

Principles of population & demography

Training Course in Sexual and Reproductive Health Research
Geneva 2017

Moazzam Ali MBBS, PhD, MPH

Department of Reproductive Health and Research

Twitter [@HRPresearch](#)



Outline of presentation

- ❑ Key definitions
- ❑ Population & demography related indicators
- ❑ Why family planning is still important
 - SDG, RH Strategy, UNSG Strategy
- ❑ Key indicators on family planning
- ❑ Conclusions

Population: definition

- ❑ “ Group of individuals of same species living in the same geographic area at the same time”
- ❑ A population is often defined by demographers according to the specific needs of the research and researcher. Three processes are relevant to demography:
 - Fertility, Mortality, and Migration

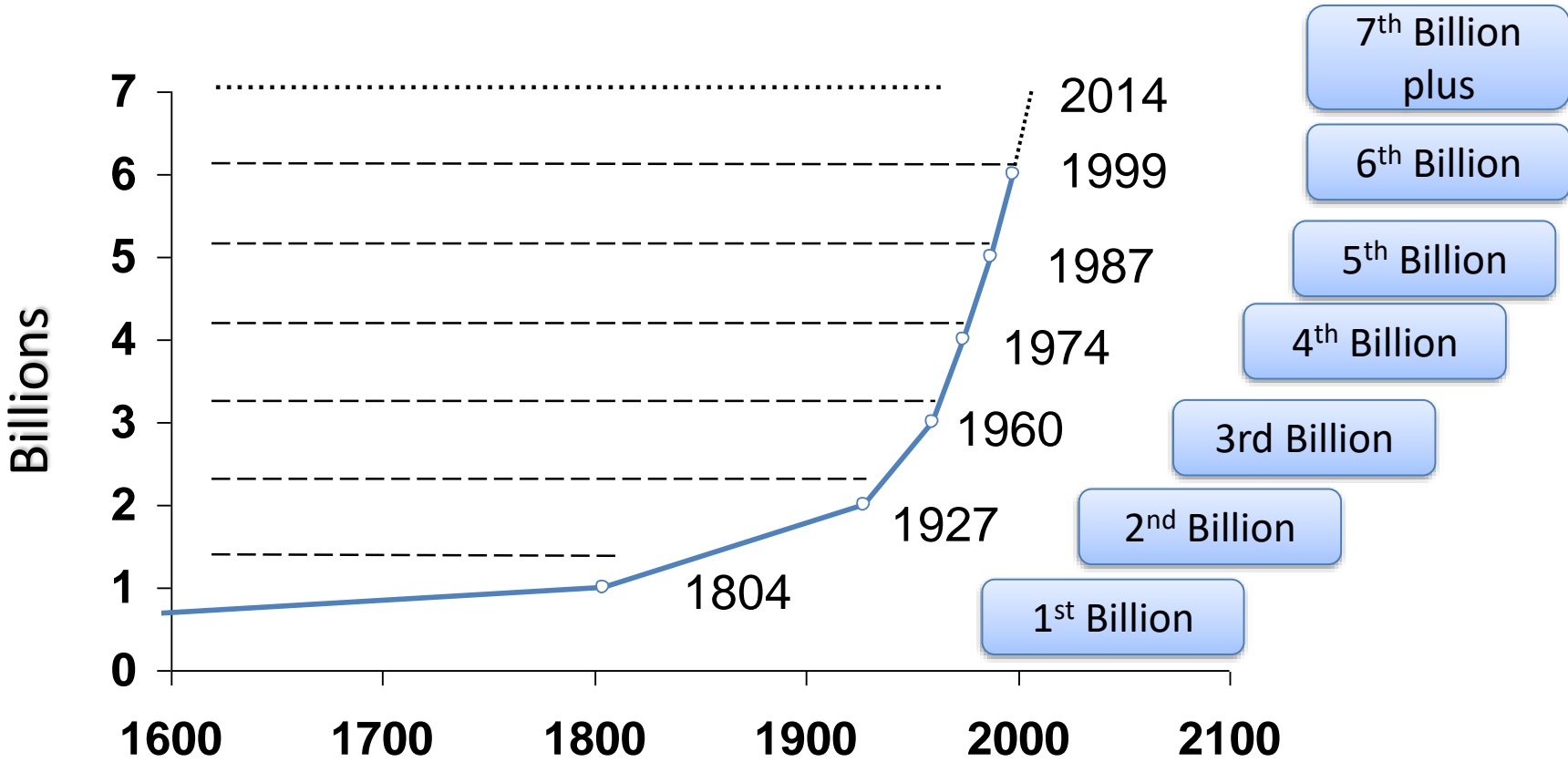
Population: basic concepts

- There are only **two** ways to **enter** a population by birth and by in-migration.
 - There are **two** ways to **leave** a population, by death and by **out-migration**.
- For example, the population of interest may be that of students attending a specific university during a specific year. In this situation, the students are born (i.e., enter) into the population when they enroll, and they die (i.e., leave) when they graduate

Global population developments

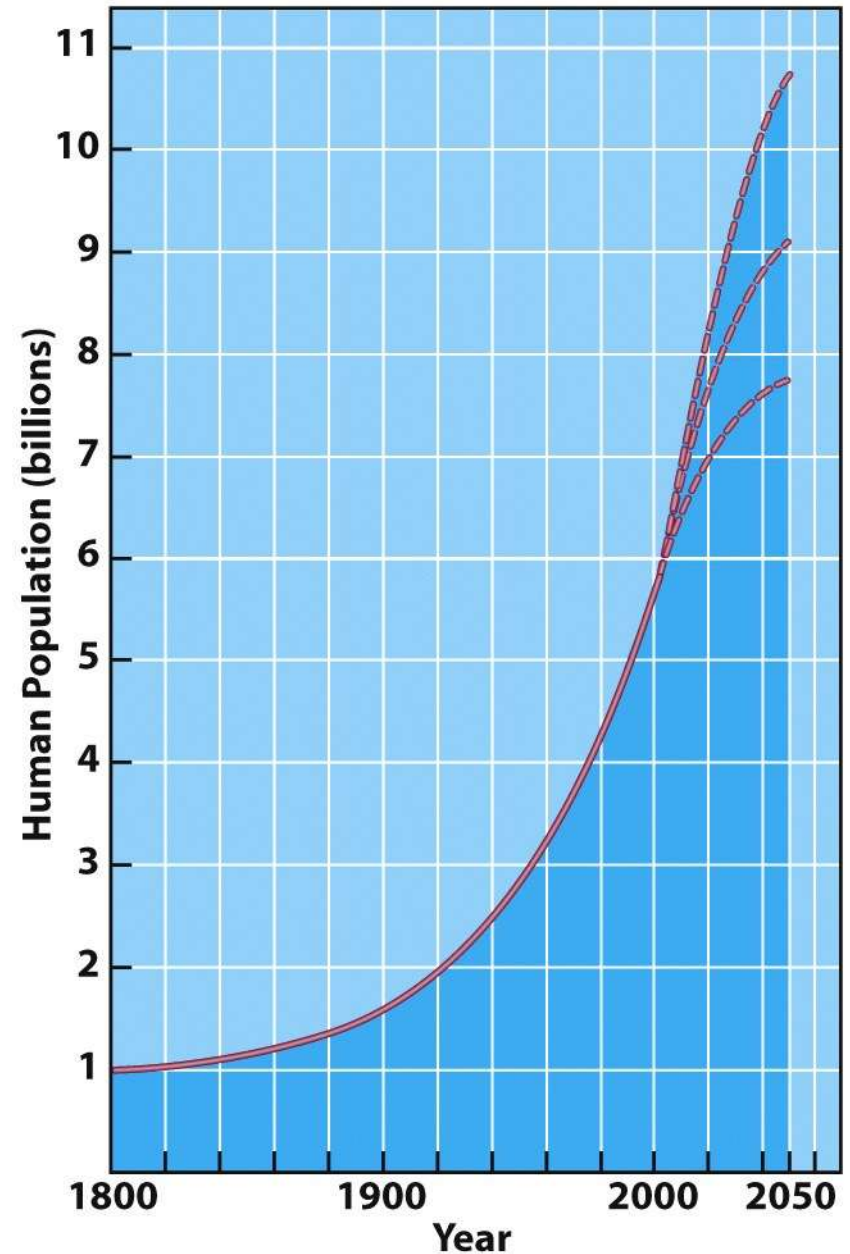
- ❑ Demographic change has been more rapid and more universal in the past six decades than any other period in human history, with birth, death and population growth varying widely across the world regions
- ❑ Fertility rates have declined to below three births per women in all regions except sub-Saharan Africa
- ❑ Global population reached 7 billion individuals in 2011
- ❑ Africa: doubles in size between 2010-2050 (e.g. Niger triples)
- ❑ If projection holds: grown by more than ten-folds i.e. 0.8 to 10 billion - between 1800 and 2100
- ❑ Pressure on public services and infrastructure, i.e. health care, education

