowledge regarding people (human populations)

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What is Demography?

- Achille Guillard first used the title on his book:
  - Eléments de Statistique Humaine ou Démographie Comparée.
- Guillard then defined demography as:
  - 'the mathematical knowledge of populations, their general movements, and their physical, civil, intellectual and moral state' (Guillard 1855:xxvi)

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"Today" Demography means…

- Is the scientific study of human populations.
- its size, distribution, composition, and the factors that determine changes in its size, distribution, and composition.

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Demography

- Cover five aspects of human population:
  1. size,
  2. distribution,
  3. composition,
  4. population dynamics,
  5. socioeconomic determinants and consequences of population change.

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Why demography important ?

- A guide for decision making
- Infrastructure and planning
- Population structure effects in the world:
  - Sub Saharan Africa young population + AIDS (lots of orphan children), VS.
  - North America and Europe's older populations (Replacement level of fertility, or Social Security systems in danger).
- Globalization:
  - Placement of factories where there are younger people who can work.
  - media campaign to target populations according to their characteristics.

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Why demography important ?

- Environment: (More resources are needed for more people)
- Politics:
  - Targeted campaign by demographic information i.e., age, sex, race, education have effects on political preference and voting
  - Apportionment of seats in the house of representatives,
  - Financial allocation is based on the demographic composition of each state.

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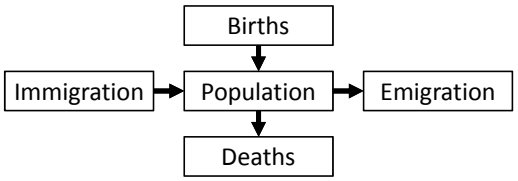
Population Size

What determine population size

- Three Basic Demographic Processes
  - Births
  - Deaths
  - Migration



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Measuring Population Change :

- Population change = (Births – Deaths) + (Immigrants – Emigrants)
- Population change = (natural increase) + (net migration)
- book keeping equation:
  - $P_t - P_0 = (B - D) + (I - E)$
    - where:
    - P_0 is the initial population and P_t is the population after time t

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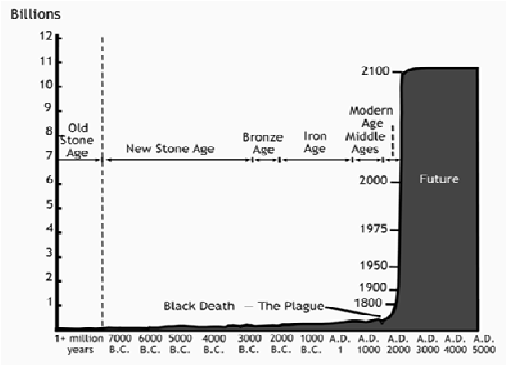
Population change – world



Sources: Population Reference Bureau; United Nations. (1998). World population projections to 2100.

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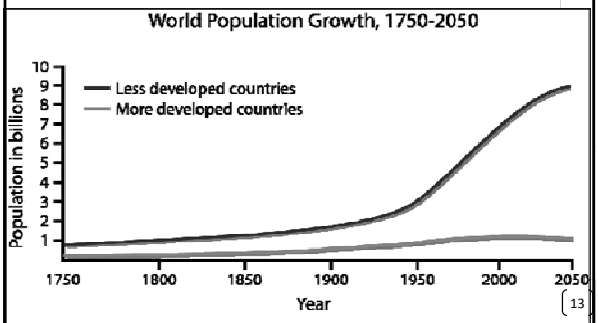
Population change – world



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Sources: Population Reference Bureau; United Nations. (1998). World population projections to 2100.

Population Milestones in Sub – Saharan Africa

- 183 million in 1959
- 183*2 =366 million in 1978, 28 years later
- 183*3=549 million in 1992, 14 years later
- 183*4= 732 million in 2004 (estimated projection), 12 years later

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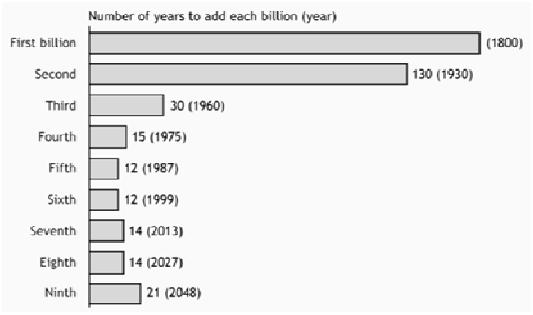
Number of Years to Add Each Billion



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Sources: First and second billion: Population Reference Bureau; Third through ninth billion: United Nations. (2005). World population prospects: the 2004 revision (medium scenario).

