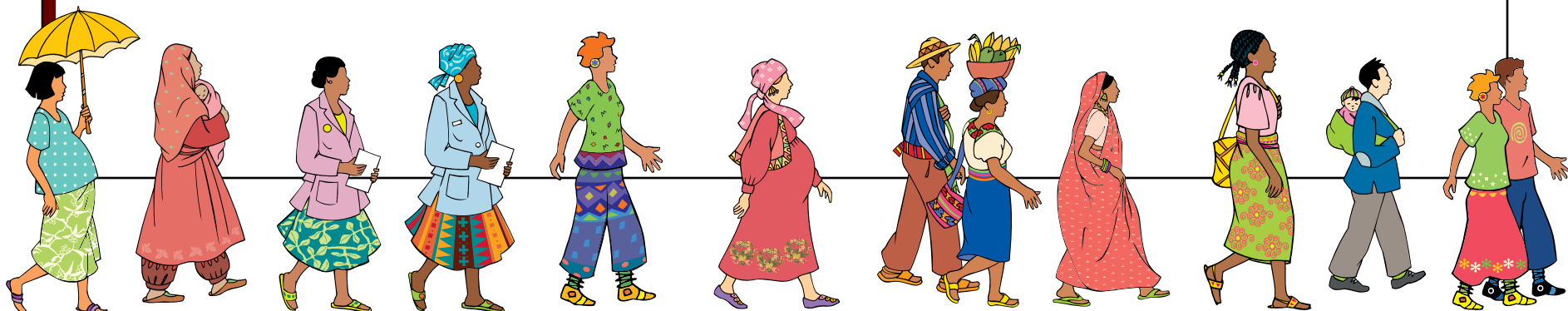


# Principles of Population & Demography

**Moazzam Ali MD, PhD, MPH**

Department of Reproductive Health and Research  
World Health Organization

Training Course in Sexual and Reproductive Health Research  
Geneva 2012



# Outline of presentation



- Definitions of population & demography and relevant indicators
- Why family planning is still important
  - MDG, RH Strategy, UNSG Strategy
- Key indicators on family planning
  - Contraceptive Prevalence
  - Unmet need for FP
- Special target populations groups
- Need for research in population & family planning

# Population: definition

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- “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

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- 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

# Trends in global population growth

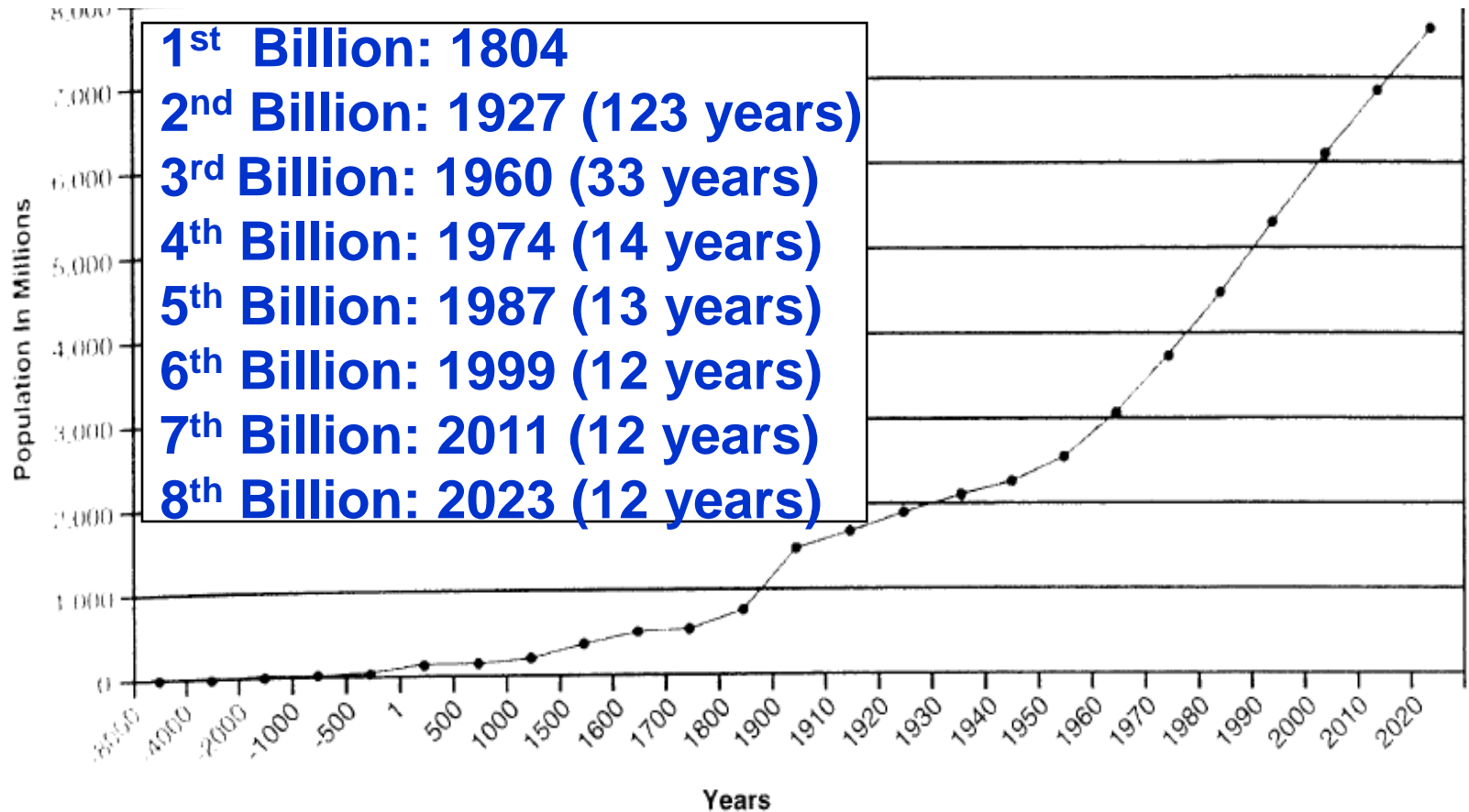
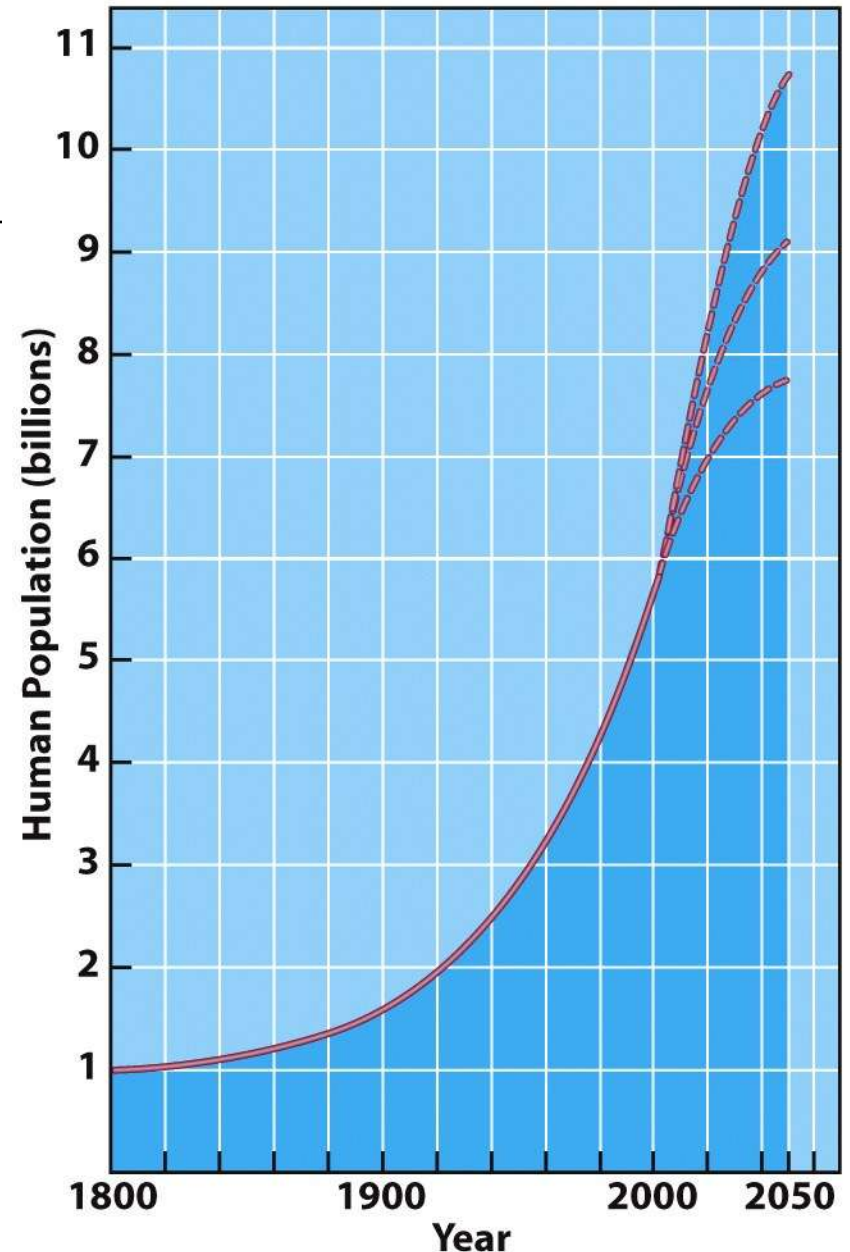


Figure 3-1 The Growth of Population and, in Particular, the Extraordinary Changes of the Past 200 Years. *Source:* Data for the years 8000 to 1900 from U.S. Census Bureau, Population Division, International Programs Center (<http://www.census.gov/ipc/www/worldhis.html>), and for the years 1910-2020 from United Nations Population Division, *World Population Prospects: The 2004 Revision Population Database* (<http://esa.un.org/unpp/>). Accessed June 22, 2005.

