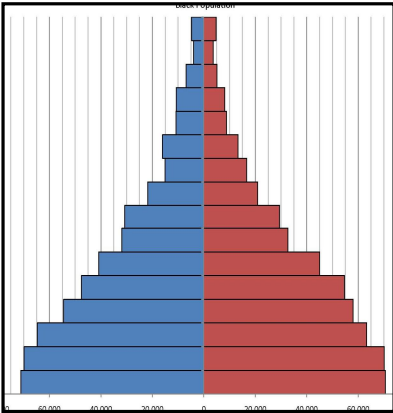


# Age and Sex composition (Cont'd)



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CDC 103 – Lecture 5 – March 4, 2012



**Analysis of Age Composition**



## General Techniques of Numerical and Graphic Analysis



- Numerical Analysis
- Graphic Measures

## Numerical Analysis



- **Nature of Age Distributions**
- **Percentage Distributions**
- **Percentage Changes by Age**
- **Use of Indexes**
- *Index of Relative Difference*
- *Index of Dissimilarity*
- **Median Age**
- **Measures of Old and of Aging Populations**
- **Age Dependency Ratios**



### Nature of Age Distributions

- Data on age are most commonly tabulated and published in 5-year groups (0–4, 5–9, etc.).
- For some types of analysis, however, data for single years may be needed (measuring accuracy of data, school children, adolescents, etc.).
- For other analytic purposes age data may be combined to obtain figures for various broader groups than 5-year groups (broad age categories):
  - For fertility analysis the total number of women 15 to 44 or 15 to 49 years of age (the childbearing ages) is significant;
  - The population 5 to 17 (school ages) is important in educational research and planning; and
  - The group 18 to 24 as a whole roughly defines the traditional university-age group.



### Nature of Age Distributions

- Special interest also is paid to the numbers reaching certain ages in each year.
- These usually correspond to the initial ages of the functional groupings described in the previous slide.
- On reaching these ages, new social roles are assumed or new stages in the life cycle are begun (e.g. birth and reaching age 5 or 6, 18, 21, and 65 in the western countries).



## Percentage Distribution

- Instead of presenting the absolute number of persons in a specific age group, we can use the percentage distribution of age.
- If the absolute numbers distributed by 5-year age groups are converted to percentages, a **clearer indication** of the relative magnitudes of the numbers in the distribution is obtained.
- Percentage distribution is important to compare between countries with different population size.
- Example: Mexico vs. USA

	<i>Total</i>	<i>Under 5</i>	<i>5 to 14</i>	<i>15 to 24</i>	<i>25 to 34</i>	<i>35 to 44</i>	<i>45 to 64</i>	<i>65+</i>
Mexico	100.0	12.6	25.9	21.7	14.6	10.0	11.0	4.2
U.S.	100.0	7.4	14.2	14.8	17.4	15.1	18.6	12.6



## Percentage Changes by Age

- It's important also to measure change of age distribution by time (for the same country).
- The simplest measure of change by age is given by the **amount** and **percentage** of change at each age.
- Consider the following example:



Population of the United States, 1980 and 1990, and Percentage Change, by Age

Age (years)	Population		Increase	
	1980 (1)	1990 (2)	Amount (2)-(1) = (3)	Percentage [(3) ÷ (1) × 100 = (4)]
Total	226,545,805	248,709,873	22,164,068	9.8
Under 5	16,348,254	18,354,443	2,006,189	12.3
5 to 9	16,699,956	18,099,179	1,399,223	8.4
10 to 14	18,242,129	17,114,249	-1,127,880	-6.2
15 to 19	21,168,124	17,754,015	-3,414,109	-16.1
20 to 24	21,318,704	19,020,312	-2,298,392	-10.8
25 to 29	19,520,919	21,313,045	1,792,126	9.2
30 to 34	17,560,920	21,862,887	4,301,967	24.5
35 to 44	25,634,710	37,578,903	11,944,193	46.6
45 to 54	22,799,787	25,223,086	2,423,299	10.6
55 to 64	21,702,875	21,147,923	-554,952	-2.6
65 and over	25,549,427	31,241,831	5,692,404	22.3

