Principles of Population & Demography

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World Health Organization

Training Course in Sexual and Reproductive Health Research
Geneva 2012
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

- “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.
Trends in global population growth

1st Billion: 1804
2nd Billion: 1927 (123 years)
3rd Billion: 1960 (33 years)
4th Billion: 1974 (14 years)
5th Billion: 1987 (13 years)
6th Billion: 1999 (12 years)
7th Billion: 2011 (12 years)
8th Billion: 2023 (12 years)

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/worldbis.html), and for the years 1910-2020 from United Nations Population Division, World Population Prospects: The 2012 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...

- World Population to surpass 7 Billion in 2011 and will reach seven billion on 31st October, a milestone that offers unprecedented challenges and opportunities to all of humanity, according to UNFPA.
World population distribution: global overview

Continents

- (26.1%) #2 Africa
- (15.0%) #6 Oceania
- (13.2%) #5 South America
- (12.7%) #1 Asia
- (10.4%) #4 North America
- (0.8%) #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

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

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

* 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.
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

- **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

(a) Rapid growth
Nigeria

(b) Slow growth
United States

(c) Decline in growth
Germany

Age

(a) Rapid growth
Nigeria

(b) Slow growth
United States

(c) Decline in growth
Germany

Number of people (in millions)
Demographic stages

- **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

- **STAGE 1**: Preindustrial
- **STAGE 2**: Transitional
- **STAGE 3**: Industrial
- **STAGE 4**: Postindustrial

The graph shows the size of the population, birth rate, and death rate over time. The Y-axis represents the birth and death rates (number per 1000 population) ranging from 0 to 80, with high and low levels indicated on the right side. The X-axis represents time.
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.
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**

<table>
<thead>
<tr>
<th>Years</th>
<th>TFR</th>
<th>Years</th>
<th>TFR</th>
<th>Years</th>
<th>TFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975–1980</td>
<td>3.84</td>
<td>2025–2030</td>
<td>2.29</td>
<td>2075–2080</td>
<td>2.06</td>
</tr>
<tr>
<td>1980–1985</td>
<td>3.59</td>
<td>2030–2035</td>
<td>2.25</td>
<td>2080–2085</td>
<td>2.05</td>
</tr>
<tr>
<td>1995–2000</td>
<td>2.79</td>
<td>2045–2050</td>
<td>2.17</td>
<td>2095–2100</td>
<td>2.03</td>
</tr>
</tbody>
</table>
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
Infant mortality rate by region 1950-2050

Life expectancy at birth by region, 1950-2050

Change in population size

Increases population:  

Decreases population:  

Births  

Deaths  

Global population  

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

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

\[ r = (b - d) + (i - e) \]

Birth (b), Death (d), Immigration (i) and Emigration (e) are calculated per 1000 people.
Why Family Planning is still important?
Family planning can help prevent unintended and unwanted pregnancies

- 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 misinformation 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

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

Selected Practice Recommendations

The Medical Eligibility Criteria Wheel

Decision-Making Tool

4th edition just published! 2010

Global Handbook

CIRE

Reproductive Choices and Family Planning for People with HIV

Guide to family planning for health care providers and their clients
Indicators on family planning
Contraceptive prevalence rate

- 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

CPR Trends - Asia

Year

ASIA
Central Asia
Eastern Asia
Southern Asia
South-Eastern Asia
Western Asia

Contraceptive prevalence rate in Asia
Trends in childbearing, by region

Average number of children per woman

<table>
<thead>
<tr>
<th>Region</th>
<th>1965-1970</th>
<th>2000-2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>4.9</td>
<td>2.7</td>
</tr>
<tr>
<td>Africa</td>
<td>6.8</td>
<td>5.0</td>
</tr>
<tr>
<td>Asia</td>
<td>5.7</td>
<td>2.5</td>
</tr>
<tr>
<td>Latin America and the Caribbean</td>
<td>5.6</td>
<td>2.6</td>
</tr>
<tr>
<td>More Developed Countries</td>
<td>2.4</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Diverging trends in fertility reduction

<table>
<thead>
<tr>
<th>Country</th>
<th>Average number of children per woman 1970-1975</th>
<th>Average number of children per woman 2000-2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egypt</td>
<td>5.7</td>
<td>3.3</td>
</tr>
<tr>
<td>India</td>
<td>5.4</td>
<td>3.1</td>
</tr>
<tr>
<td>Indonesia</td>
<td>5.2</td>
<td>2.4</td>
</tr>
<tr>
<td>Iran</td>
<td>6.4</td>
<td>2.1</td>
</tr>
<tr>
<td>Pakistan</td>
<td>6.4</td>
<td>4.3</td>
</tr>
<tr>
<td>Turkey</td>
<td>5.3</td>
<td>2.5</td>
</tr>
<tr>
<td>Yemen</td>
<td>8.5</td>
<td>6.2</td>
</tr>
</tbody>
</table>

Rising family planning use, developing countries

Married Women 15 to 49 Using Any Method
(Percent)

Family planning methods, worldwide

- Not Using: 39%
- Female Sterilization: 21%
- Male Condom: 5%
- Injectable or Implant: 3%
- Male Sterilization: 7%
- Traditional Methods: 3%
- Other Modern Methods: 1%
- Pill: 8%
- IUD: 14%

Note: Total exceeds 100 due to rounding.
Family planning methods, Sub-Saharan Africa

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

Note: Total exceeds 100 percent due to rounding.

Defining unmet need for family planning

- The number of women with unmet need for family planning
  - 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

- 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)

- Cameroon 2004: 22
- Kenya 2003: 45
- Madagascar 2003/2004: 16
- Philippines 2003: 44
- Morocco 2003/2004: 30
- Columbia 2005: 54

Wanted Births, Worldwide

Recent Births, by Mother’s Attitude, Late 1990s

- Wanted: 73%
- Not Wanted: 11%
- Wanted Later: 16%

Note: Estimates based on approximately 60 percent of births worldwide.
Global unmet need for family planning

![Graph showing the unmet need for family planning globally and by region from 1990 to 2009.](image)

- **GLOBAL**: The unmet need generally decreases over time, with a slight increase in the last two years observed.
- **AFRICA**: Shows the highest unmet need, maintaining a steady decline with minor fluctuations.
- **ASIA**: Exhibits a moderate unmet need, with a slight decrease over the years.
- **SOUTHERN EUROPE**: Demonstrates a consistent trend with a slight decrease over time.
- **LATIN AMERICA AND THE CARIBBEAN**: Shows a moderate unmet need, with a slight decrease over the years.
- **NORTHERN AMERICA**: Exhibits the lowest unmet need, with a slight decrease over the years.
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
Why do we need more research?

- 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

- 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

- 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

- 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

- 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

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

![Graph showing R.P.S. with weights A to E](image-url)
Conclusion

- 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.