Trends in global population growth

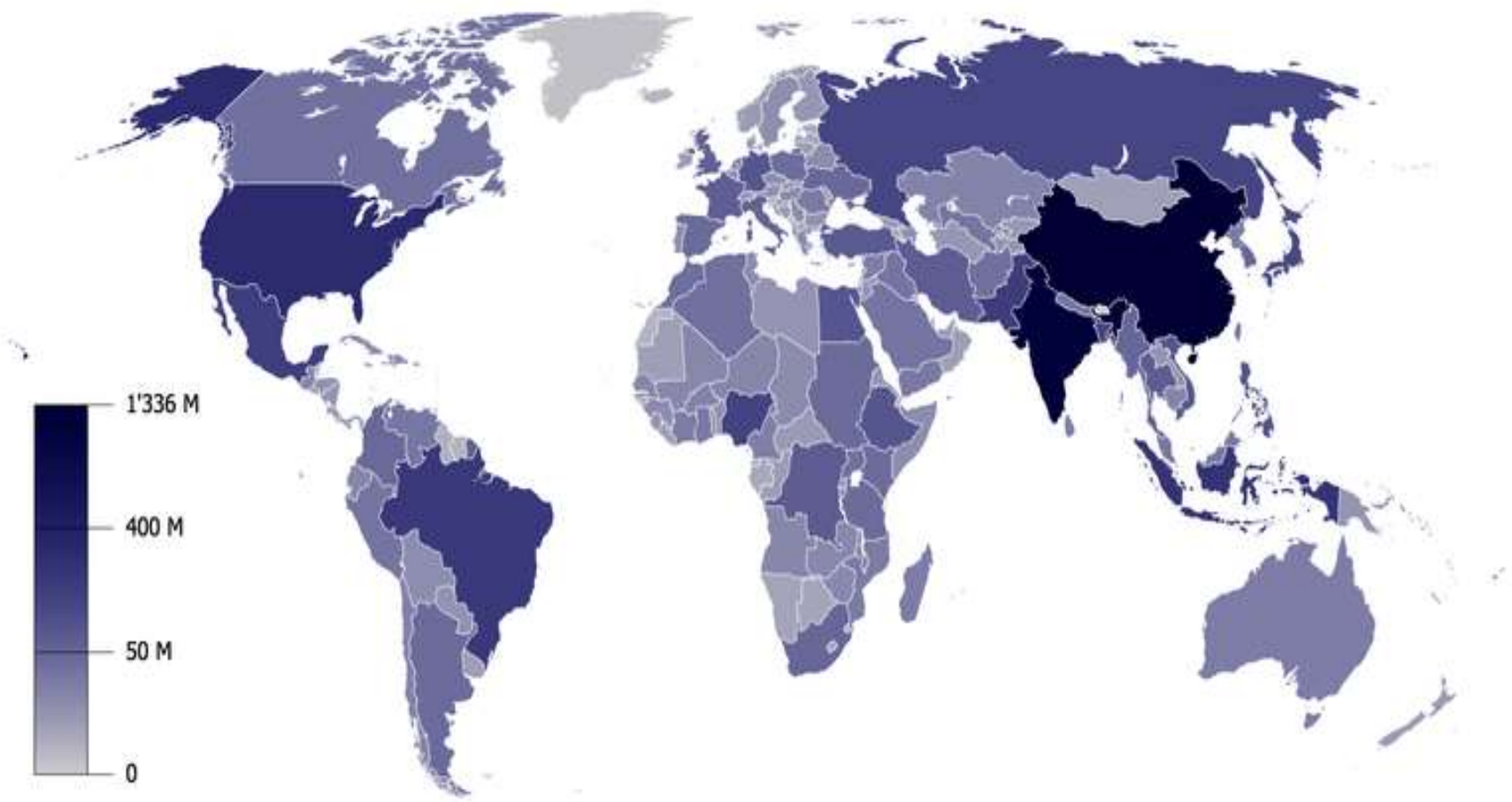


Projecting future populations

- ❑ Human Population since 1980 is J-shaped curve
- ❑ Population is increasing however growth rate (r) has started to decline
- ❑ Projections for 2050 (2007)
 - Low = 7.7 billion
 - High = 10.6 billion
 - Most likely = 9.1 billion



World population distribution: global overview



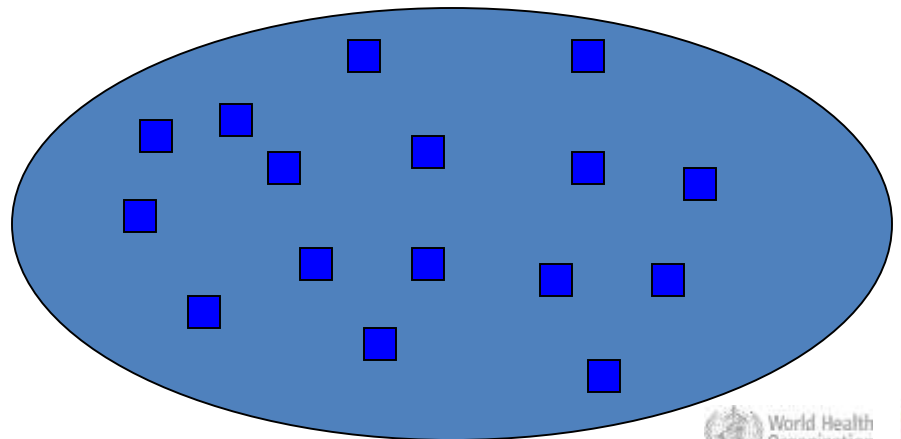
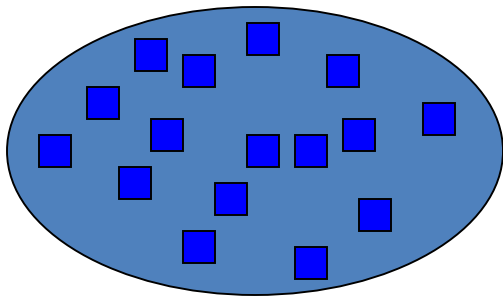
Population projections 2010-2050

	Population (Billions)		% increase
	2010	2050	2010-50
Africa	1.02	2.19	114%
Sub-Saharan	0.86	1.96	129%
Asia	4.16	5.14	23%
China	1.34	1.30	-3%
Latin America and Caribbean	0.59	0.75	27%
Europe	0.74	0.72	-3%
USA and Canada	0.34	0.45	30%
World wide	6.90	9.31	35%

Reference: Data from UN World Population prospects: The 2010 Revision (UN medium variant)

Population density

- Population density
 - The number of individuals of a species per unit area or volume at a given time
- Ovals below have same population, and different densities



Population density of countries

<i>Country</i>	<i>2006 Population (in millions)*</i>	<i>Population Density (per mi²)</i>
China	1311.4	355
India	1121.8	884
United States	299.1	80
Indonesia	225.5	307
Brazil	186.8	57
Pakistan	165.8	539
Bangladesh	146.6	2637
Russia	142.3	22
Nigeria	134.5	377
Japan	127.8	876

* These figures are from mid-2006. At the end of 2006, the United States reached a population milestone of 300 million people.

Effects of overpopulation

Some of the global effects of overpopulation include:

- ❑ Ultimate shortages of energy sources and other natural resources
- ❑ Famine
- ❑ Serious communicable diseases in dense populations
- ❑ Shortage of arable land (where food crops will grow)
- ❑ Little surplus food
- ❑ Mass extinctions of plants and animals as habitat is used for farming and human settlements
- ❑ War over scarce resources such as land area.

Demography: historical perspective

- **Demography** is the study of human population dynamics.

Achille Guillard first used the title on his book:

"Éléments de Statistique Humaine ou Démographie Comparée".