Cause of the rapid population growth

- Changes in Mortality
  - increase of life expectancy from 1950-2025
  - Increase in life expectation is the mirror image of decline in mortality.
- Changes in Fertility
  - a decline in fertility in all countries.
  - higher in the more developed than the developing countries.
- Demography Transition

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Demographic Transition

- Concept evolved from the history of population growth in Europe and the United States and has been broadly applied to populations everywhere
- Trend shift from high rate of births and deaths to low rates of births and deaths

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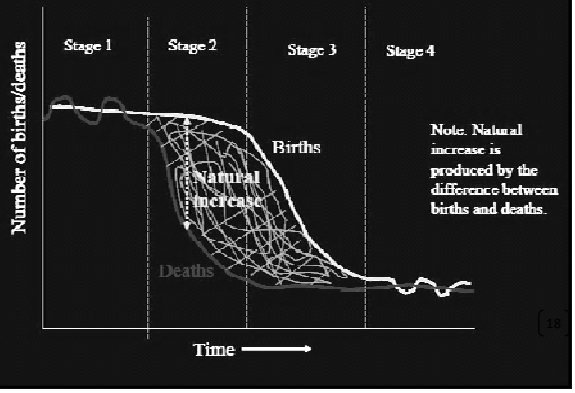
The Classic Stages of Demographic Transition



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The Stages of the Demographic Transition

- Stage I:
  - high death rates balance high birth rates resulting in no, or slow population growth (or decline)
- Stage II:
  - The death rates begin to drop with birth rates remaining high leading to increasing rates of population growth

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Stages of the Demographic Transition

- Stage III:
  - The birth rate declines resulting in a slowing of population growth
- Stage IV:
  - both birth rates and death rates are low and population growth slows, stops or even declines

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Demographic Transition European vs. LDCs

- European countries
  - BR and DR low over entire time period
  - Gradual decline in mortality and fertility over 200 years
  - Population growth rates peaked in 19thcentury, at 1-2% per year
- Developing countries
  - High pre-transition BR and DR, prior to World War II
  - Precipitous decline in mortality post World War II
  - Population growth rates peaked in 2ndhalf of 20thcentury, at 2.5-3.5% per year

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Demographic Transition: Where are we now?

- Western Europe, US, Canada, Australia, New Zealand, Japan, China–essentially have completed the four stages of demographic transition.
- East Asia, Latin America, Middle East, South Africa –mostly in Stage 3.
- South Asia (Pakistan), Sub-Saharan Africa – mostly in Stage 2.

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Demographic Transition: What After Stage 4?

- Balanced numbers of births and deaths with population size stabilizing ?
- OR
- Continued declines of birth rates so that population numbers decline?
  - Most of Western Europe has shown a continued birth rate decline below the 2-child family with beginning declines in population size.

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Deviations from Classic Stages of Demographic Transition

- Former Soviet Union, Eastern Europe – since 1989, show a demographic "reversal" with a return of high mortality, continued low fertility and population decline
- Reversal in mortality gains with HIV epidemic in Sub-Saharan Africa

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Demography & Health

The application of the content and methods of demography to the study of health status and health behavior . . .

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Epidemiological transition

- 1st described by Abdel Omran in 1971
  - put forward a theory describing for the first time the decrease of infectious diseases, gradually replaced by chronic diseases.
- The pattern of mortality and disease is transformed from high mortality among infants and children & episodic famine and epidemic affecting all age groups → degenerative and man-made diseases affecting principally the elderly.

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Stages of Epidemiological Transition

- Age of Pestilence and Famine
- Age of Receding Pandemics
- Age of Degenerative and Man-made diseases
- Age of delayed degenerative diseases

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Age of Pestilence and Famine

- Lasted until the middle of the 19th century.
- Characterized by high mortality rates, little population growth (fertility is high, but the high fertility rates are off set by very high mortality rates) and very low life expectancy
- Traditional society, chronic shortage of food, poor sanitary conditions, high MCH morbidity and mortality, environmental problems, young population

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Age of Receding Pandemics

- Ended in the middle of the 20th century for most developed countries.
- Epidemics become less frequent, infectious diseases in general become less frequent, a slow rise in degenerative diseases begin to appear, improved life expectancy, organized health services, increased proportion of older people

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Age of Degenerative and Man-made diseases

- Characterized by the predominance of chronic diseases and the stabilization of mortality at a low level.
- Chronic diseases, cheap calories, morbidity overshadows mortality, rise in living standards, dramatic decline in fertility, comprehensive healthcare

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Age of delayed degenerative diseases

- Mid-1980s, a fourth stage of the epidemiologic transition was suggested when Olshansky And Ault 1986
  - Found that, contrary to what omran had predicted, the decline of mortality never stopped.
- Observed an uninterrupted increase in life expectancy. They believed this trend was important enough to distinguish it from Omran's three previous phases.