# 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



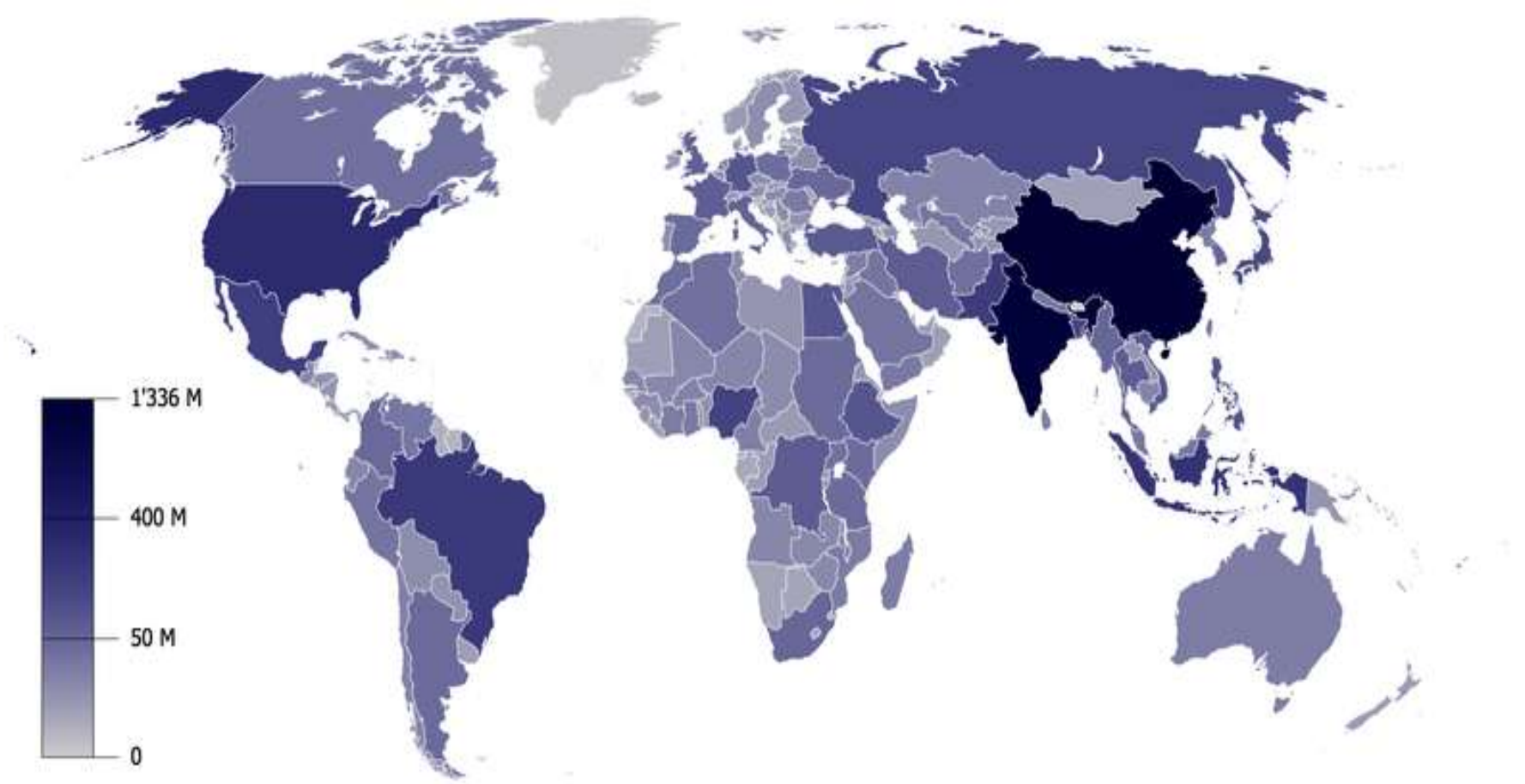


# Reaching the 7 billion mark...

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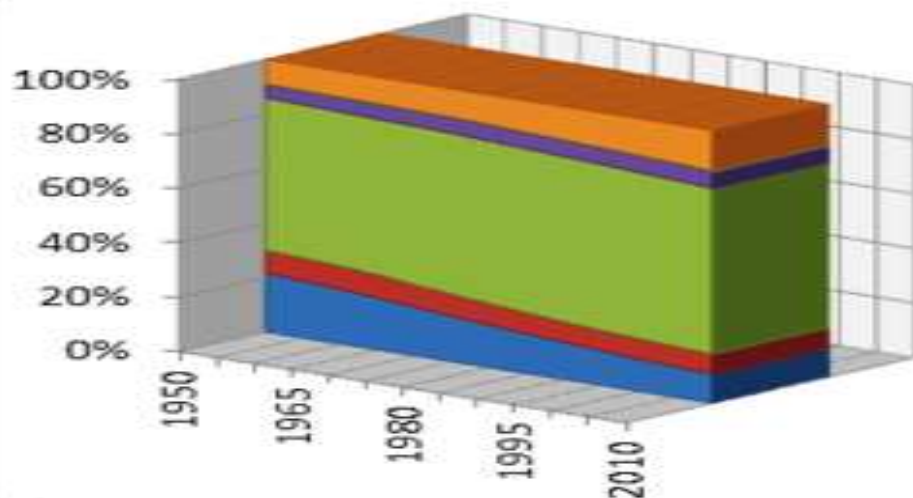
- World Population to surpass 7 Billion in 2011 and will reach seven billion on 31<sup>st</sup> October, a milestone that offers unprecedented challenges and opportunities to all of humanity, according to UNFPA

# World population distribution: global overview



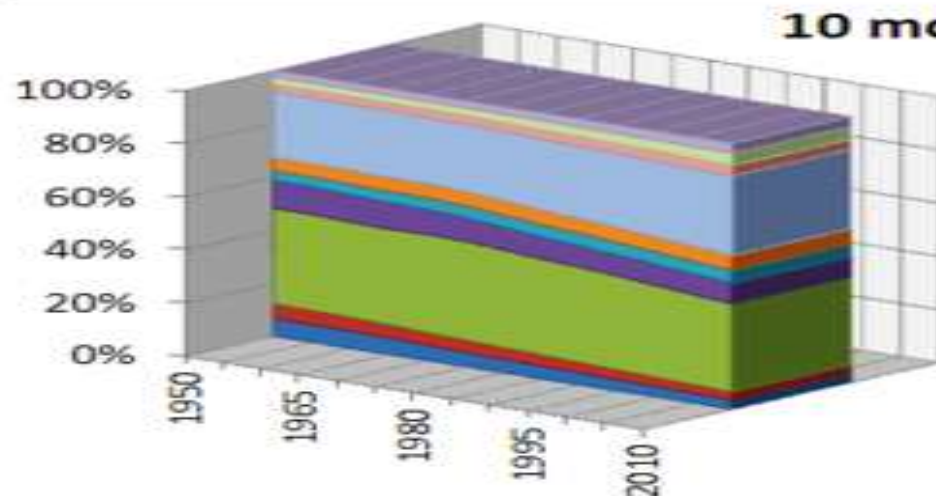


## Share of Population from 1950 to 2010 & Population Growth in the 2000-2010 Decade



### Continents

- (26.1%) #2 Africa
- (15.0%) #6 Oceania
- (13.2%) #5 South America
- (12.7%) #1 Asia
- (10.4%) #4 North America
- (00.8%) #3 Europe



### 10 most populated countries

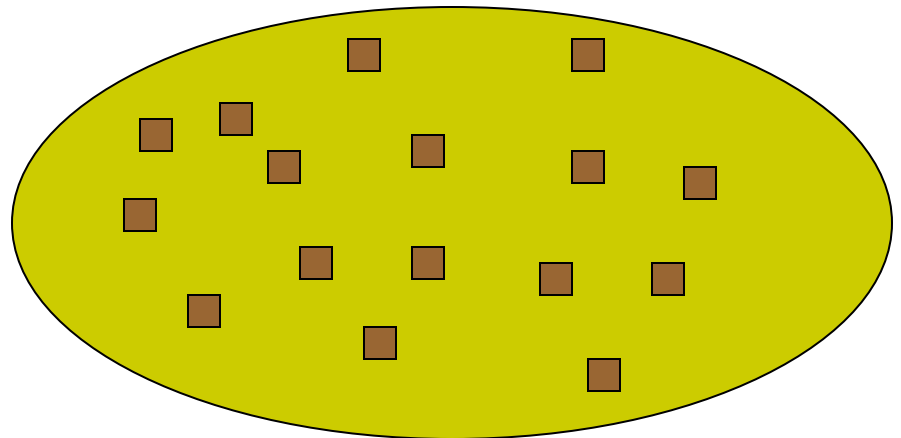
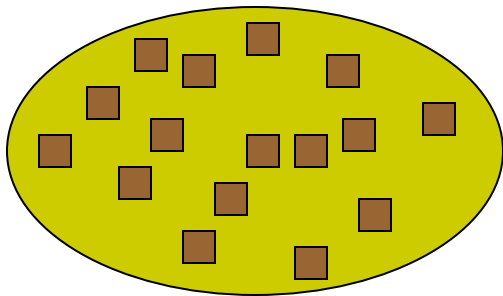
- (26.8%) #8 Nigeria
- (24.7%) #6 Pakistan
- (16.8%) #7 Bangladesh
- (16.5%) #2 India
- (13.3%) #4 Indonesia
- (12.2%) #5 Brazil
- (10.4%) #3 United States
- (06.9%) #1 China
- (00.2%) #10 Japan
- (-4.3%) #9 Russia

Source: Department of Economic and Social Affairs, United Nations Population Division (UNPD). 2010. Available on-line at: <http://esa.un.org/unpp/>

# 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 mi<sup>2</sup>)</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

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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.



# Effects of overpopulation

---

- ❑ High birth rates
- ❑ Lower life expectancies
- ❑ Lower levels of literacy
- ❑ Child poverty
- ❑ Higher rates of unemployment, especially in urban
- ❑ Poor diet with ill health and diet-deficiency diseases (e.g. rickets)
- ❑ Low per capita GDP
- ❑ Increasingly unhygienic conditions
- ❑ Government stretched economically
- ❑ Increased crime rates resulting from people stealing resources to survive

# Demography: historical perspective

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

**Achille Guillard** first used the title on his book:

*"Elements de Statistique Humaine ou Demographie Comparee"*.

- 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).

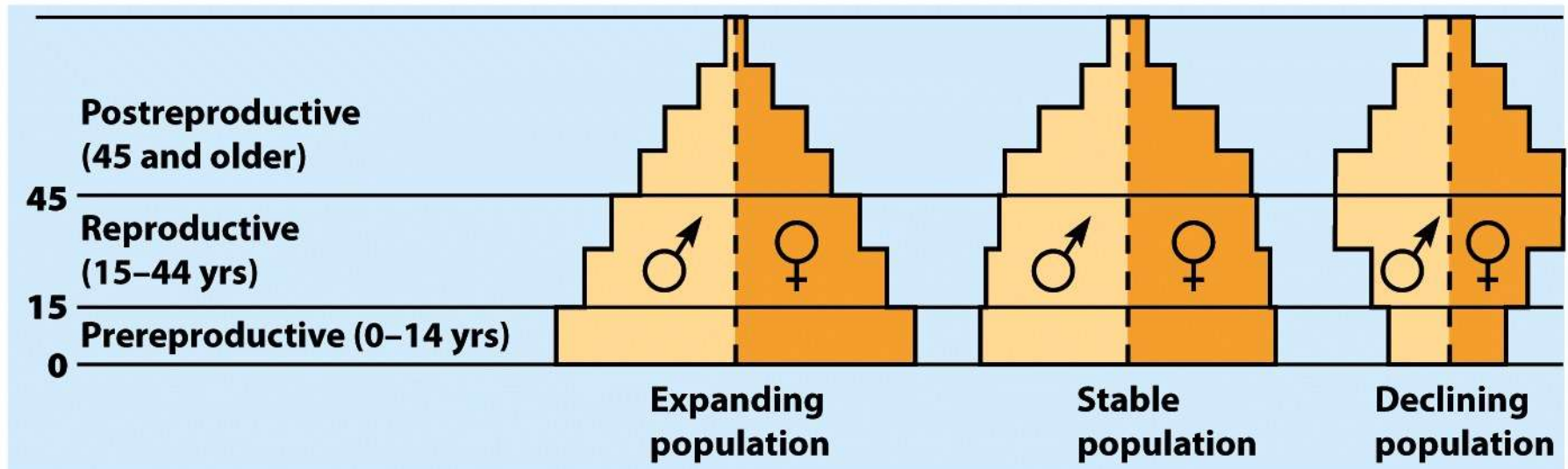
# Today demography encompass...

---

- ...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)