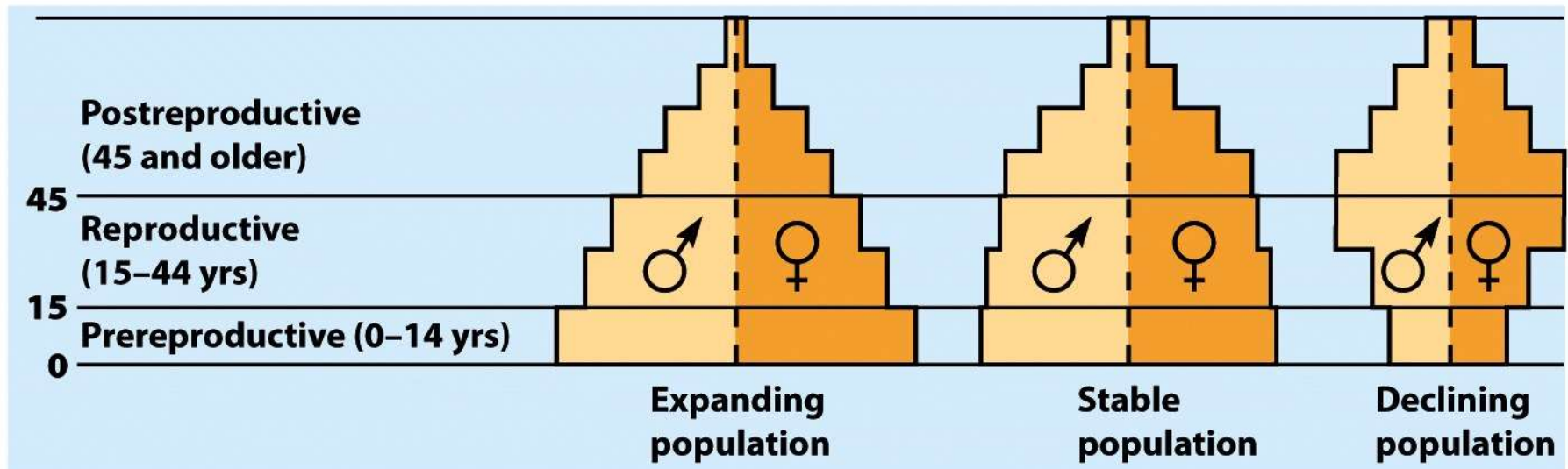
- Two Greek roots:
 - **demos** (people)
 - **graphy** (branch of knowledge regarding a particular science in this case, human populations).
- Guillard then defined demography as: ‘the mathematical knowledge of populations, their general movements, and their physical, civil, intellectual and moral state’ (Guillard 1855:xxvi).

Today demography encompass...

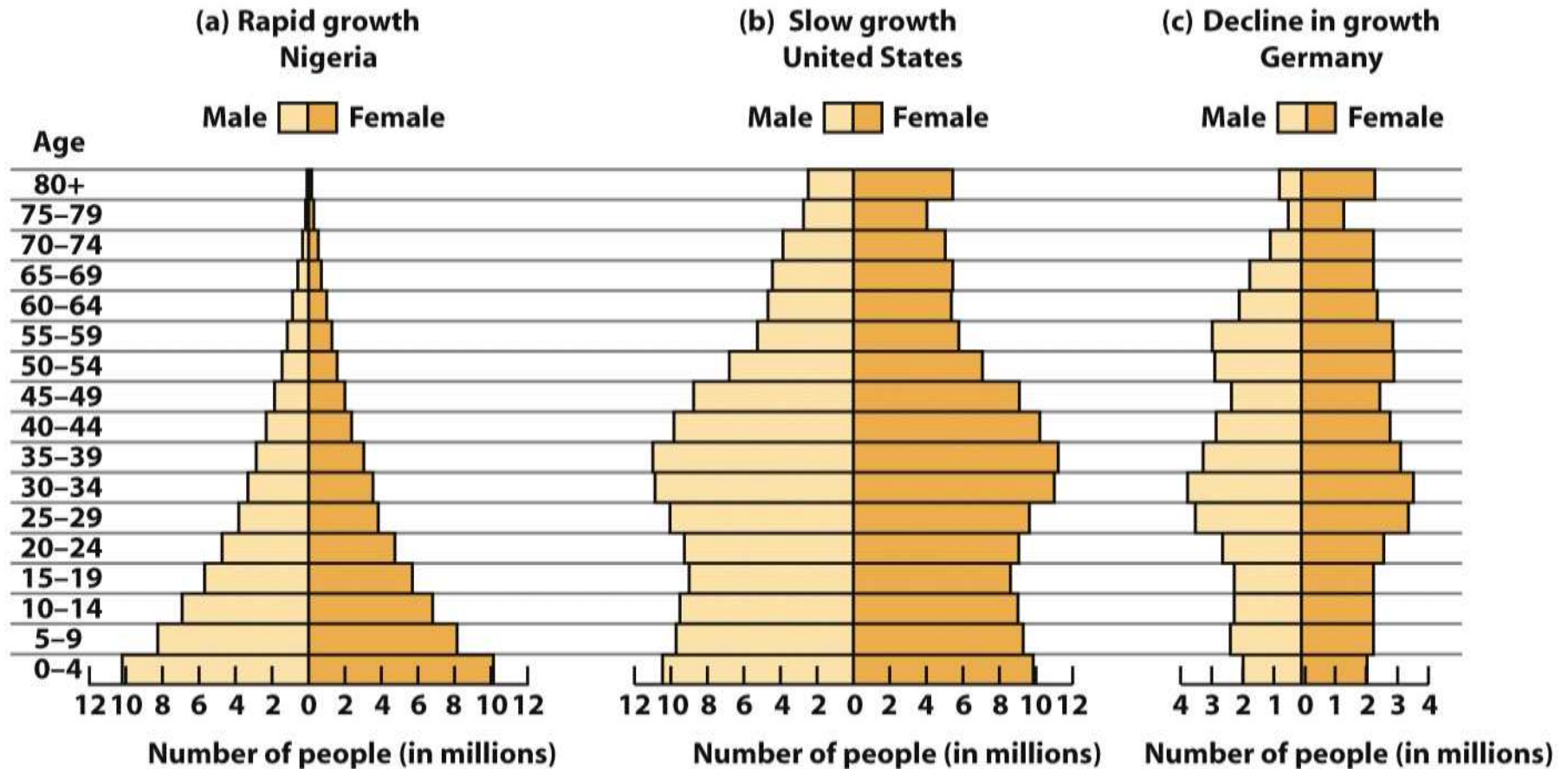
- ❑ ...the determinants and consequences of population change and is concerned with **virtually everything** that influences or can be influenced by:
 - ❑ Population Size
 - ❑ Population growth or decline
 - ❑ Population processes (levels and trends in mortality, fertility and migration that are determining population size and change).
 - ❑ Population characteristics (education, religion, or ethnicity)
 - ❑ Population structure (how many by age)