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Factors Affecting Mortality & Fertility

Explaining demographic and epidemiological transition

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Determinant of mortality

- General framework in demography - and focuses on demographic characteristics, distal causes, proximate factors, and outcomes
- The framework will try to explain the effect of demographic factor (age, sex, race/ethnicity) on the distal factor that indirectly influence mortality through proximate factors - which have more direct impacts on mortality.
- Many of these factors have been examined in the medical, public health, and epidemiological literatures because of their more direct biological links to mortality.
- Nevertheless, demographers have become increasingly interested in the behavioral, health, and genetic factors associated with adult mortality.

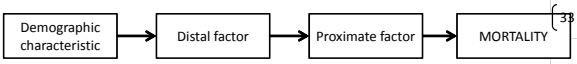

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Table 10.1. Framework Depicting Factors Related to Adult Mortality

Demographic Characteristics	Distal Causes	Proximate Factors	Outcomes
Age	**Socioeconomic status**	**Health behaviors**	
Sex	Education	Cigarette smoking	
Race/ethnicity	Income	Alcohol drinking	
	Employment status	Diet	
	Occupational status	Exercise	
	Health insurance	Sleep	
	Wealth	Seat belt use	
		Use of violence	
	Social relations		
	Family relations	**Health conditions**	
	Marital status	Childhood health status	Mortality
	Family composition	Parent/sibling health status	Overall mortality
	Relatives	Self-reported health status	Underlying cause
	Friends	Functional limitations	Multiple cause
	Neighbors	Mental and addictive disorders	
	Community ties		
	Religion	**Physiological influences**	
		Height	
	Geographical factors	Weight	
	Region	Cholesterol	
	Urban/rural	Blood pressure	
	Migration	Stress	
	Neighborhood effects	Diabetes	
		Genetic markers	
	Human and environmental hazards		
	Natural disasters		
	Technological risks		
	Acts of terrorism and war		

Source: Expanded from Rogers, Hummer, and Nam (2000).

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Determinants of Fertility

Indirect determinants Socioeconomic, cultural, environmental variables → *Direct determinants* Intermediate fertility variables → Fertility

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Intermediate determinant – Davis & Blake 1956

I. Factors Affecting Exposure to Intercourse ("Intercourse Variables").
  A. Those governing the formation and dissolution of unions in the reproductive period.[2]
    1. Age of entry into sexual unions.
    2. Permanent celibacy: proportion of women never entering sexual unions.
    3. Amount of reproductive period spent after or between unions.
      a. When unions are broken by divorce, separation, or desertion.
      b. When unions are broken by death of husband.
  B. Those governing the exposure to intercourse within unions.
    4. Voluntary abstinence.
    5. Involuntary abstinence (from impotence, illness, unavoidable but temporary separations).
    6. Coital frequency (excluding periods of abstinence).
II. Factors Affecting Exposure to Conception ("Conception Variables").
    7. Fecundity or infecundity, as affected by involuntary causes.
    8. Use or non-use of contraception.
      a. By mechanical and chemical means.
      b. By other means.[3]
    9. Fecundity or infecundity, as affected by voluntary causes (sterilization, subincision, medical treatment, etc.).
III. Factors Affecting Gestation and Successful Parturition ("Gestation Variables").
    10. Foetal mortality from involuntary causes.
    11. Foetal mortality from voluntary causes.

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Analyzing the Proximate Determinants

- Bongaarts(1982) provided an analytical model for measuring in surveys the most important proximate determinants that affect fertility.
- summarized the set of 11 intermediate fertility variables proposed by Davis and Blake into eight factors grouped in three broad categories

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Intermediate Determinants – Bongaarts 1978

I Exposure factors
1. Proportion married

II Deliberate marital fertility control factors
2. Contraception
3. Induced abortion

III Natural marital fertility factors
4. Lactational infecundability
5. Frequency of intercourse
6. Sterility
7. Spontaneous intrauterine mortality
8. Duration of the fertile period

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Population Composition

Recognizing the characteristic of a population

Population Composition

- Population composition refers to the numbers of person in sex, age, and other "demographic" categories.
- 'Ascribed' characteristics :
  - age, sex, race, year of birth, and place of birth
- 'Achieved' characteristics : social and economic characteristics
  - nativity, ethnicity, ancestry, religion, citizenship, marital status, household characteristics, living arrangements, educational level, school enrolment, labour force status, income, and wealth.

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Population Composition

- There are three main characteristics of population composition:
  - Demographic characteristics such as age and sex,
  - Social characteristics such as ethnicity and citizenship,
  - Economic characteristics such as economic activity.