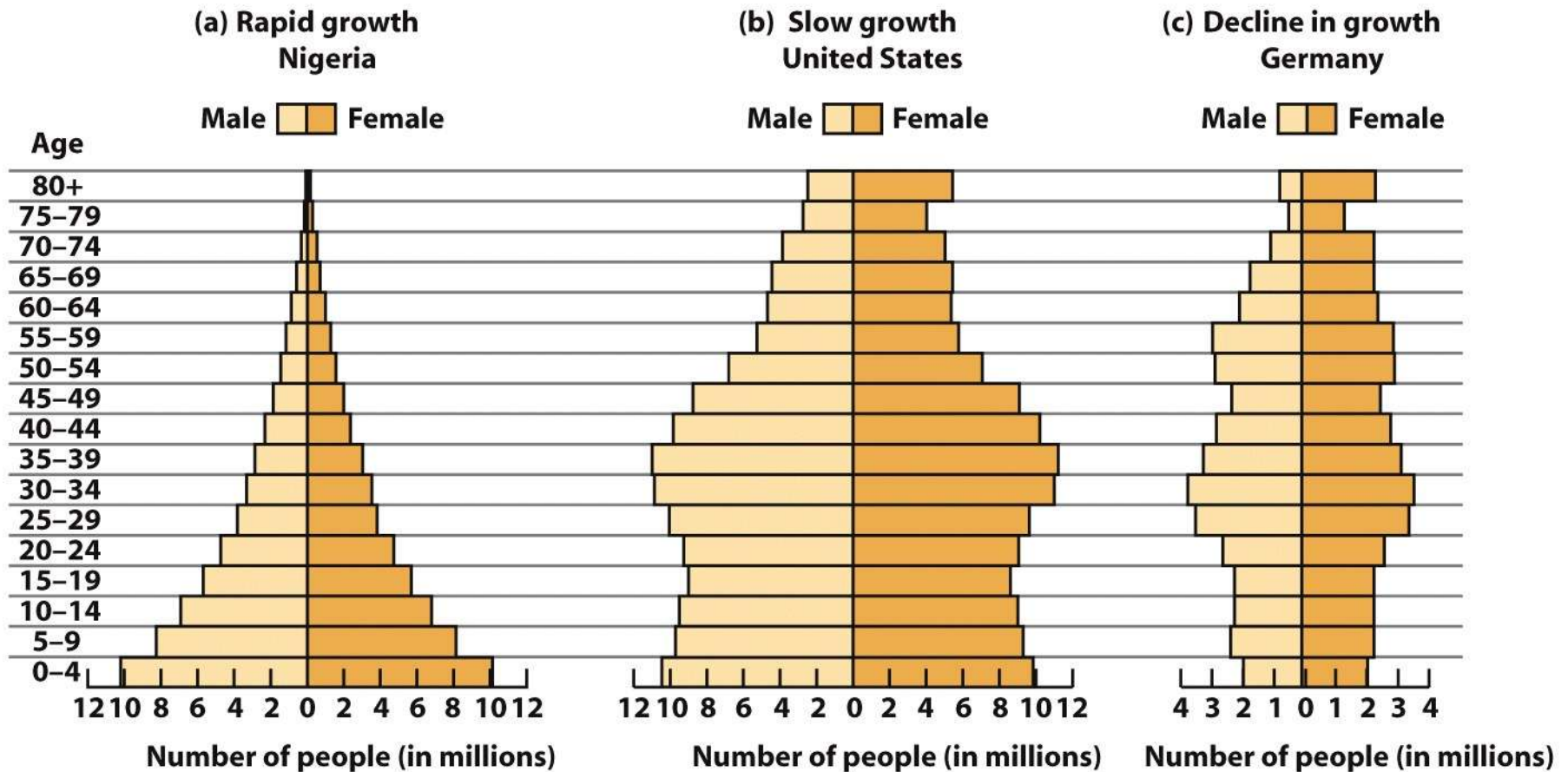
# Population pyramid: age structure

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





# Demographics of specific countries



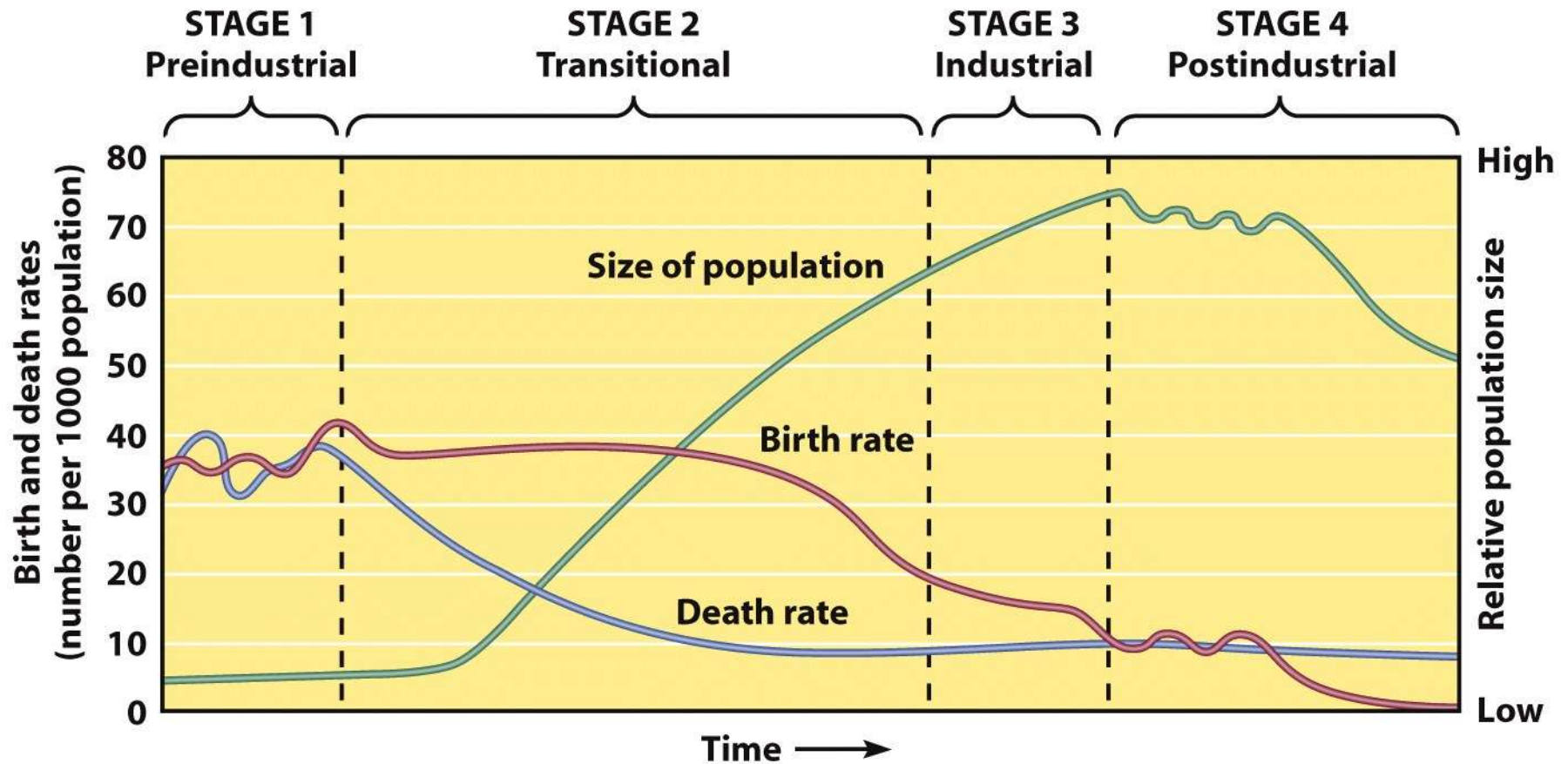


# Demographic stages

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- Pre-industrial Stage
  - Birth and death rates high
  - Modest population growth
- Transitional Stage
  - Lowered death rate
  - Rapid population growth
- Industrial Stage
  - Birth rate decline
  - Population growth slow
- Post Industrial Stage
  - Low birth and death rates
  - Population growth very slow

# Demographic stages



# Demographic indicators

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- 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.

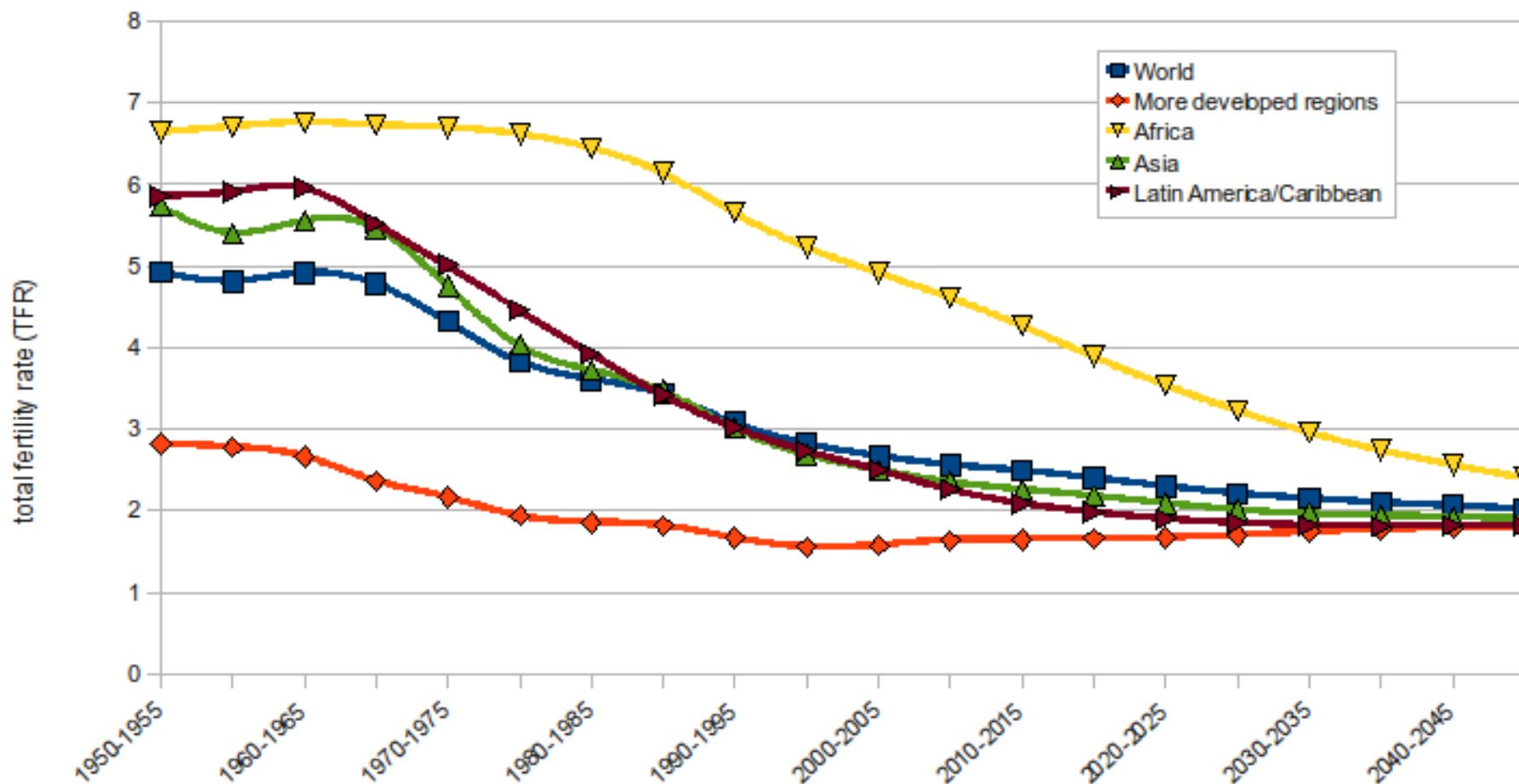
# World historical and predicted total fertility rates (1950–2100) UN, 2010

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



# Trends in TFR 1950-2050

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



# Mortality

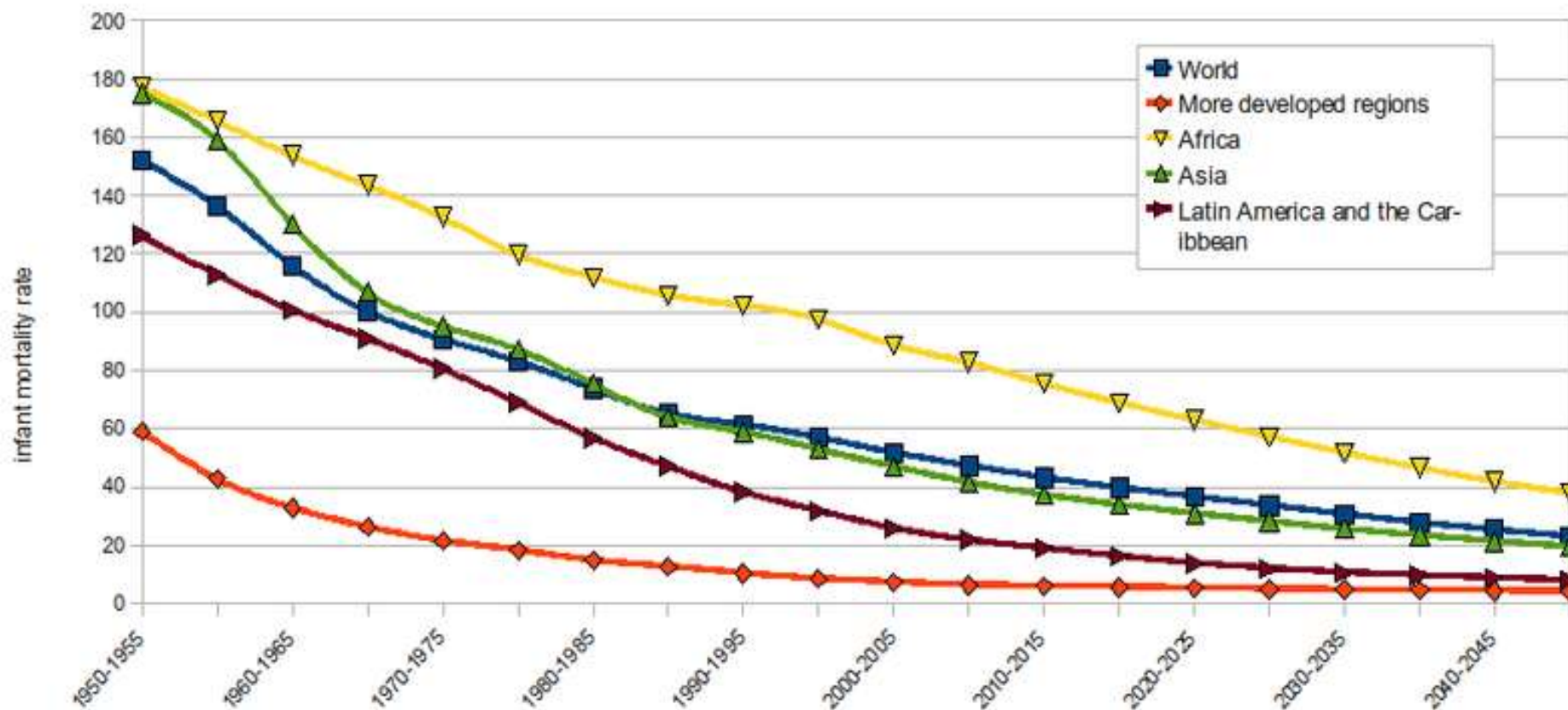
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- **Mortality** refers to the finite nature of humanity: people die. Mortality in demography is interested in the number of deaths in a given time or place or the proportion of deaths in relation to a population. Some of the more common demographic 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

# Infant mortality rate by region 1950-2050

Infant Mortality Rate by Region, 1950-2050.