Population pyramid: age structure

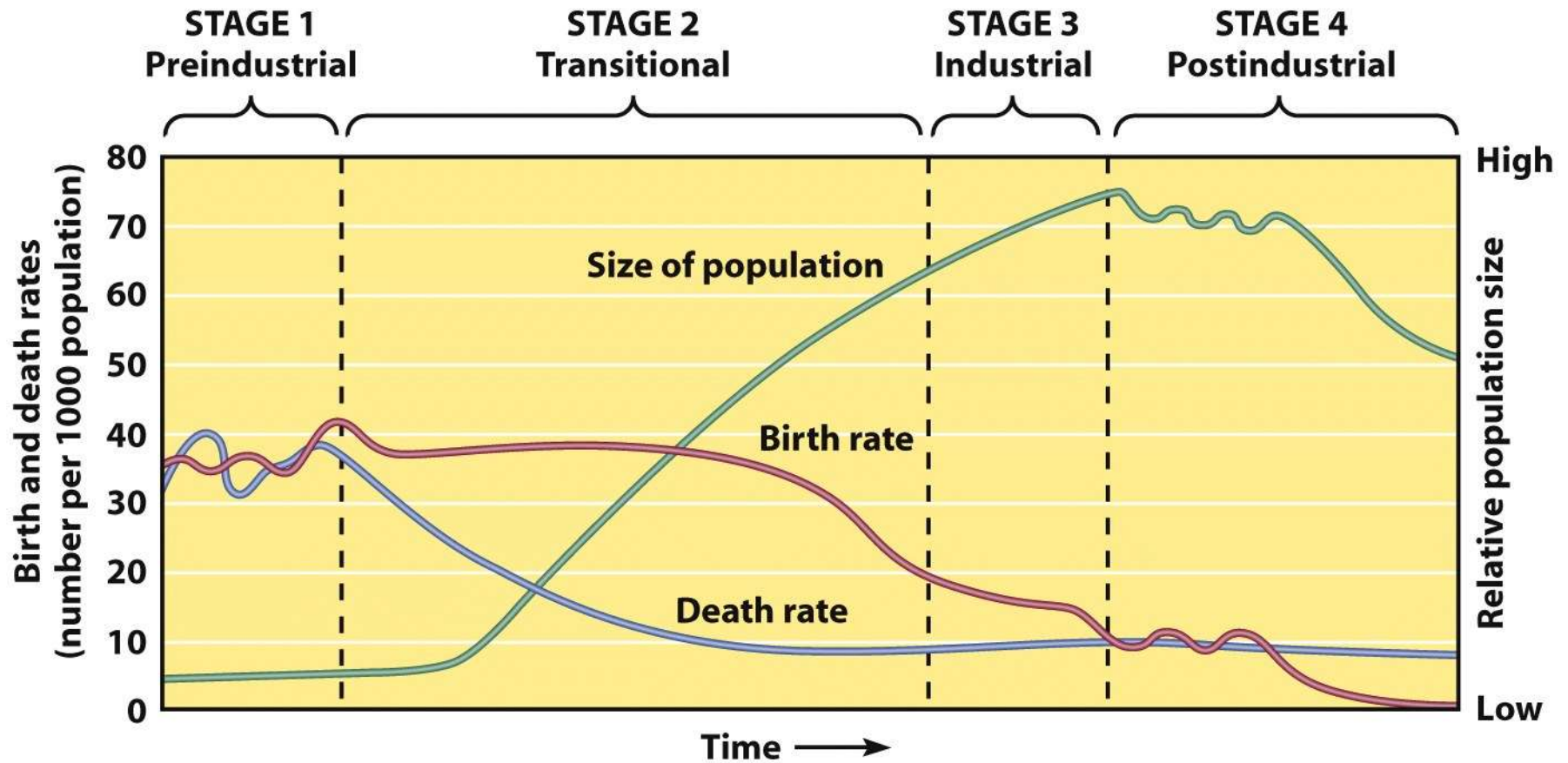
- The number and proportion of people at each age in a population



Demographics of specific countries



Demographic stages



Demographic indicators

- ❑ Because demography is interested in changes in human populations, demographers focus on specific indicators of change.
- ❑ Two of the most important indicators are birth and death rates, which are also referred to as fertility and mortality.
- ❑ Additionally, demographers are interested in migration trends or the movement of people from one location to another.

Fertility and fecundity

- **Fertility**, in demography, refers to the ability of females to produce healthy offspring in abundance. **Fecundity** is the potential reproductive capacity of a female. Some of the more common demographic measures used in relation to fertility and/or fecundity include:
 - **Crude birth rate**
 - **General fertility rate**
 - **Age-specific fertility rate**
 - **Total fertility rate**
 - **Gross reproduction rate**
 - **Net reproduction rate**

Replacement level fertility

- ❑ It refers to the number of children that a woman (or monogamous couple) must have in order to replace the existing population. Replacement level fertility is generally set at 2.1 children in a woman's lifetime (this number varies by geographic region given different mortality rates).
- ❑ The reason the number is set to 2.1 children per woman is because two children are needed to replace the parents and an additional one-tenth of a child is needed to make up for the mortality of children and women who do not reach the end of their reproductive years.

Total fertility rate

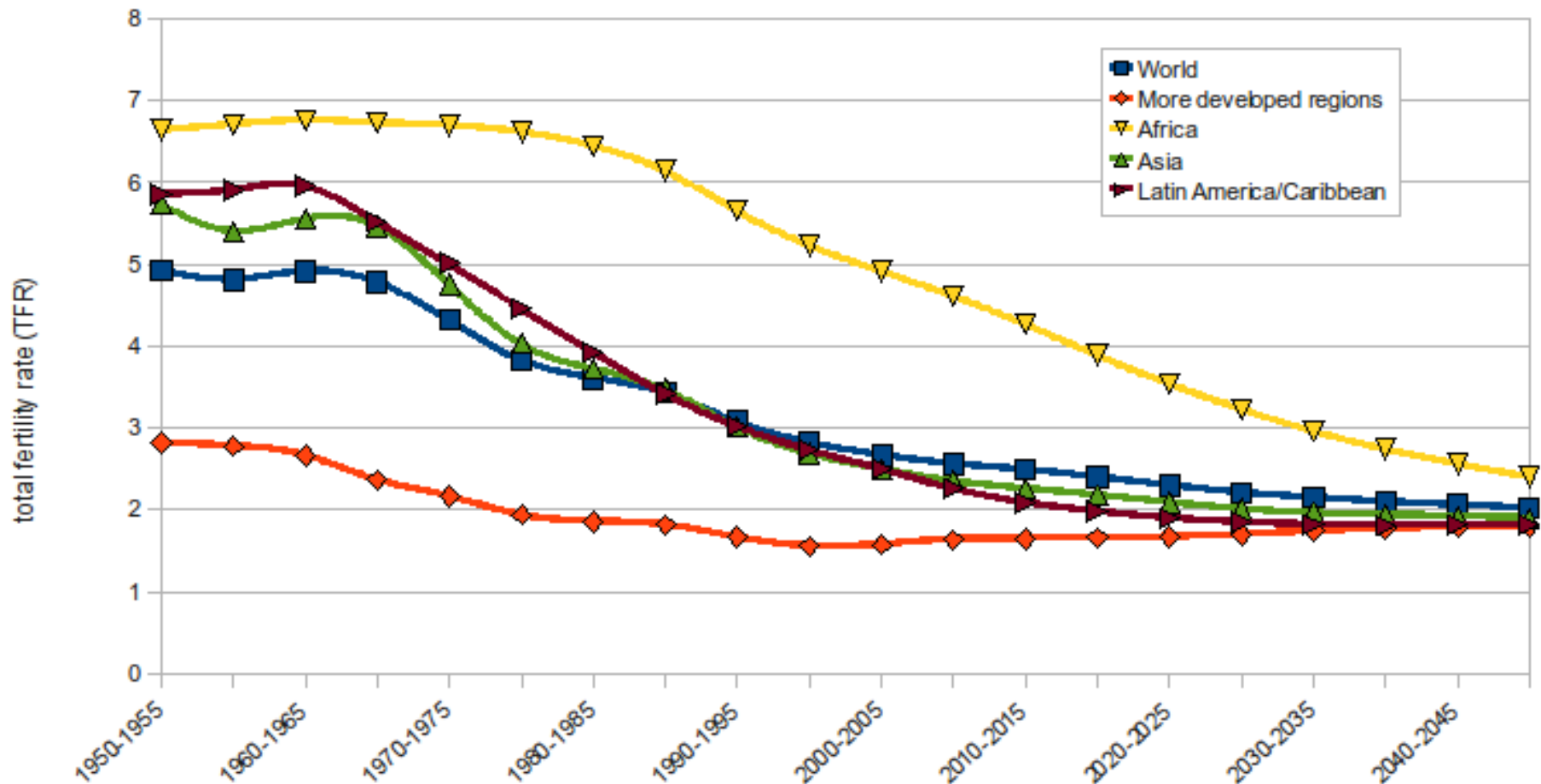
- The **total fertility rate (TFR)** of a population is the average number of children that would be born to a woman over her lifetime if;
 - (1) she were to experience the exact current age-specific fertility rates (ASFRs) through her lifetime, and
 - (2) she were to survive from birth through the end of her reproductive life. It is obtained by summing the single-year age-specific rates at a given time.

World historical and predicted total fertility rates (1950–2100) UN, 2010

Years	TFR	Years	TFR	Years	TFR
1950–1955	4.95	2000–2005	2.62	2050–2055	2.15
1955–1960	4.89	2005–2010	2.52	2055–2060	2.12
1960–1965	4.91	2010–2015	2.45	2060–2065	2.11
1965–1970	4.85	2015–2020	2.39	2065–2070	2.09
1970–1975	4.45	2020–2025	2.33	2070–2075	2.08
1975–1980	3.84	2025–2030	2.29	2075–2080	2.06
1980–1985	3.59	2030–2035	2.25	2080–2085	2.05
1985–1990	3.39	2035–2040	2.22	2085–2090	2.04
1990–1995	3.04	2040–2045	2.19	2090–2095	2.04
1995–2000	2.79	2045–2050	2.17	2095–2100	2.03

Trends in TFR 1950-2050

Trends in Total Fertility Rate by Region, 1950-2050.



