Demographic Analysis

Age and Sex Structure

The Population Pyramid as an Historical Record and a Tool for Demographic Analysis





Age-Sex Structure

For further reading, see Chapter 2 of the Census Bureau's

Population Analysis with Microcomputers

which provides more details about the importance of age-sex data, techniques for checking data for consistency, and methods for correcting for age misreporting.





MICROCOMPUTERS Volume I PRESENTATION OF TECHNIQUES By

POPULATION ANALYSIS

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U.S. Census Bureau

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Age and Sex Structure: The Population Pyramid

Outline of this session -

- Population pyramid
 - Definition
 - What can it tell us—a critical tool for demographic analysis
- Demographic transition
- Stable and stationary population
- Age, period, and cohorts perspectives





What is a "Population Pyramid" ?

 A graphical depiction of current population structure, by age and sex







Key Components of a Population Pyramid







What does a Population Pyramid Tell Us?

Size

- Age groups by sex
- Shape
 - Age-sex distribution
 - Migration
 - War deaths
 - Population aging and dependency ratio
 - Fertility
 - Mortality Demographic Transition
 - Population growth
 - History and the future!







Population (in thousands)

Age Group

Population (in thousands)













Source: U.S. Census Bureau, International Database.

http://www.census.gov/population/international/data/idb/region.php?N = %20 Results%20 & T = 12 & A = separate & RT = 0 & Y = 2005 & R = -1 & C = LA & A = separate & RT = 0 & Y = 2005 & R = -1 & C = LA & A = separate & RT = 0 & Y = 2005 & R = -1 & C = LA & A = separate & RT = 0 & Y = 2005 & R = -1 & C = LA & A = separate & RT = 0 & Y = 2005 & R = -1 & C = LA & A = separate & RT = 0 & Y = 2005 & R = -1 & C = LA & A = separate & RT = -1 & R = -1 & R







- Wide base -> High fertility
- Triangle shape -> High population growth
- "Young" population
 - Large % of population at younger ages







Population (in millions)

Age Group

Population (in millions)







- Narrow base -> Low fertility
- Low population growth
- Women live longer than men
- Population aging

High dependency ratio





Population Aging vs. Aging of an Individual

Population Aging

- Based on population age structure
- A shift in the distribution of a country's population towards older ages

VS.

Individual Aging

- Based on life course of each person
- Individuals will age whether the population they live in is getting older or younger







Source: U.S. Census Bureau, International Database.

http://www.census.gov/population/international/data/idb/region.php?N=%20Results%20&T=12&A=separate&RT=0&Y=2005&R=-1&C=JA





Dependency Ratios

The ratio between those at less economically productive ages and those at more productive ages:

Youth Dependency: e.g. ages 0-14 vs. 15-64

Old Age Dependency: e.g. ages 65+ vs. 15-64

Total Dependency: Youth Dependency + Old Age Dependency e.g., ages 0-14 +& 65+ vs. 15-64





Dependency ratios are critical tools for decisions on allocation of resources:

- Child immunizations
- Education (schools, teachers)
- Medical care for older population
- Retirement benefits
- Other





Limitations of dependency ratios:

- Some people at the dependent ages actually contribute (e.g. older children care for elders, and vice versa; elders also may work)
- Some people at peak work ages may themselves be dependent on others







- Narrow base -> Low fertility
 - Low population growth
- Women live longer than men
- Population aging
- High dependency ratio
- Baby boom
- Baby boom echo effect







Source: U.S. Census Bureau, International Database.

http://www.census.gov/population/international/data/idb/region.php?N = %20 Results%20 & T = 12 & A = separate & RT = 0 & Y = 2005 & R = -1 & C = JA & C =







Source: U.S. Census Bureau, International Database.

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Population (in thousands)

Age Group

Population (in thousands)







 More men in prime working ages—male migrants





- Jordan 1990 to 2015
- Jordan 2016 to 2040
- Libya 1990 to 2015
- Libya 2016 to 2040





What does a Population Pyramid Tell Us?

Size

- Age groups by sex
- Shape
 - Age-sex distribution
 - Migration
 - War deaths, famines
 - Baby busts or booms
 - Population aging and dependency ratio
 - Fertility
- **Demographic Transition**
- Mortality
- Population growth
- History and the future!