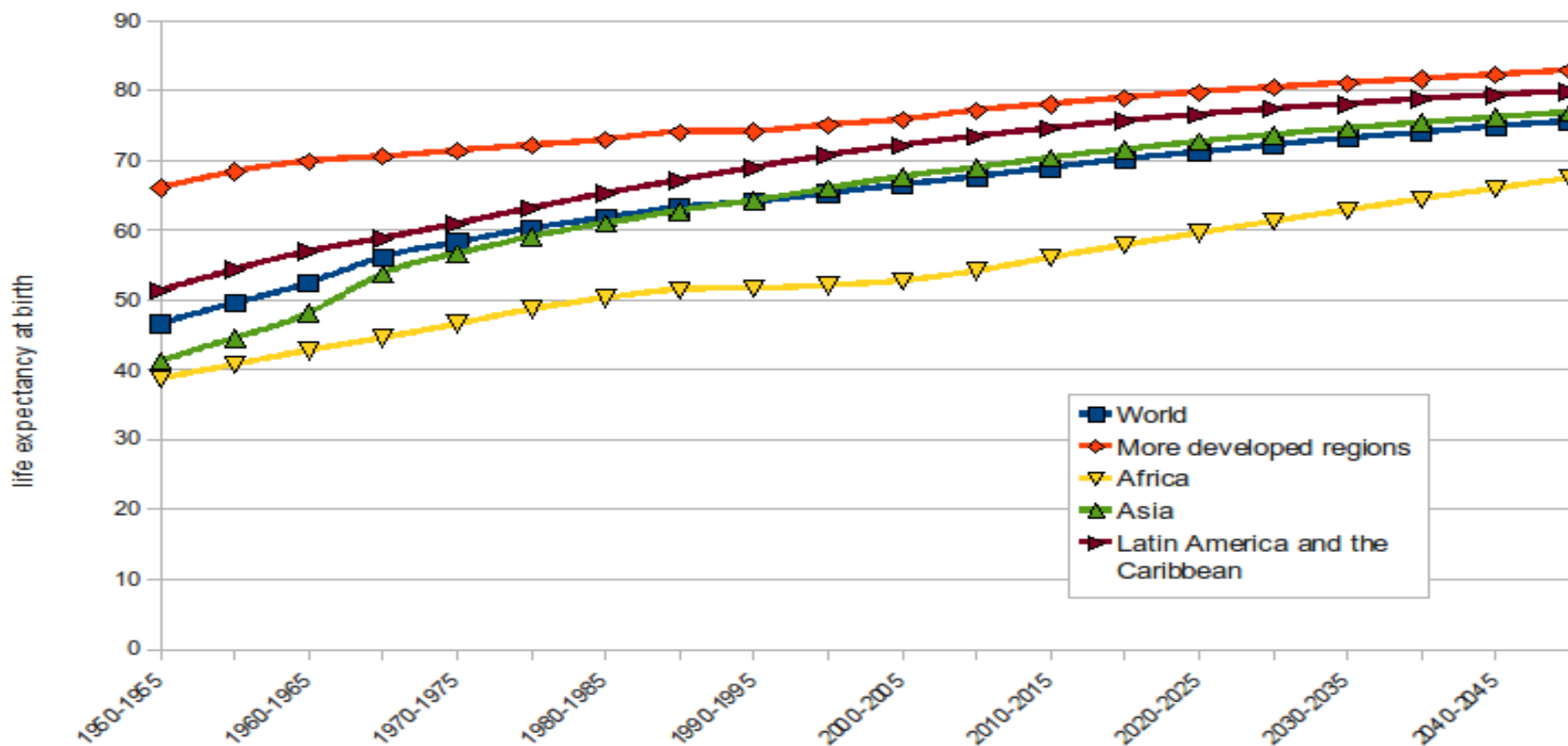
Source: UN World Population Prospects, 2008.



# Life expectancy at birth by region, 1950-2050

Life Expectancy at Birth by Region, 1950-2050.

Source: UN World Population Prospects, 2008.

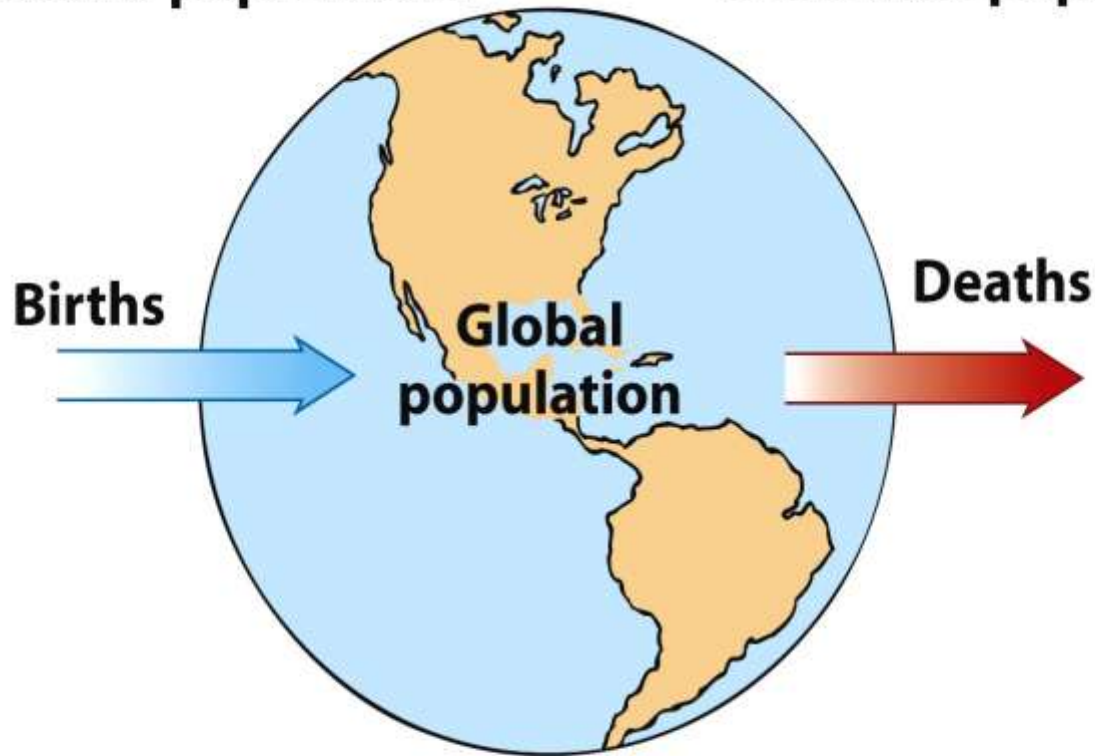


# Change in population size

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**Increases population:**

**Decreases population:**



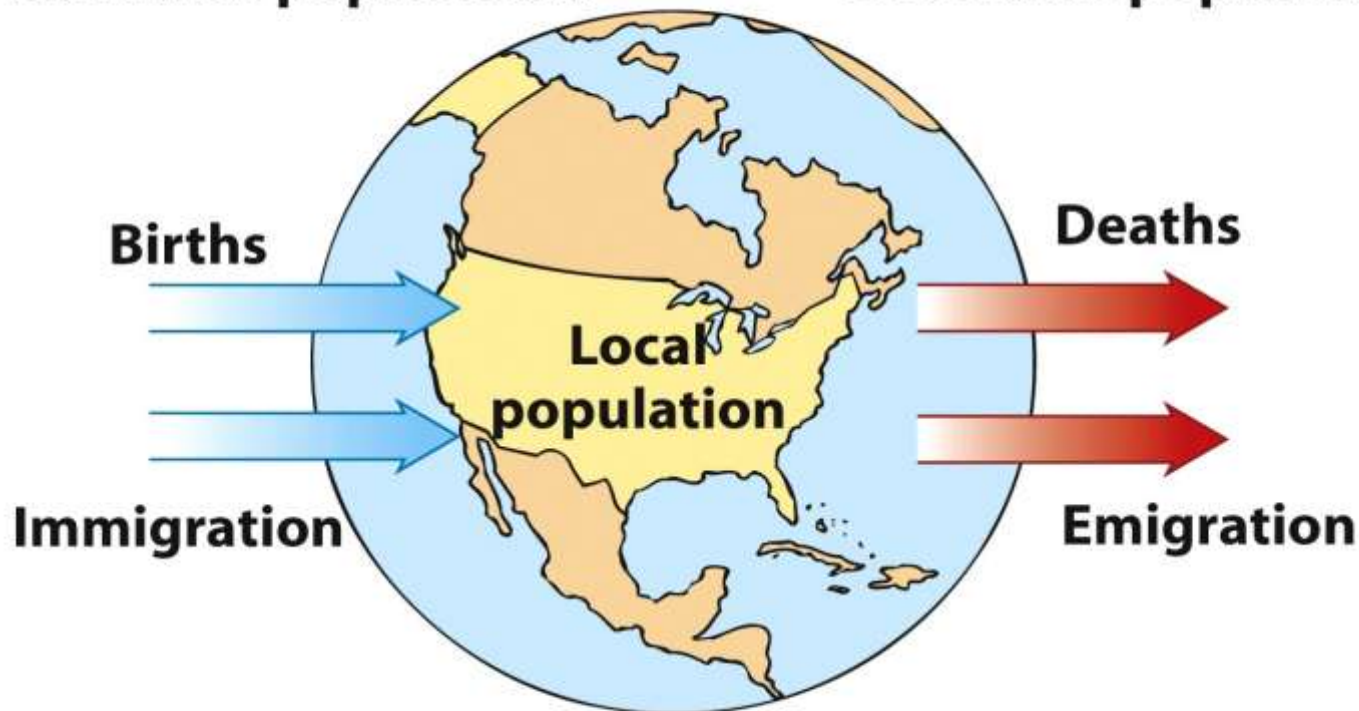
**On global scale the change in a population is due to the number of births and deaths.**

# 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

Why Family Planning is still important ?

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# Family planning can help prevent unintended and unwanted pregnancies

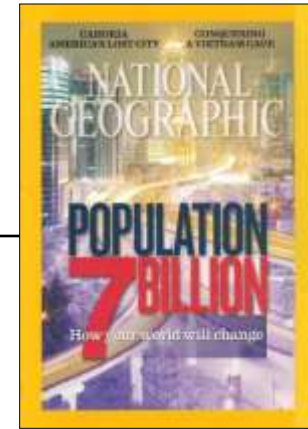
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- It has intrinsic benefits to the women themselves, and contributes to child health and survival
  - gender equality and empowerment
  - fulfillment of human rights
  - child survival,
  - poverty reduction
  - opportunities (e.g. education, economic empowerment)
  - maternal health and survival
  
- Estimated that 27% of maternal deaths can be prevented by meeting unmet need for family planning

# Current situation on family planning

## Constraints:

- 26 countries have CPR below 20%
- 215 million couples have an unmet need for family planning
- Decreased investment in contraceptive research and development by industry, despite increased demand
- Active mis - and disinformation



## Opportunities:

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

# MDG 5: improve maternal health

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- 5 A: Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio
  - 5.1 Maternal mortality ratio
  - 5.2 Proportion of births attended by skilled health personnel
  
- 5.B: Achieve, by 2015, universal access to reproductive health
  - 5.3 Contraceptive prevalence rate
  - 5.4 Adolescent birth rate
  - 5.5 Antenatal care coverage (at least one visit and at least four visits)
  - 5.6 Unmet need for family planning

# UN Secretary General's Global Strategy for Women's and Children's Health: 2010



## Components

- ❑ Country-led health plans
- ❑ Comprehensive, integrated package of essential interventions and services
- ❑ Integrated care
- ❑ Health systems strengthening
- ❑ Health workforce capacity building
- ❑ Coordinated research and innovation