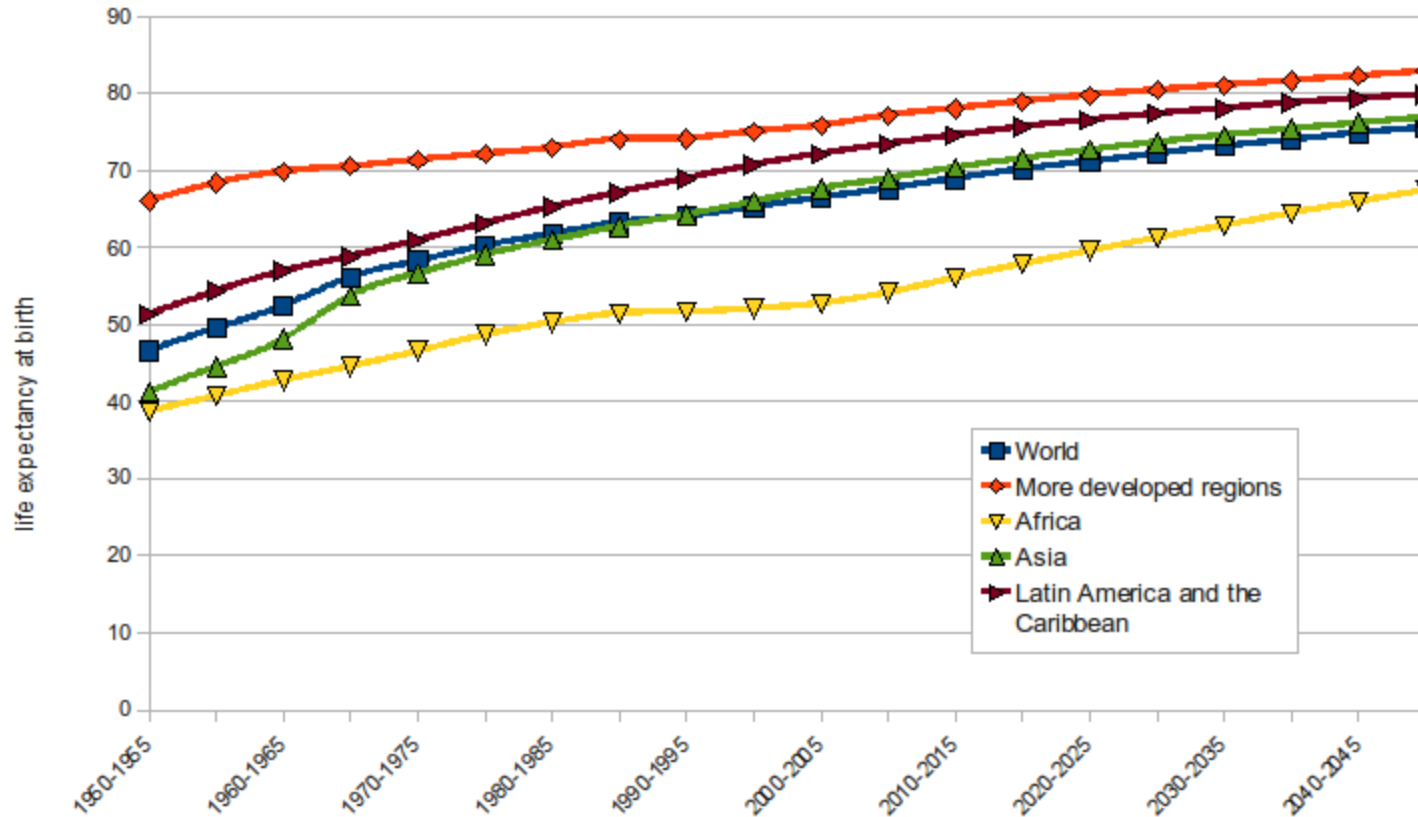
Mortality

- **Mortality** refers to the finite nature of humanity: people die. Mortality in demography is interested in the number of deaths in a given time or place or the proportion of deaths in relation to a population. Some of the more common demographic measures of mortality include:
 - **crude death rate**: the annual number of deaths per 1000 people
 - **infant mortality rate**: the annual number of deaths of children less than 1 year old per thousand live births
 - **life expectancy**: the number of years which an individual at a given age can expect to live at present mortality rates

Life expectancy at birth by region, 1950-2050

Life Expectancy at Birth by Region, 1950-2050.

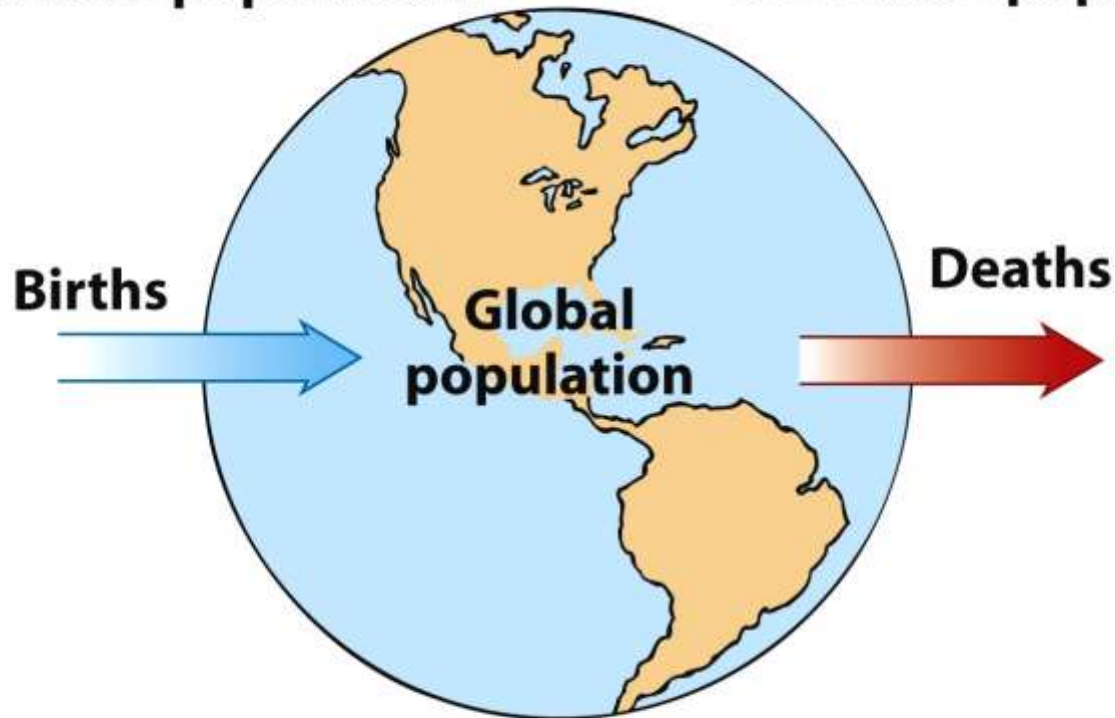
Source: UN World Population Prospects, 2008.



Change in population size

Increases population:

Decreases population:

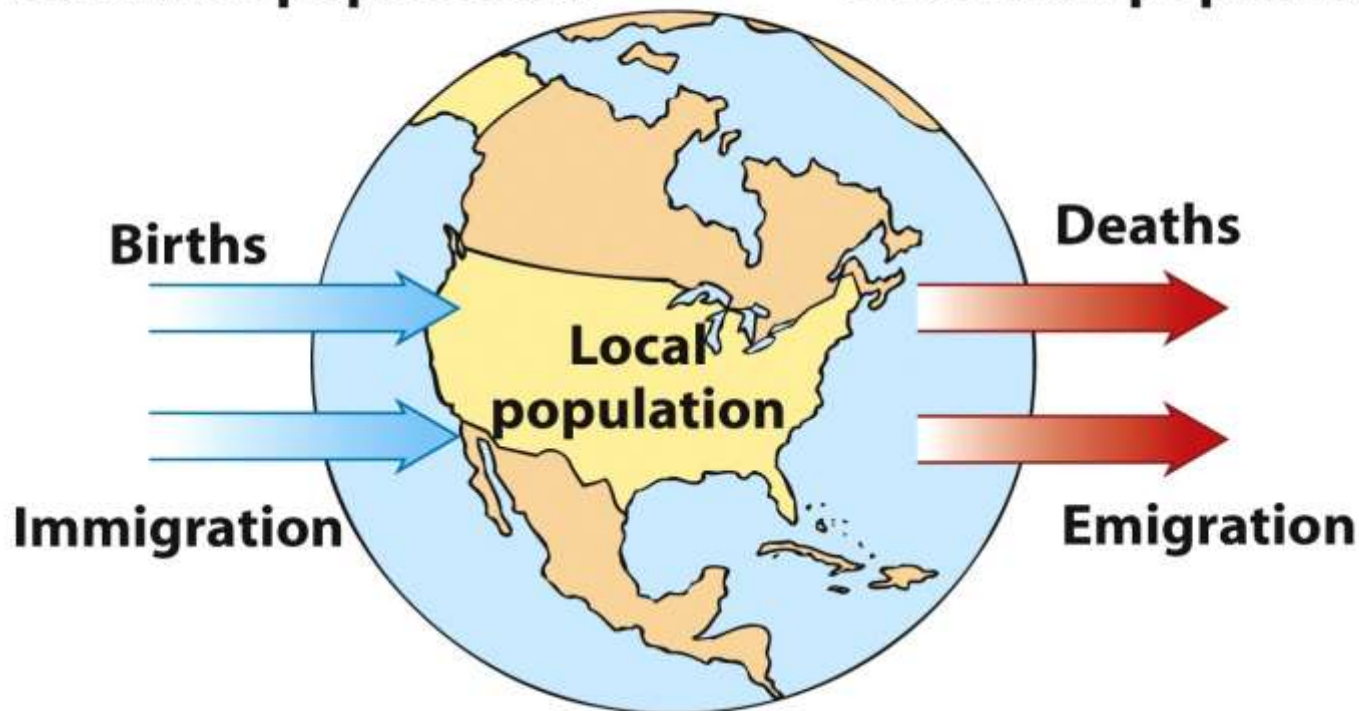


On global scale the change in a population is due to the number of births and deaths.

Migration : change in population size

Increases population:

Decreases population:



In local populations, such as the population of the United States, the number of births, deaths, immigrants, and emigrants affect population size.

Calculating population change

$$\begin{array}{ccccc} \text{Growth} & & \text{Death} & & \text{Emigration} \\ \text{rate} & & \text{rate} & & \text{rate} \\ \downarrow & & \downarrow & & \downarrow \\ \mathbf{r} = & \mathbf{(b - d)} & + & \mathbf{(i - e)} \\ \uparrow & & \uparrow & & \\ \text{Birth} & & \text{Immigration} & & \\ \text{rate} & & \text{rate} & & \end{array}$$

Birth (b), Death (d), Immigration (i) and Emigration (e) are calculated per 1000 people

FAMILY PLANNING: WHY IT IS STILL RELEVANT

Background: Post 2015 Agenda

- ❑ Opportunity to redefine the global agenda for reproductive health & development
- ❑ Reflecting on ICPD and Beijing programme of action
- ❑ FP 2020 (120/20)
- ❑ Sustainable Development Goals (3.7 and 5.6)



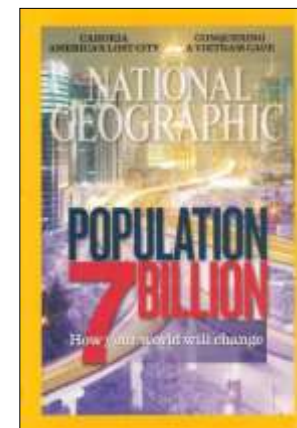
SDGs – 3.7 and 5.6

- ❑ 3.7 - By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes
- ❑ 5.6 - Ensure universal access to sexual and reproductive health and reproductive rights as agreed in accordance with the Programme of Action of the International Conference on Population and Development and the Beijing Platform for Action and the outcome documents of their review conferences

Current situation on family planning

Constraints:

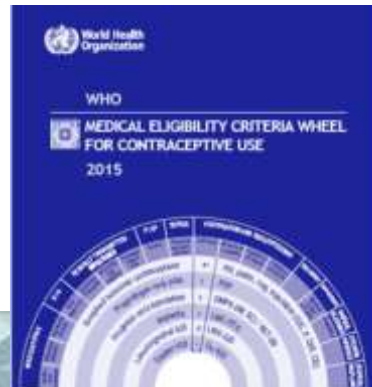
- 26 countries have CPR below 20%
- 225 million couples have an unmet need for family planning
- Decreased investment in contraceptive research and development by industry, despite increased demand
- Shifting international priorities in the past decades
- Mis and dis-information



Opportunities:

- ❑ MDG 5b: Universal access to reproductive health
 - FP and other SRH services
- ❑ Renewed interest in supporting family planning internationally

Contraceptive Guidelines



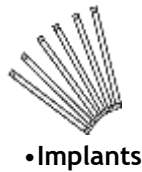
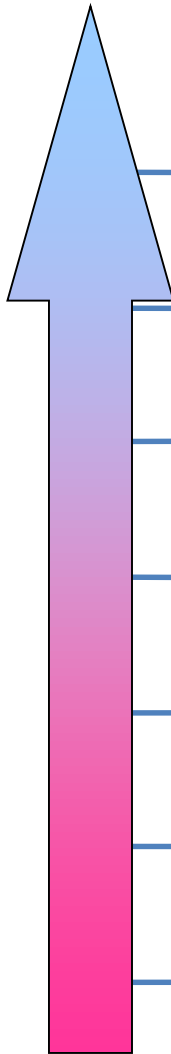
- ❑ *Continuous Identification of Research Evidence (CIRE) system:*
 - identifies,
 - critically appraises,
 - and synthesize best available evidence for FP intervention
 - Next MEC revision completed in 2015

•Most effective

• Generally 2 or fewer pregnancies per 100 women in one year

• About 15 pregnancies per 100 women in one year

• About 30 pregnancies per 100 women in one year



•Implants



•Sterilisation for women



•Vasectomy



•IUD

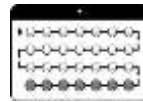
•How to make your method more effective

•One-time procedures; nothing to do or remember

•Need repeat injections every 1, 2 or 3 months



•Injectables



•Pills

•Must take a pill each day



•LAM

•Must follow LAM instructions



•Male condoms

•Must use every time you have sex; requires partner's cooperation



•Diaphragm

•Must use every time you have sex



•Female condoms

•Must use every time you have sex; requires partner's cooperation



•Fertility Awareness-Based Methods (selected)

•Must abstain or use condoms on fertile days; requires partner's cooperation



•Spermicides

•Must use every time you have sex

•Least effective

FAMILY PLANNING AND ECONOMIC ASPECTS

Decrease in fertility strengthens economy

- ❑ Family planning programs can reduce fertility in resource poor settings such as rural Bangladesh and Ghana
- ❑ Fertility declines are associated with an increase in women's health, earnings, and participation in paid employment
- ❑ Children of women with better access to FP and health services are healthier and better educated than those women without access
- ❑ Household level behavioral effects on the female labour supply, child health, and education can lead to large macroeconomic demographic benefits