30 to 34 21,862,887 - 17,560,920 = 4,301,967

$$\frac{4,301,967}{17,560,920} \times 100 = 24.5 \text{ Percent}$$



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## Use of Indexes

- Two indexes can be used to compare between two percentage distributions of age groups;
  - Index of relative difference, and
  - Index of dissimilarity



## Index of Relative Difference (IRD)

- Method of calculating IRD:
  1. the deviations of the age-specific indexes from 100 are summed without regard to sign,
  2. one- $n^{\text{th}}$  ( $n$  representing the number of age groups) of the sum is taken to derive the mean of the percentage differences at each age, and
  3. the result in step 2 is divided by 2 to obtain the index of relative difference.



## Index of Relative Difference (IRD)

- The formula to calculate IRD is:

$$IRD = \frac{1}{2} \times \frac{\sum \left( \left( \frac{r_{2a}}{r_{1a}} \times 100 \right) - 100 \right)}{n}$$

- Where:
  - r1a represents the percent at each group in the first population, and
  - r2a represents the percent at each group in the second population



## IRD Calculation

Age	r1	r2	Index
0-4	10.1	9.8	97.3
9-May	12.0	11.7	97.3
14-Oct	12.6	12.3	97.4
15-19	12.3	12.1	97.8
20-24	10.5	10.4	98.5
25-29	8.9	8.8	99.0
30-34	7.6	7.6	99.2
35-39	6.4	6.4	99.0
40-44	5.0	4.9	98.7
45-49	4.1	4.1	99.9
50-54	2.7	3.0	112.4
55-59	2.1	2.3	110.4
60-64	1.9	2.2	114.5
65-69	1.7	1.8	109.4
70-74	1.0	1.2	120.4
75+	1.0	1.5	142.5
Total (%)	100.0	100.0	125.5

Sum of percent differences without regard to sign = Sum/Index - 100 = 125.5  
Number of categories = 16  
7.8 Mean percent difference = (Sum/Index - 100)/16  
3.9 IRD (Half of the mean percent difference)



## Index of Dissimilarity

- Another summary measure of the difference between two age distributions—the index of dissimilarity—is based on the absolute differences between the percentages at each age.
- In this procedure, the differences between the percentages for corresponding age groups are determined, they are summed without regard to sign, and one-half of the sum is taken. (Taking one-half the sum of the absolute differences is equivalent to taking the sum of the positive differences or the sum of the negative differences.)



## Index of Dissimilarity

- The general formula is then

$$ID = \frac{1}{2} \sum |r_{2a} - r_{1a}|$$

- Where:
  - $r_{1a}$  represents the percent at each group in the first population, and
  - $r_{2a}$  represents the percent at each group in the second population



## ID Calculation



Microsoft Excel - ID.xls

File Edit View Insert Format Tools Data Window Help

Type a question for help

D23 =D22/2

Age	r1	r2	Differen
0-4	10.1	9.8	-0.3
5-9	12.0	11.7	-0.3
10-14	12.6	12.3	-0.3
15-19	12.3	12.1	-0.3
20-24	10.5	10.4	-0.2
25-29	8.9	8.8	-0.1
30-34	7.6	7.6	-0.1
35-39	6.4	6.4	-0.1
40-44	5.0	4.9	-0.1
45-49	4.1	4.1	0.0
50-54	2.7	3.0	0.3
55-59	2.1	2.3	0.2
60-64	1.9	2.2	0.3
65-69	1.7	1.8	0.2
70-74	1.0	1.2	0.2
75+	1.0	1.5	0.4
Total (%)	100.0	100.0	3.3 Sum of Absolute difference
			1.6 ID (Half of sum of absolute difference)

$$ID = \frac{1}{2} \sum |r_{2a} - r_{1a}|$$

Ready

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## Median Age



- The analysis of age distributions may be carried further by computing some measure of central tendency.
- The most appropriate measure of central tendency for an age distribution is the median.
- The median age of an age distribution may be defined as the age that divides the population into two groups of equal-size, one of which is younger and the other of which is older than the median.
- It corresponds to the 50-percentile mark in the distribution.
- Comparative data can be found in the “[World Population Prospects](#).”