## Role of UN agencies

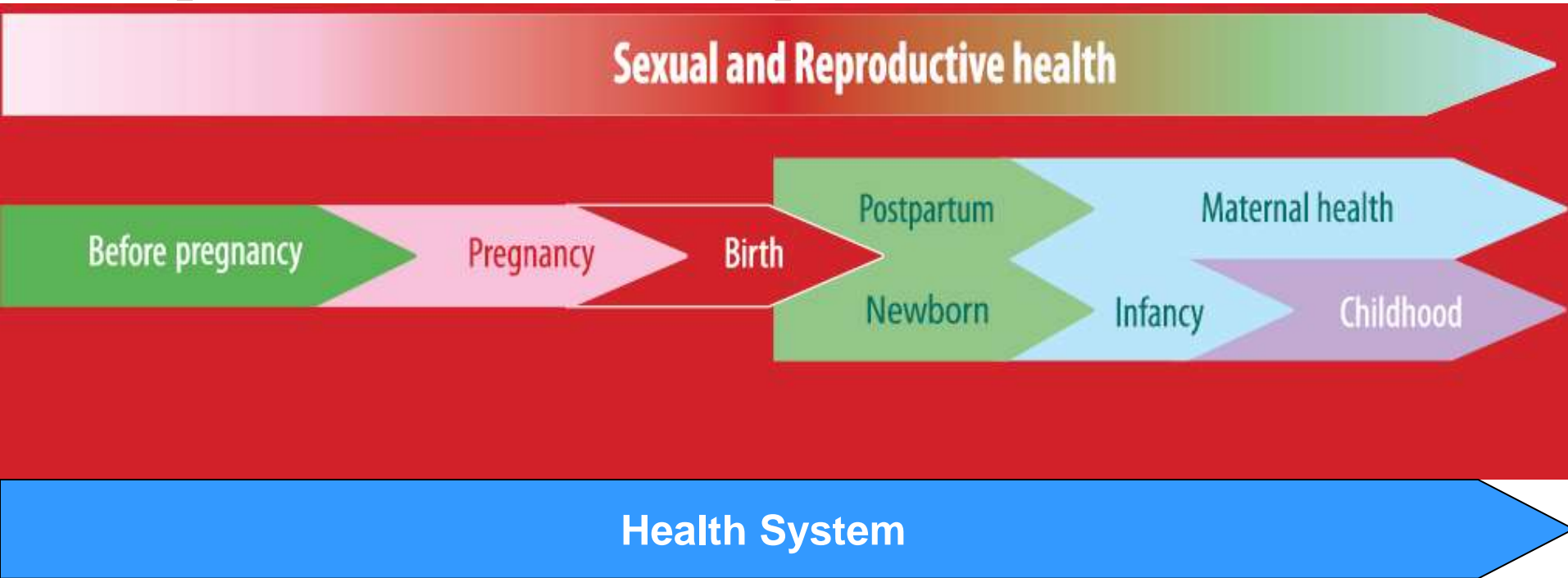
- ❑ Define norms, regulations and guidance to underpin efforts
- ❑ Help countries align their national practices
- ❑ Work together and with others to strengthen technical assistance to scale-up
- ❑ Encourage links between sectors and integration with other international efforts
- ❑ Support systems that track progress and identify funding gaps
- ❑ Generate and synthesize research-derived evidence and provide a platform for sharing

## Accelerating progress in achieving MDG 5: Trends and lessons from countries

- ❑ Effective policies and coordination of stakeholders at national level in improving maternal health (Nepal)
- ❑ Increasing the utilization of skilled health personnel for delivery services (Benin)
- ❑ PMTCT as an integrated element of reproductive/maternal health programme (Botswana)
- ❑ H4+ coordination in countries – challenges and successes (Ethiopia)
- ❑ Accelerating progress in achieving MDG 5 – the international response (Dr M. Chan, for H4+)

*September 2010, World Summit, UN General Assembly*

# Evidence-based packages of interventions to improve SRH (H4+) and partners

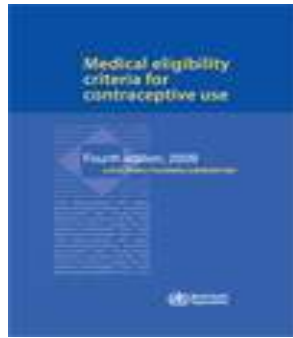


## Components

- Benefits and potential impact of interventions, including Family planning
- Health system requirements
- Service delivery recommendations
- Indicators

# Family planning guidelines and tools

## Medical Eligibility Criteria



4th edition just published!  
2010



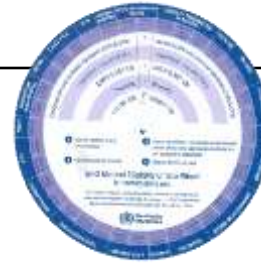
## Decision-Making Tool

## Selected Practice Recommendations



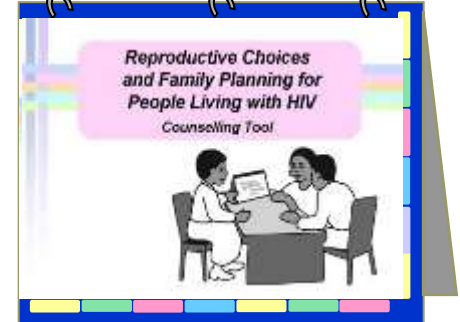
## Global Handbook

New →



CIRE

## The Medical Eligibility Criteria Wheel



## Reproductive Choices and Family Planning for People with HIV



**Guide to family planning for health care providers and their clients**

# Indicators on family planning

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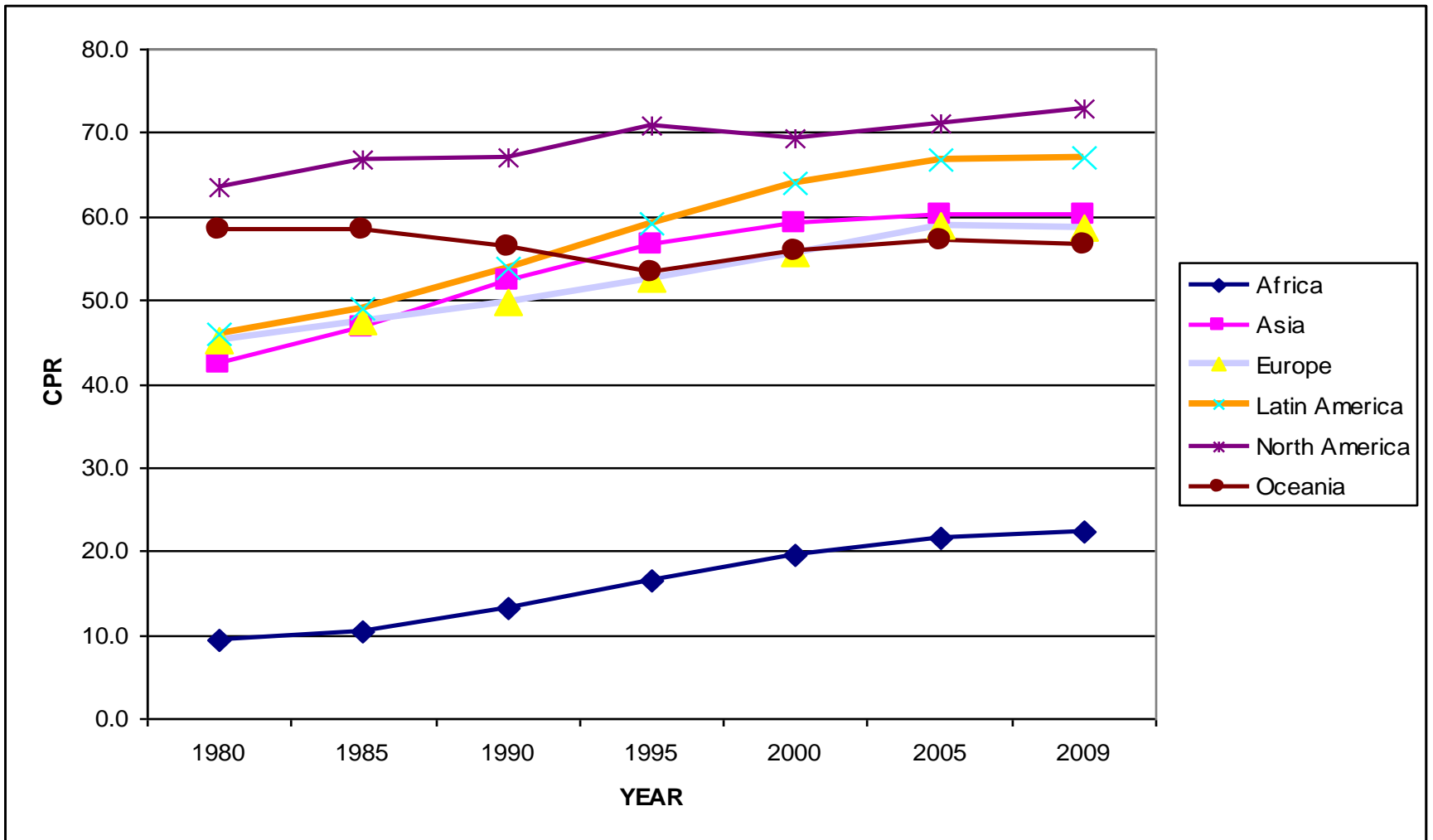


# Contraceptive prevalence rate

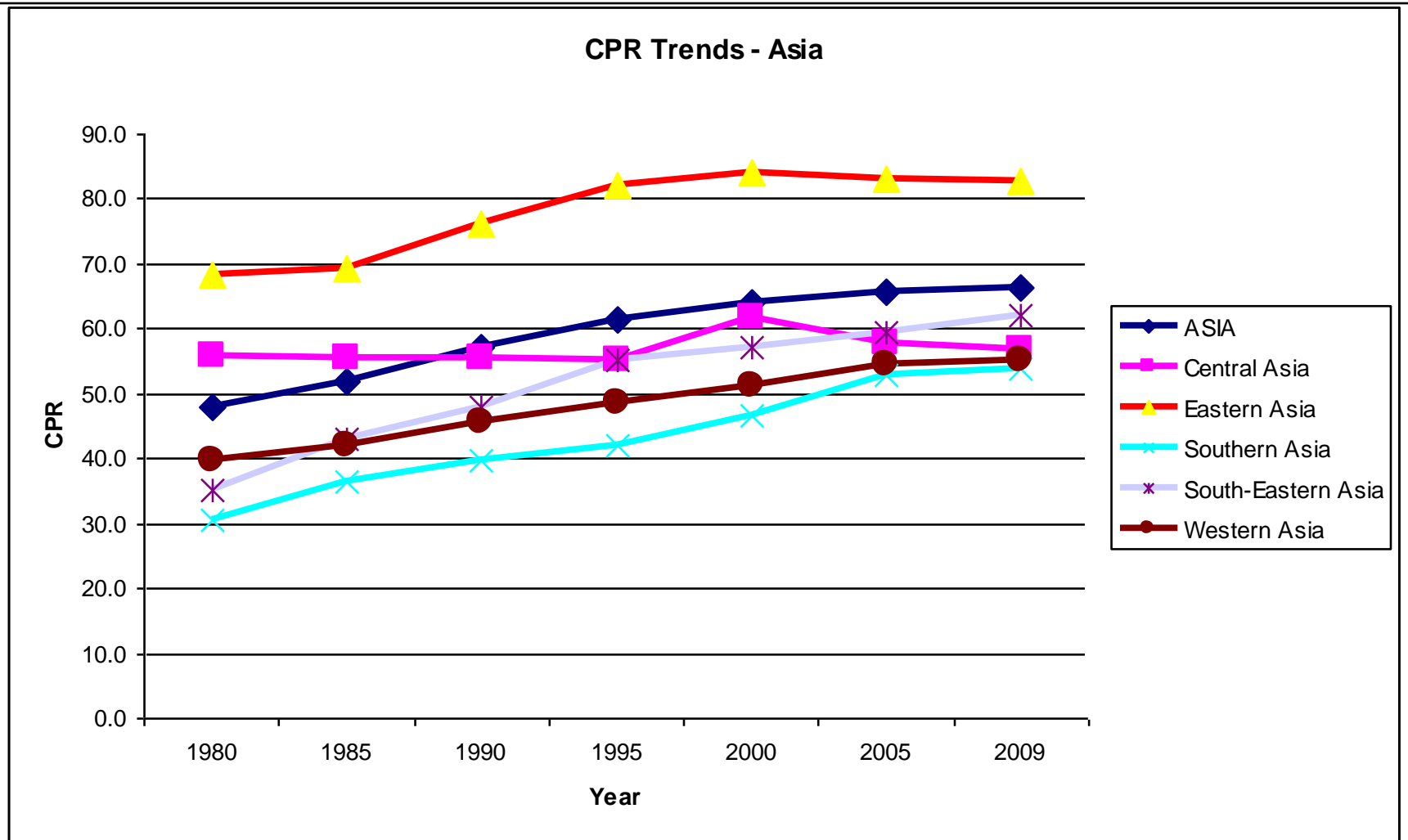
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- Contraceptive prevalence is the percentage of women who are currently using, or whose sexual partner is currently using, at least one method of contraception, regardless of the method used.
  - It is usually reported for married or in union women aged 15 to 49.
  - A union involves a man and a woman regularly cohabiting in a marriage-like relationship.