Going beyond health: findings from Matlab, Bangladesh

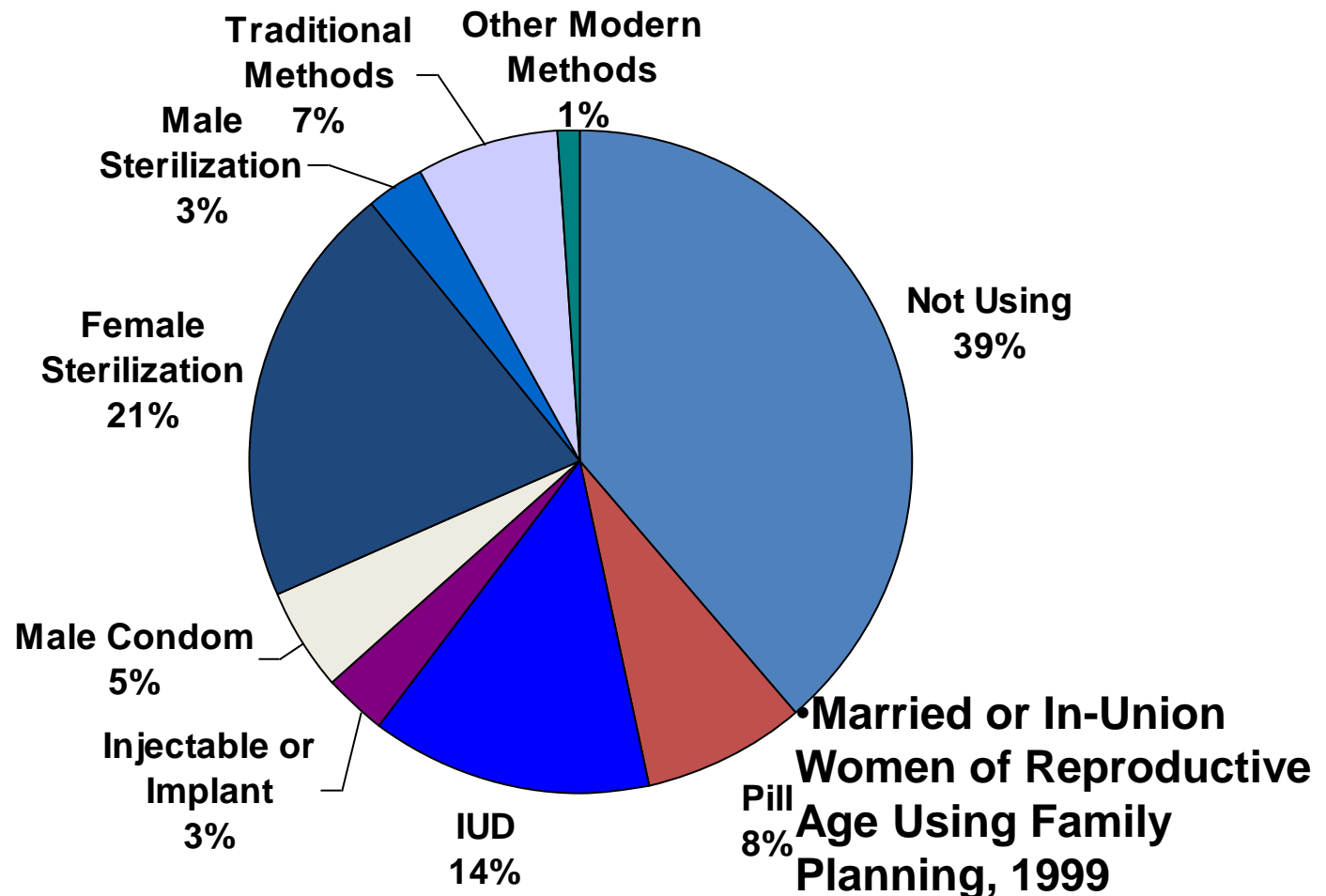
To comparison area, after 19 years: (1977-1996):

- Child-to-women ratio: 16% lower
- Women aged 35-54 years in 1996 had 23% fewer children
- Mortality in children under 5 years was 30% lower
- Women (aged 25-54) average BMI: $> 1 \text{ kg/m}^2$
- Monthly earnings in 1996: 40% higher
- Married women reported 25% more physical assets per adult in their household
- Children: better BMI and more completed schooling

Reference: Canning and Schultz, 2012

STATUS OF UNMET NEED IN FAMILY PLANNING

Family Planning Methods, Worldwide

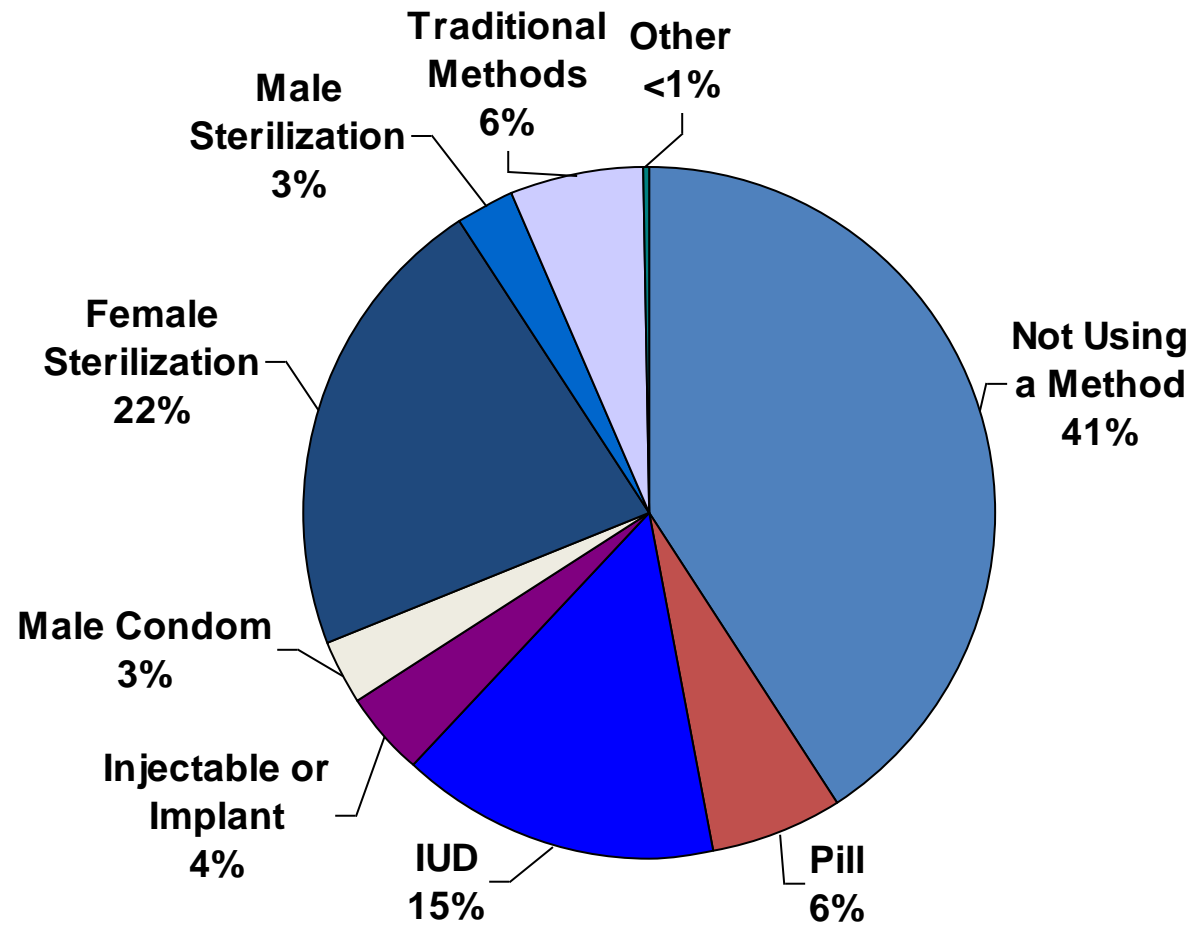


•Note: Total exceeds 100 due to rounding.

•Source: United Nations Population Division, *World Contraceptive Use 2005*.