## Median Age

Country	Median Age (2010)
Denmark	40.6
Djibouti	21.4
Egypt	24.4
Germany	44.3
Ghana	20.5



## Median Age

- Calculation of median age ([Excel Sheet](#))

$$Md = l_{Md} + \left( \frac{\frac{N}{2} - \sum f_x}{f_{Md}} \right) i$$

where

$l_{Md}$  = the lower limit of the class containing the middle,

$N$  = the sum of all the frequencies;

$\sum f_x$  = the sum of the frequencies in all the classes preceding the class containing the containing the  $N/2$  item;

$i$  = size of the class interval containing the  $N/2$

$f_{Md}$  = frequency of the class of the  $Md$



## Aging (The elderly population)

- The proportion of aged persons:
  - Population 65+ as a percent of the total population

$$\frac{P^{65+}}{P_t} \times 100$$

- Aged-child ratio:
  - Population 65+ divided by population 0-14

$$\frac{P^{65+}}{P_{0-14}} \times 100$$



Summary Measures of Age Composition for Various Countries: Around 1990

Country and year	Median age (1)	Percentage of total population		Ratio of aged persons to children (per 100)
		Under 15 years (2)	65 years and over (3)	
<i>Africa</i>				
Kenya (1989)	15.9	47.9	3.3	6.9
South Africa (1991)	22.7	34.6	4.3	12.4
Uganda (1991)	16.3	47.3	3.3	7.1
Zambia (1990)	16.8	45.3	2.6	5.7
Zimbabwe (1992)	17.0	45.2	3.3	7.3
<i>North America</i>				
Canada (1991)	na	20.9	11.6	55.7
Mexico (1990)	19.8	38.6	4.2	10.8
United States (1990)	32.9	21.5	12.6	58.3
<i>South America</i>				
Argentina (1991)	27.2	30.6	8.9	29.0
Bolivia (1992)	19.2	41.4	4.3	10.3
Brazil (1991)	22.7	34.7	4.8	13.9



### Age Dependency Ratio

- The variations in the proportions of children, aged persons, and persons of “working age” are taken account of jointly in the age dependency.
- The age dependency ratio represents the ratio of the combined child population and aged population to the population of intermediate age.
- Formula:

$$\frac{P_{0-14} + P_{65+}}{P_{15-64}} \times 100$$



- Separate dependency ratio can be calculated for children under 15 (child-dependency ratio):

$$\frac{P_{0-14}}{P_{15-64}} \times 100$$



- Also another measure of 65+ dependency can be calculated by the following formula (old-age dependency ratio):

$$\frac{P_{65+}}{P_{15-64}} \times 100$$

Age Dependency Ratios for Various Countries:  
Around 1990 (ratios per 100)

Country and year	Total dependency ratio <sup>1</sup> (1)	Child dependency ratio <sup>2</sup> (2)	Aged dependency
<i>Africa</i>			
Kenya (1989)	104.9	98.2	6.8
South Africa (1991)	63.7	56.6	7.0
Uganda (1991)	102.5	95.8	6.8
Zambia (1990)	91.9	86.9	4.9
Zimbabwe (1992)	94.4	87.9	6.4
<i>North America</i>			
Canada (1991)	48.1	30.9	17.2
Mexico (1990)	74.7	67.4	7.3
United States (1990)	51.7	32.7	19.1
<i>South America</i>			
Argentina (1991)	65.1	50.5	14.6
Bolivia (1992)	84.0	76.1	7.8
Brazil (1991)	65.4	57.5	8.0
Chile (1992)	56.3	46.0	10.3
Ecuador (1990)	75.7	68.1	7.6
Venezuela (1990)	70.2	63.4	6.8





## Next Week



- **March 11: Age and Sex Composition (Cont'd)**  
**Racial and Ethnic Composition**
- **Readings:**
  - Siegel, J. & Swanson, D. Chapter 8 ; pp :175-190 .
- **Assignments:**
  - Using the World Population Prospects interactive Data Base, calculate the median age for five countries of your choice for the period from 1980 till 2010 and comment on the results.