# Global contraceptive prevalence rate

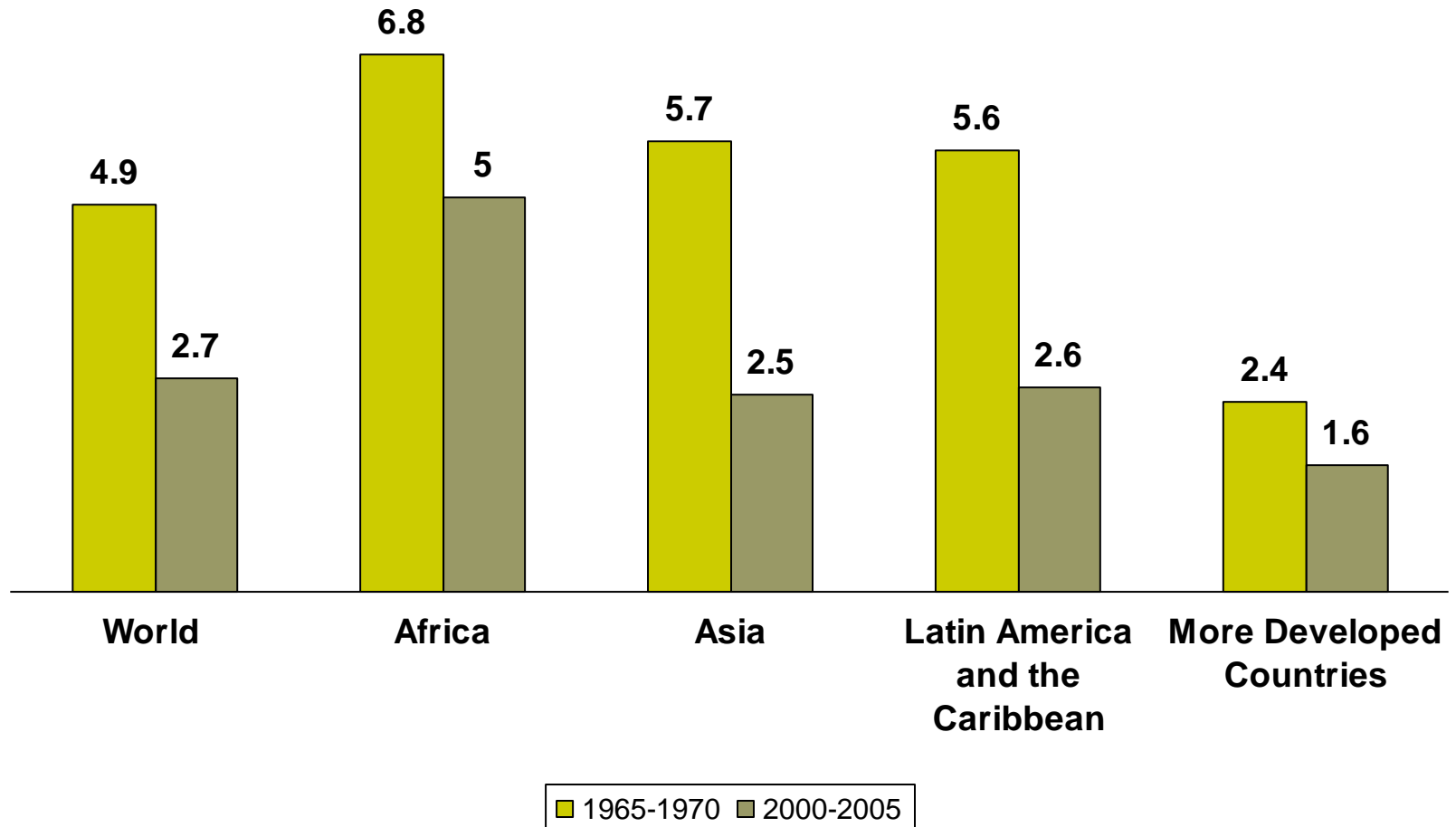


# Contraceptive prevalence rate in Asia



# Trends in childbearing, by region

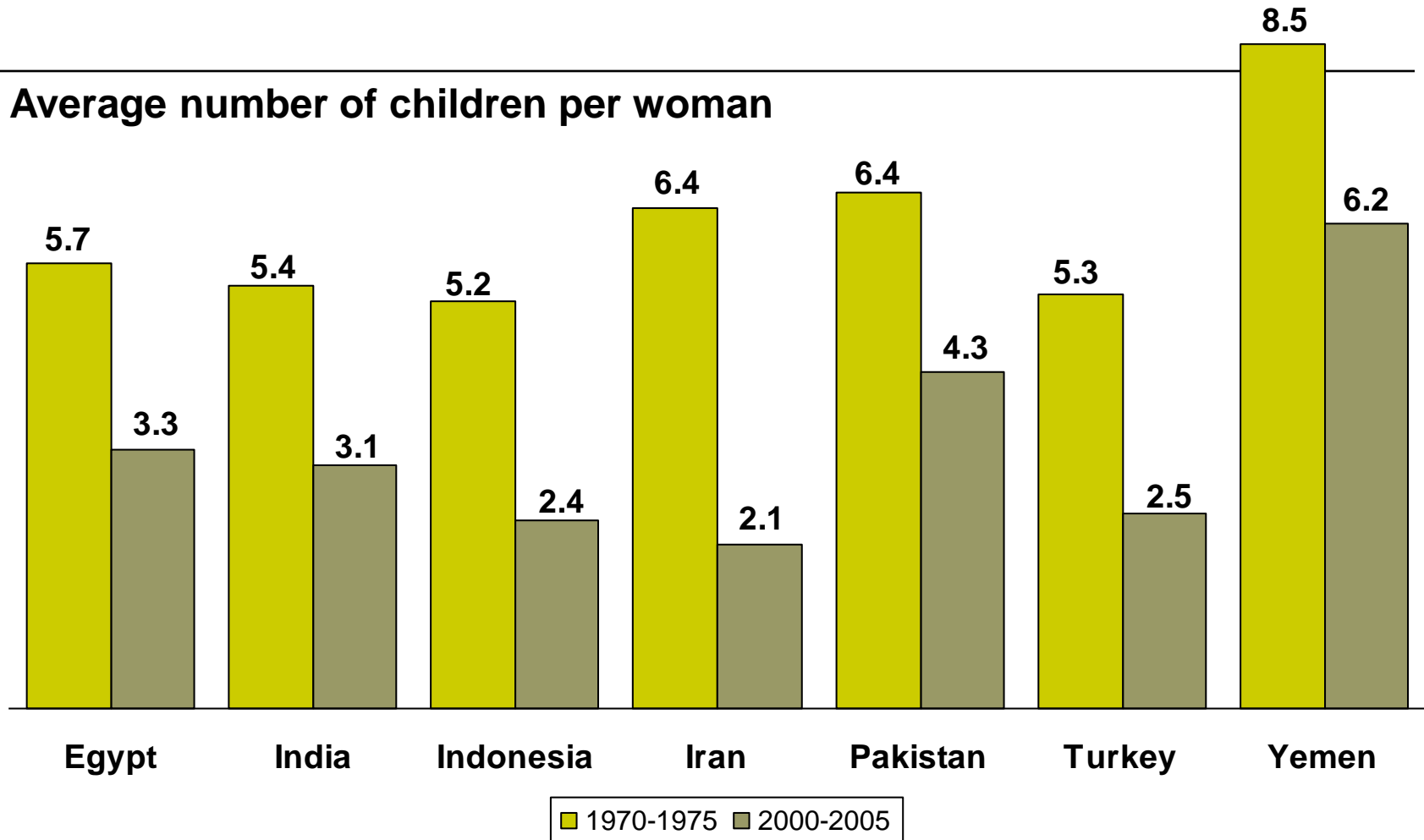
Average number of children per woman



Source: United Nations, *World Population Prospects: The 2004 Revision*, 2005.

# Diverging trends in fertility reduction

Average number of children per woman

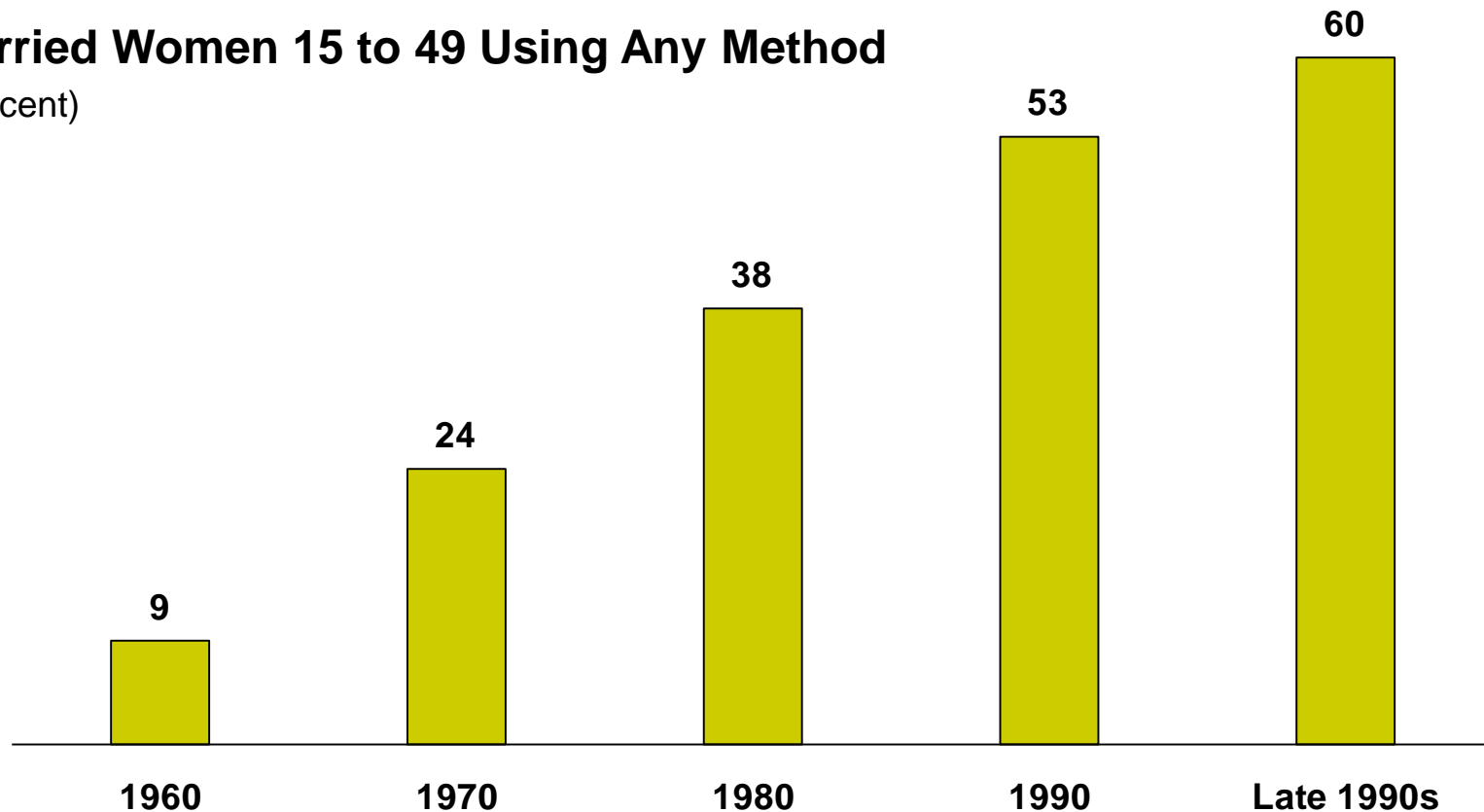


Source: United Nations, *World Population Prospects: The 2004 Revision*, 2005.