Family Planning Methods, Developing Countries

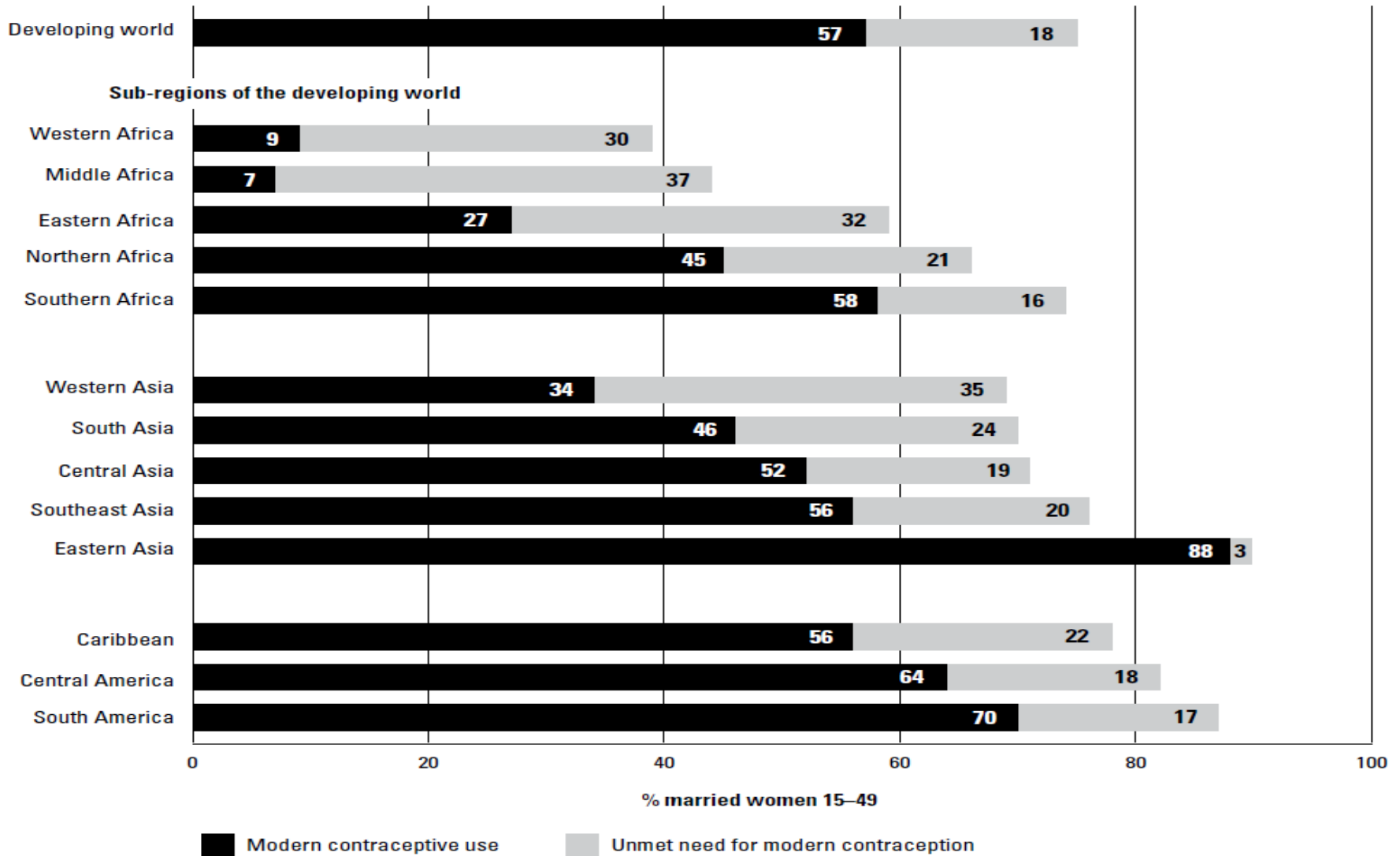
•Married or In-Union Women of Reproductive Age Using Family Planning, 1999



•Note: Total exceeds 100 due to rounding.

•Source: United Nations Population Division, *World Contraceptive Use 2005*.

There are large variations in married women's level of unmet need for and use of modern contraception among subregions of the developing world in 2012.



Reasons for high unmet need

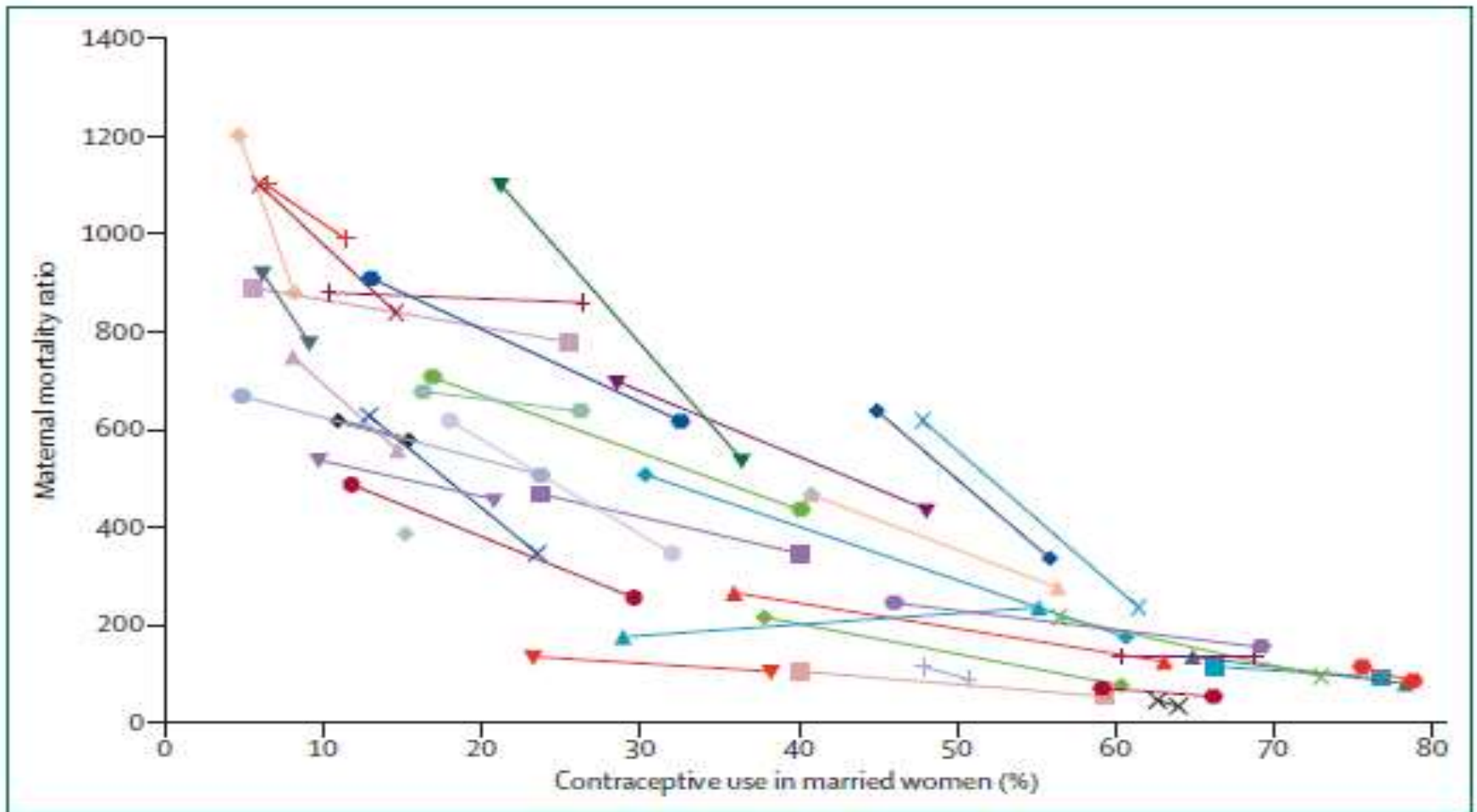
- ❑ Perceived lack of exposure to pregnancy was the most common reason cited
 - Between one-third and two-thirds of women with unmet need said they were never or infrequently having sex.
 - Believed they could not become pregnant because of menopause, breastfeeding, or another reason.
- ❑ Opposition to family planning (by women, their husbands, or others).
- ❑ Gender imbalance –
 - Men's unmet need tends to be lower because men want to have more children (or sooner) than do women
- ❑ Method-related problems were cited by about one-third of women with unmet need.
 - Problems related to side effects and health concerns
 - Cost and access also mentioned.
- ❑ Lack of knowledge about methods or sources of supply

IF UNMET NEEDS ARE MET IN DEVELOPING COUNTRIES...

- Serving all women in developing countries who currently have an unmet need for modern methods would prevent
 - unintended pregnancies would drop by 70%, from 74 million to 22 million per year;
 - maternal deaths would drop by 67%, from 290,000 to 96,000;
 - newborn deaths would drop by 77%, from 2.9 million to 660,000;
 - the burden of disability related to pregnancy and delivery experienced by women and newborns would drop by two-thirds

Singh and Darroch, Adding it up. 2014

FAMILY PLANNING AND EFFECTS ON MATERNAL HEALTH



Maternal mortality ratio and contraceptive use in married women in 40 countries over time

Estimates of contraceptive use were obtained from Demographic and Health surveys, done between 1986 and 2009, in 40 developing countries (countries and dates listed in the appendix). The WHO time series of estimates⁷ was used to obtain maternal mortality ratios that corresponded to the dates of each of the contraceptive use estimates. The first datapoint corresponds to the earliest Demographic and Health survey data available for that country, and the second datapoint corresponds to the most recent survey data. The average length of time between surveys was 12 years (ranging from 4–21 years). Median slope –8.5 (IQR –22.2 to –2.3).

To summarize decline in fertility has several benefits...

- ❑ Maternal and infant mortality benefit from wide spread use of contraception
- ❑ Less acute stresses on public services and infrastructure
- ❑ Boost to the economy (the demographic dividend): labour force grows rapidly (women also works)
- ❑ Benefit economy by improving general health and reducing fertility

Follow us on Twitter [@HRPresearch](https://twitter.com/HRPresearch)

Visit our website [who.int/reproductivehealth](https://www.who.int/reproductivehealth)