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Population structure and composition

- Population structure and composition are influenced by :
  - Demographic variables :
  - Non-demographic variables :

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Demographic variables :

- Age and sex structure

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Non-demographic variables

1. Socioeconomic status
2. Cultural factor
3. Marital status
4. Household composition
5. Education
6. Ethnicity
7. Residence (rural-urban)
8. Occupation

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Age and sex composition/structure

- Age and sex are the most basic characteristics of a population.
- Every population has a different age and sex composition
  - the number and proportion of males and females in each age group
- This structure have considerable impact on the population's social and economic situation, both present and future
- Interaction of fertility, mortality and migration that influences the age-sex structure.

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Age and sex composition/structure

- The age-sex structure of population is best represented graphically by a POPULATION PYRAMID

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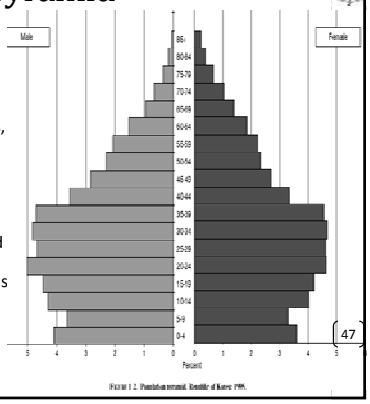
Population pyramid

- Graphical illustration that shows the distribution of various age groups in a population
- Consists of two back-to-back horizontal bar graphs,
  - X axis – population
  - Y axis – age groups
- Males shown on the left and females on the right ,
- younger age group are at the bottom of the pyramid
- They may be measured by raw number or proportions or percentage of the total population



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Types of population pyramid

- Expansive pyramid
- Constrictive pyramid
- Stationary pyramid

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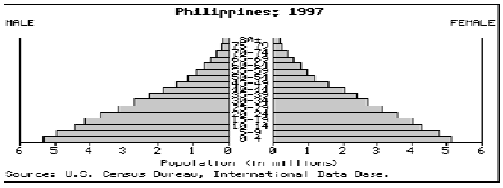
Types of population pyramid

- **Expansive pyramid** :
  - Broad base, indicating a high proportion of children
  - High birth rate - a rapid rate of population growth
  - low proportion of older people.
  - steady upwards narrowing shows that more people die at each higher age band.
  - Typical for developing countries (high birth rate, short life expectancy)



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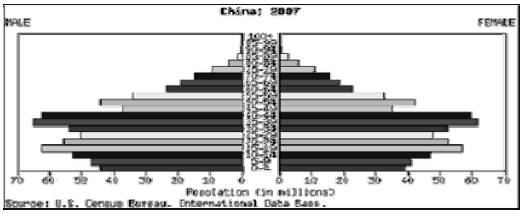
Types of population pyramid

- **Constrictive pyramid** :
  - lower numbers or percentages of younger people.
  - Constrictive at the base (smaller birth cohorts)
  - The country will have a greying population which means that people are generally older.



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Types of population pyramid

- **Stationary pyramid** :
  - Proportion of population in each age group are somewhat equal
  - Possible "zero population growth"
  - Low birth rates and death rates, immigration constant
  - Developed countries :Denmark, Belgium, Spain

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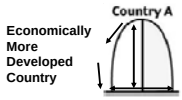
What Population Pyramids Show Us



Economically More Developed Country

Economically Less Developed Country

KEY

- slope of pyramid indicate the death rate
- width of the base is related to birth rate/fertility rate
- proportions of men and women can suggest male or female migrations
- height of graph can indicate life expectancy (ignore the very thin end of the wedge as occurs on graph B as these people are a definite minority)
- "kinks" indicate dramatic reductions in birth rate or increases in death rate in the past
- area of graph indicates total population - compare areas of different population age groups or different sex on one graph

The overall shape of the population pyramid can indicate whether it is an Economically More Developed Country or Economically Less Developed Country

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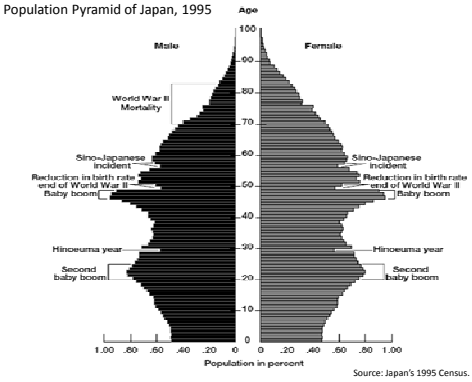
Pop pyramid – history teller

Population Pyramid of Japan, 1995



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Other Measurement from Population Pyramid

- Women –child ratio
- Sex ratio
- Dependency ratio

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Summary

- Demography is the scientific study of human populations
- Population change = (Births – Deaths) + (Immigrants – Emigrants)
- Stages of the Demographic Transition Model
- Determinant of mortality
- Determinants of Fertility

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Thank you

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