# Rising family planning use, developing countries

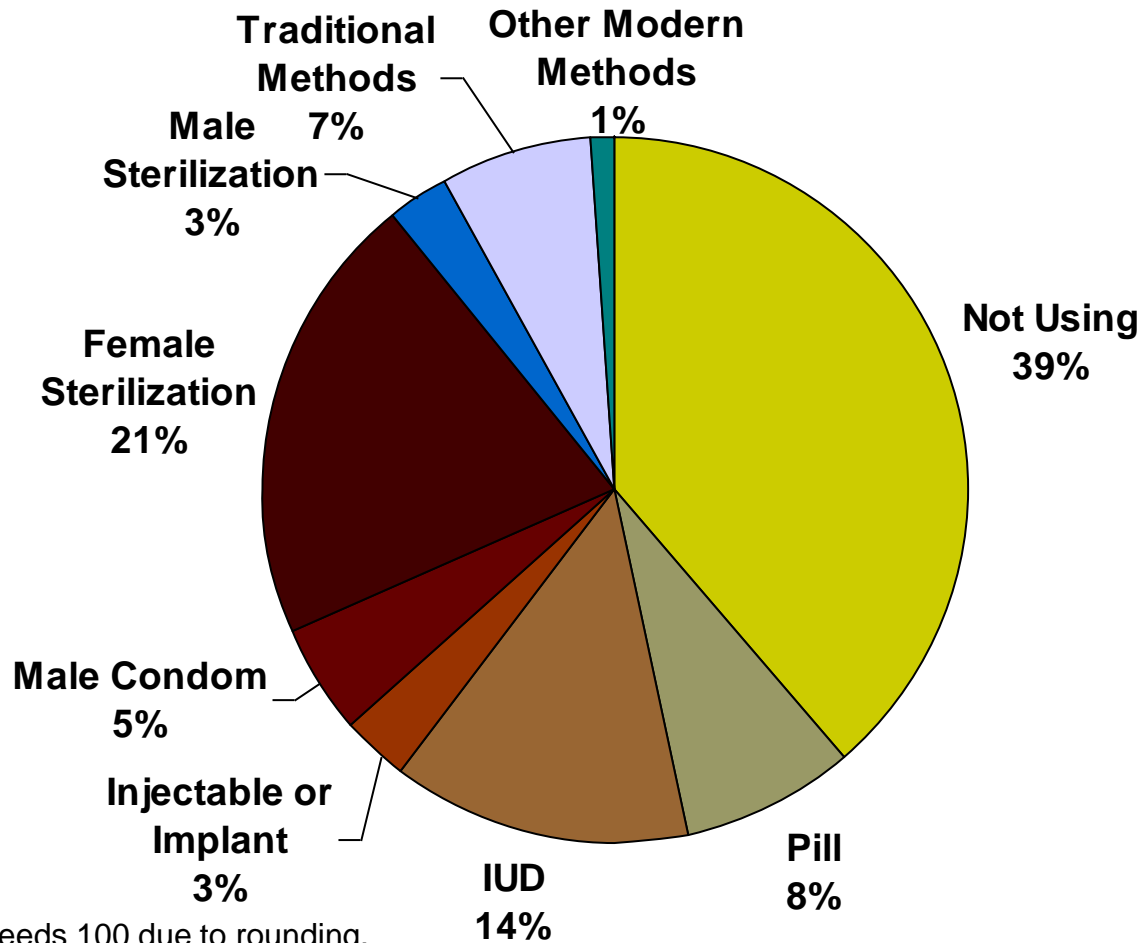
## Married Women 15 to 49 Using Any Method

(Percent)



Source: Population Reference Bureau, *Family Planning Worldwide 2002 Data Sheet*.

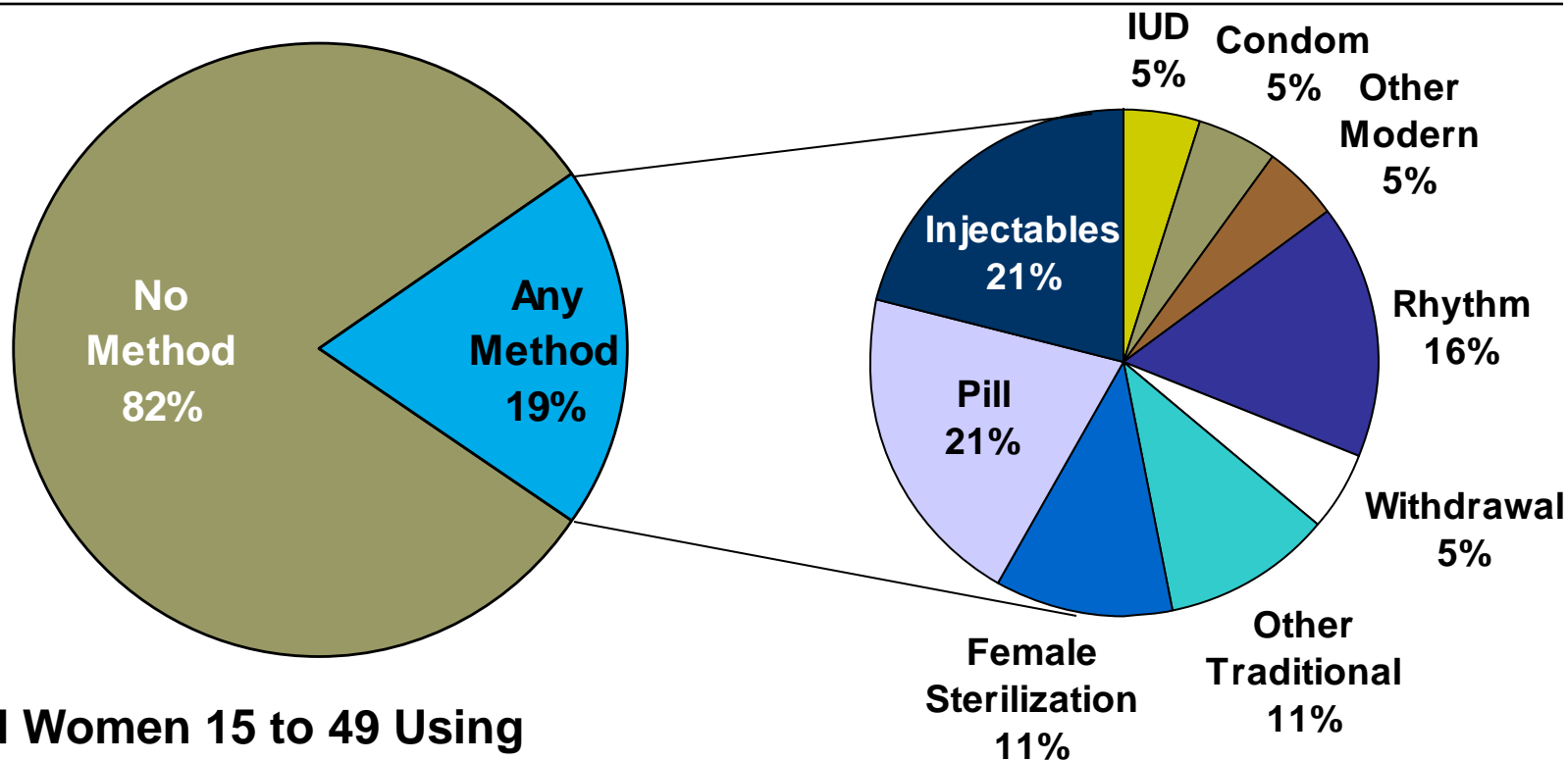
# Family planning methods, worldwide



Note: Total exceeds 100 due to rounding.

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

# Family planning methods, Sub-Saharan Africa



**Married Women 15 to 49 Using Family Planning, Late 1990s**

Note: Total exceeds 100 percent due to rounding.

Source: Population Reference Bureau, *Family Planning Worldwide 2002 Data Sheet*.



# Defining unmet need for family planning

---

- The number of women with unmet need for family planning X 100  
Women of reproductive age who are married or in a union
  
- Understood by many as
  - the percentage of women who are not currently using a method of family planning and want to stop or delay childbearing
  
- Complete calculation
  - Is complex
  - Is not widely understood
  - Is difficult to calculate using data other than Demographic and Health Surveys (DHS)



# Unmet needs for family planning

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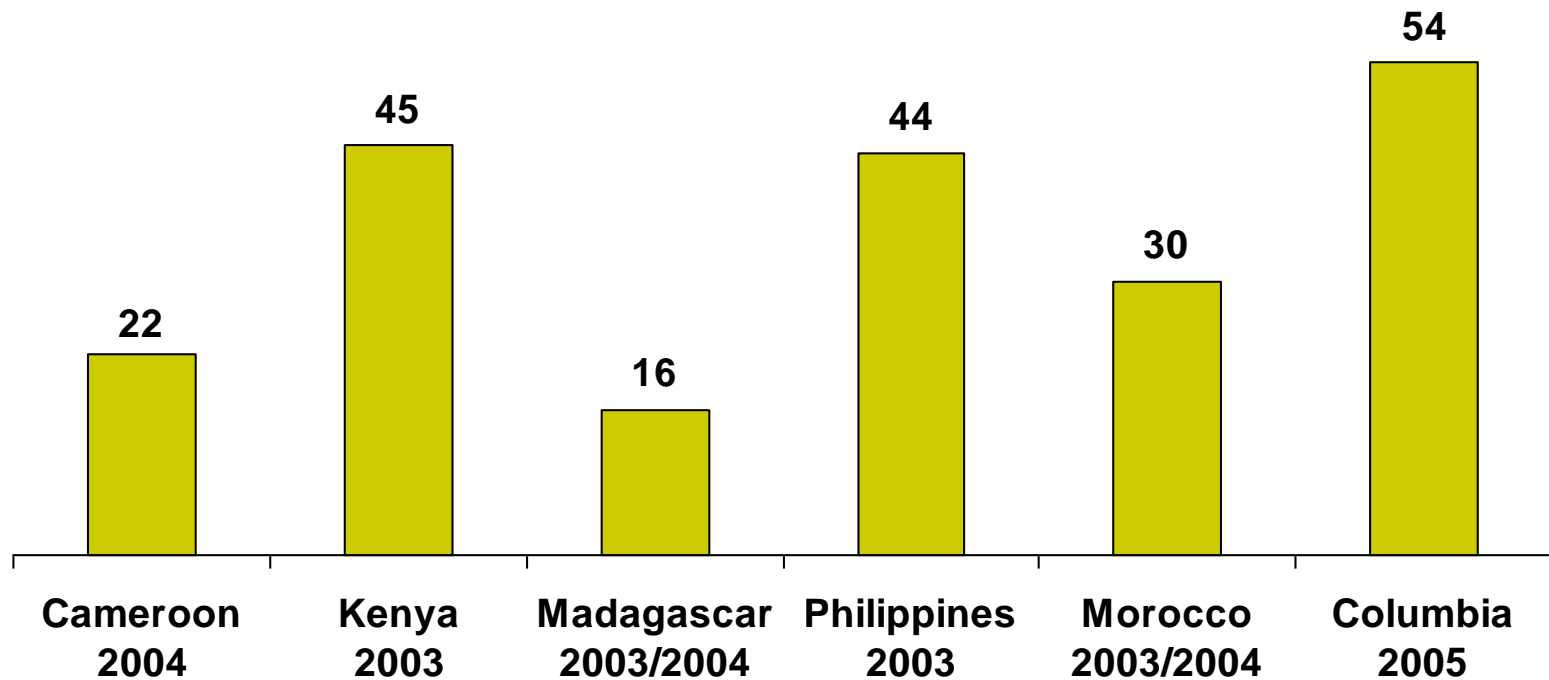
- As unmet need is increasingly used for
  - advocacy
  - development of family planning policies
  - implementation and monitoring

And has been adopted as a Millennium Development Goal (MDG) indicator ([target 5b, indicator 5.6](#))

- Understanding this indicator has become crucial
- New urgency to find a definition that can be applied consistently over time and across DHS, MICS, RHS, and other surveys

# Unintended births

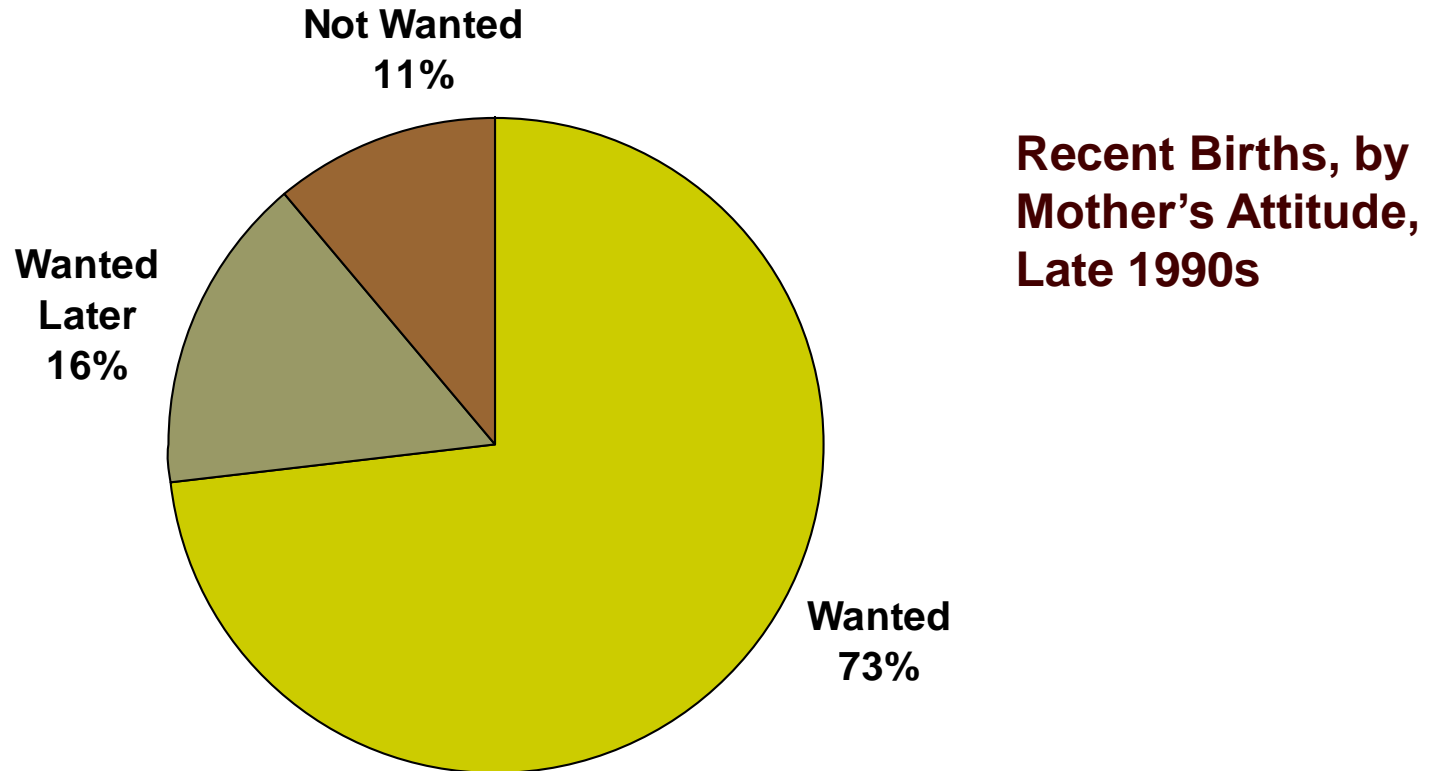
**Births Reported by Women as Either Unwanted or Wanted Later**  
(Percent)



Source: DHS STATcompiler: accessed online at [www.measuredhs.com/statcompiler](http://www.measuredhs.com/statcompiler) on June 14, 2006.