Demographic Transition

The shift from high birth and death rates to lower rates is known as the *demographic transition*.



https://commons.wikimedia.org/wiki/File:Stage5.jpg



DEMOGRAPHIC CHANGE, SWEDEN, 1735-2000

"Demographic change in Sweden 1735-2000". Licensed under CC BY 2.5 via Commons -

https://commons.wikimedia.org/wiki/File:Demographic_change_in_Sweden_1735-2000.png#/media/File:Demographic_change_in_Sweden_1735-2000.png





Demographic Transition

The key result of the demographic transition can be seen in the age structure of the population, which looks less like a *pyramid*, and more like a *rectangle*.

Examples of the "rectangularization" of age structure over time ...





From Pyramid to Rectangle: Age-Sex Structure in the United States, 1900, 1940, 1960, 1980, 2000 (from Population Reference Bureau Chart)







Stable and Stationary Population

Stable population

- Birth and death rates have stayed constant for a very long time
- Population size may change
- The resulting *shape* of the pyramid will not change, although it may grow (or shrink) over time.

Stationary population

- A special case of a stable population
- Birth and death rates are equal.
- Population growth rate = 0
- The shape and size of the pyramid will be constant.

Several demographic methods rely on the assumption that a population is stable -which implies that relative size of one age group to another **does not change over** *time*.





Period vs. Cohort: Concept of Time in Demography

- Calendar time
- Personal time (age)

We age one year in one year of time





Period vs. Cohort: Lexis Diagram



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Period vs. Cohort: Lexis Diagram



Cohort

- A group of people sharing a particular statistical or demographic characteristic
 - The relationship between time and age is the same
 - Born at the same time and go through life aging together





Period vs. Cohort: Lexis Diagram



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Age, Period, and Cohort Perspectives

Tabular depictions ...





MEXICAN FEMALES, 1975-2000

Age	1975	1980	1985	1990	1995	2000
Total, All Ages	29,754	35,240	41,557	48,697	56,505	64,789
0-4	5,336	6,187	7,092	7,980	8,733	9,330
5-9	4,606	5,265	6,118	7,029	7,921	8,679
10-14	3,903	4,587	5,245	6,100	7,011	7,903
15-19	3,139	3,889	4,572	5,231	6,086	6,997
20 - 24	2,584	3,122	3,870	4,553	5,213	6,067
25-29	2.061	2,565	3,099	3,846	4,530	5,189
30-34	1.686	2,041	2,542	3,076	3,821	4,504
35-39	1.391	1.663	2,015	2,514	3,046	3,788
40-44	1.161	1.366	1,636	1,985	2,480	3,009
4549	972	1,135	1,337	1,603	1,949	2,439
50-54	791	942	1,102	1,300	1,562	1,902
55-59	588	576	901	1,056	1,250	1,505
60-64	469	548	706	845	994	1,179
65-60	411	421	494	640	768	907
0J~~03 7074	310	350	359	424	552	665
75 and over	345	405	467	514	590	725

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Some Unusual Age-Sex Structures

And what causes them to look that way??





What country am I?

Male

Female



Census Bureau



What country am I?



Source: U.S. Census Bureau, International Database.

http://www.census.gov/population/international/data/idb/region.php?N=%20Results%20&T=12&A=separate&RT=0&Y=2005&R=-1&C=SA





What kind of place am I?, 2005



Number in thousands



Age Cohort



A Mythical "College Town" USA - 2005



Number in thousands





Age-sex structure can be depicted:

- At various geographic levels (country, state, and other sub-national levels)
- Among populations with particular characteristics - a few examples:
 - Literate
 - Workers
 - Deceased







Source: Census of India, ORGI





Illiterate Rural Population in Delhi, 2001



Source: Census of India, ORGI





Deaths in Brazil, 2012







Exercises

- Create population pyramids using PAS: PYRAMID.xls
- Use data from your country
- Optional:
 - NewPAS: Pyr2.xls (doubles your fun!)
 - Compare population pyramid of your country to another country
 - Compare population pyramid of one region in your country to another region