# Wanted Births, Worldwide

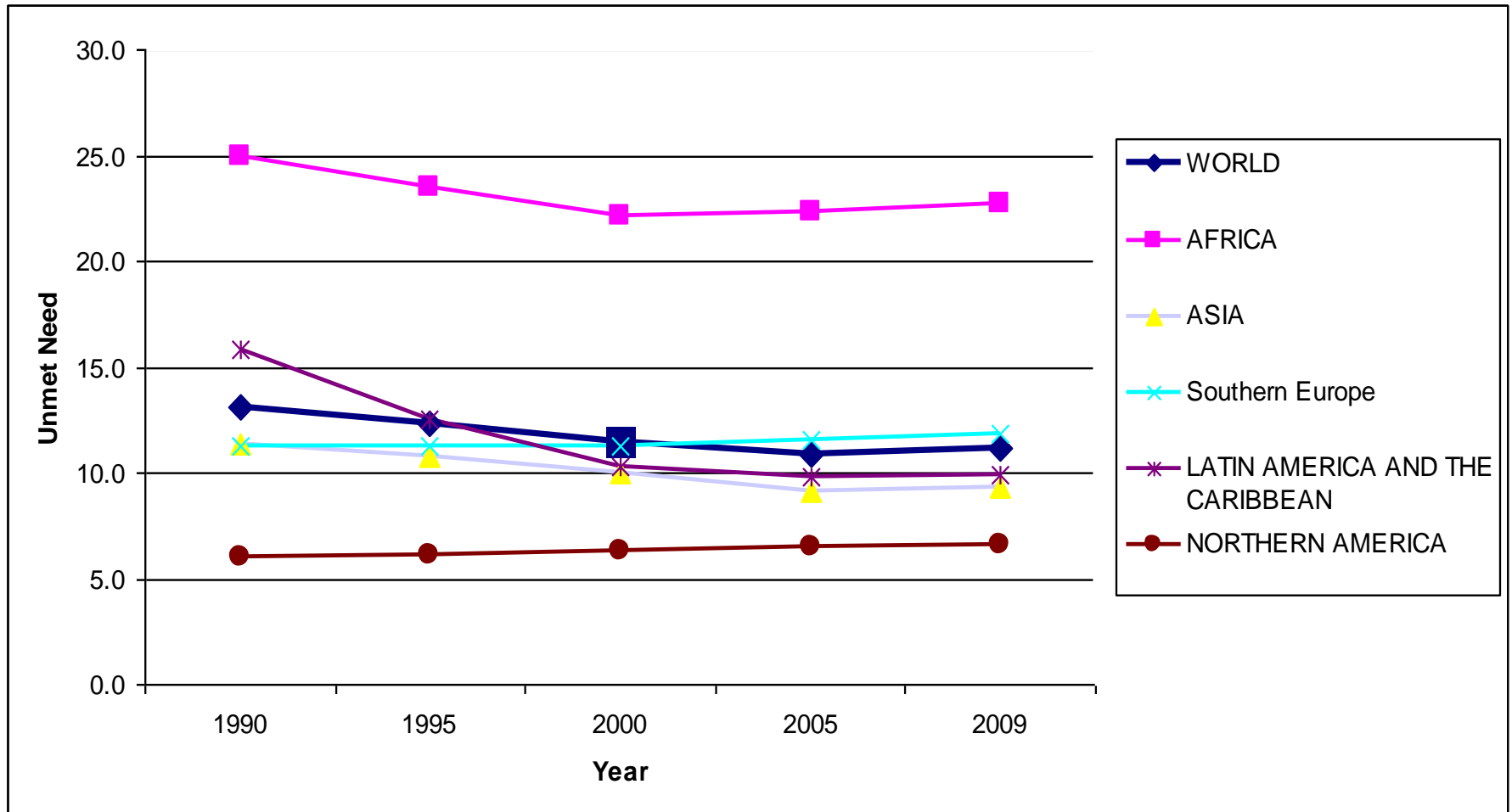
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Note: Estimates based on approximately 60 percent of births worldwide.

Source: Population Reference Bureau, *Family Planning Worldwide 2002 Data Sheet*.

# Global unmet need for family planning



# 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



# Special groups: lack of Access to family planning

---

- 215 million couples worldwide don't have access to family planning
  
- Groups without access:
  - Adolescents
  - Unmarried women
  - Women postponing their first pregnancy
  - People with disabilities
  - Poor, especially people in rural areas and urban slums
  - Migrants
  - Postpartum women

# Why to do the research in family planning

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# Why do we need more research?

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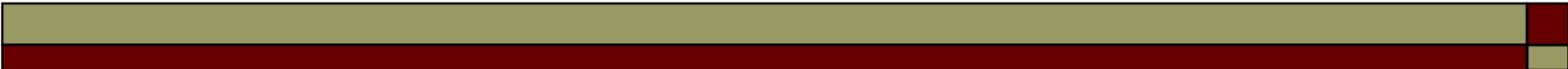
- High unmet need
  
- High percent of non-use
  
- Existing methods do not meet the needs of all
  - Some are difficult to use consistently and correctly
  - High typical use failure rates of temporary methods
  - Side effects or fear of side effects
  - High discontinuation of temporary methods
  - Changing needs and desires over reproductive lifespan



## ...we can improve upon existing methods

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- Less expensive
- Easier to use in a compliant way
- Highly effective in typical use
- Safe and Acceptable
- Rapidly reversible
  - Convenient and easy to use
  - Use in chronic disease states
- Provide additional health benefits
- Easier to deliver in service settings: availability, affordability and acceptability
- User-independent (Forgiving of misuse)
- Provided by CHWs (task shifting), or provider independent



## ...or develop new methods that could be game changers

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- ❑ Male methods that are practical
- ❑ Non-condom approaches for dual protection
- ❑ Non-surgical sterilization
- ❑ Peri-coital methods
- ❑ Immuno-contraceptives
- ❑ Novel and/or non-hormonal contraceptives (daily or long acting)
- ❑ Methods with non-contraceptive health benefits

# Research is important

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- Research can play a critical role in responding to the challenge of unmet need for family planning, especially during periods when resources are limited.
- To fill the knowledge gap regarding contraceptive technology & safety, and address implementation issues related to improving contraceptive uptake, removing barriers and increasing acceptability.
- Aims to develop new innovations in service delivery and contraceptive methods.



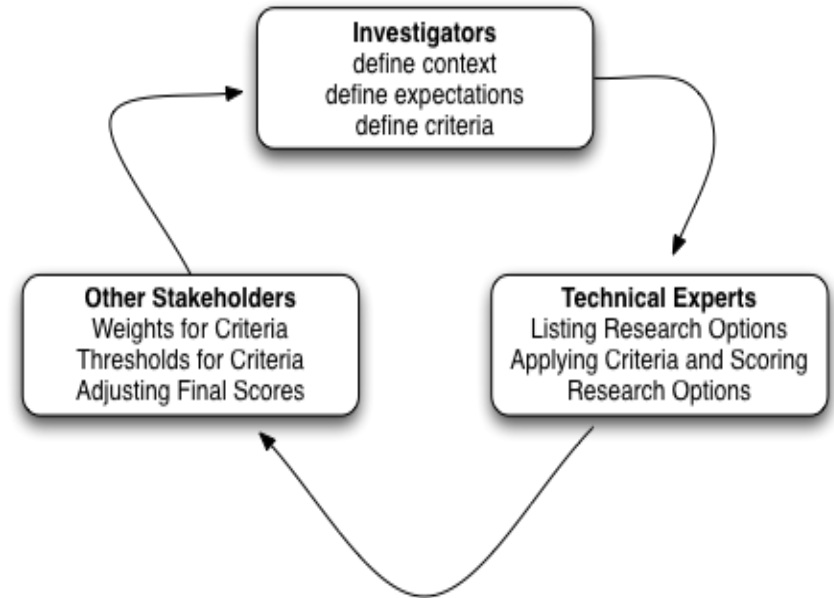
# Research prioritization for next decade

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- Research priorities must be reviewed and updated periodically to maintain their relevance in a fair and transparent way.

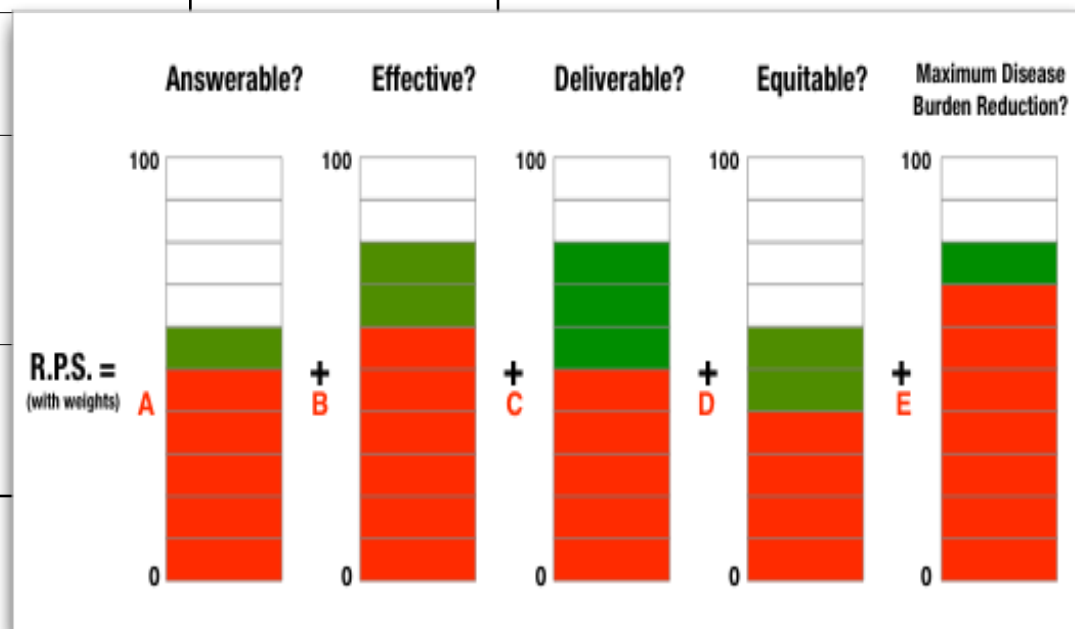
# CHNRI Prioritization Process: Setting the agenda

- The CHNRI priority setting process aims to include not only research that produces new knowledge, but also research that focuses on implementation of existing knowledge.
- The CHNRI process is systematic. This diagram details the process of prioritization.



# CHNRI process: research prioritization

Research Instrument	Research Avenue	Research Option (Research Project)	Research Question (research papers)
Basic Epidemiological Research	Measuring the unmet need	(list research options within each research avenue)	(list research questions within each research option)
	Understanding barriers to use		
	Evaluating existing contraceptives		
Health Policy and Systems research	Study the capacity to reduce obstacles to use of contraceptives		
	Studying capacity to deliver efficacious interventions		
Research to improve existing interventions	Research to improve deliverability		
	Research to improve affordability		
	Research to improve sustainability		
Research for development of new contraceptive technologies	Basic research		
	Clinical research		
	Public health research		





# Conclusion

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- Use in reducing MMR is under emphasized.
- Potential to reduce poverty and hunger and avert 32% of all maternal deaths and nearly 10% of childhood deaths.
- Fall in total fertility rate from 6 to 3.
- Need for political willingness and commitment.
- Call for renewed commitment by donors and the potential of commercial sector through partnerships should be explored.