Demographic transition and its causes: what reduces fertility

Malcolm Potts MB, BChir, PhD
Martha Campbell, PhD
Kate Bedford, MPH

University of California, Berkeley
Bixby Center for Population, Health and Sustainability

2008

Prepared as part of an education project of the Global Health Education Consortium and collaborating partners.
Learning objectives

On completion of this module you will be able to

- Describe the changes in death rates and birth rates that up the demographic transition.
- Understand the impact of population momentum
- Describe the biological variables controlling family size
- Understand the changing history of explanations of the demographic transition
- Discuss the strengths and weaknesses of alternative explanations of the demographic transition
- Describe the barriers which exist between those striving to limit the number of their children and the means they need to do so
Useful definitions

• **Birth rate**: number of births per 1000 people in the population per year
• **Death rate**: number of deaths per 1000 people in the population per year
• **Population Pyramids**: a visual representation of a population broken down by age and sex
How to read a population pyramid

Males on the left

Females on the right

Length of bar represents population at that age (ie. 20-24)

Source: U.S. Census Bureau, International Data Base.

Some population pyramids use percent of population, other use number population in thousands or millions.
Two more population pyramids

**Algeria 1988**
- Wide base reflecting large young population
- Smaller top reflecting small older population

**Norway 2050**
- Large older population
- Smaller base reflecting smaller young population

Population in millions

---

Source: U.S. Census Bureau, International Data Base.
What is the Demographic Transition?

The process by which a country moves from high birth and high death rates to low birth and low death rates with population growth in the interim

Adapted from John R. Weeks
Population an Introduction to Concepts and Issues, 9th edition
The classic description of the demographic transition is based on observations from the West. It describes a falling death rate followed sometime later by a decline in the birth rate. The transition in the developed countries took around 100 years and is classically attributed to improvement in socio-economic conditions which changed child survival rate and fertility preferences.
The Demographic Transition (Stage 1)

- High birth rate
- High death rate
- Slow population growth
- Agricultural societies

Birth rate/Death rate vs. Time
The Demographic Transition (Stage 2)

- High birth rate
- Falling death rate (due to better medical care and nutrition)
- Rapid population growth
- Industrializing society

Birth rate/Death rate vs. Time
Falling birth rate (classically attributed to improvement in socio-economic factors)
Continued low death rate

The Demographic Transition (Stage 3)
The Demographic Transition (Stage 4)

Birth rate/Death rate vs. Time

Stage 4:
- Low birth rate
- Low death rate

Stable/falling population
Since 1960, the demographic transition in SOME developing countries has occurred much more rapidly than in developed countries. For example in Bangladesh this transition occurred in a span of 10 years. Furthermore, in Bangladesh, birth rates have fallen without the simultaneous socio-economic improvement.
TFR (Total Fertility Rate)

*TFR is the average number of children that would be born per woman if all women lived to the end of their childbearing years and meanwhile bore children according to a given set of age-specific fertility rates.*
Demographic Transition in Action

During a demographic transition the total fertility rate of a country or region drops. For example, in the case of the US TFR dropped from 6 in 1842 to 3.5 in 1900.
Replacement Fertility

“The average number of children sufficient to replace both parents in the population”

In developed countries a TFR of 2.1 is considered replacement level.

Why 2.1 children per woman and not just 2 children? Since some children do not reach adulthood, and more boys are born than girls, replacement fertility must be slightly higher than 2 children per woman.
The time it takes for a country to go through the demographic transition (in this example from a TFR of 6 to a TFR of 3.5) varies greatly and reflects the ease with which women could obtain the means to limit the size of their family.
Population Momentum

The tendency for population growth to continue beyond the time that replacement-level fertility has been achieved because of the relatively high percentage of fertile women in their childbearing years and girls moving up to this age.
What causes population momentum?

When a country has a broad-based population pyramid, there are more females entering their fertile years than leaving the fertile years.

Large numbers of girls about to enter their childbearing years.
What are the consequences of population momentum?

- A twenty year delay in reaching replacement level fertility can make a difference of 50 million in the final stable population of the Philippines.
- A twenty year delay in reaching replacement level fertility can make a difference of over 200 million in the final stable population of Pakistan.
Ultimate Population Size Under Different Fertility Assumptions: Philippines

Calculation by Carl Haub, Senior Demographer, Population Reference Bureau
Ultimate Population Size Under Different Fertility Assumptions: Pakistan

Notice a final population of over 700 million

Population in millions

Calculation by Carl Haub, Senior Demographer, Population Reference Bureau
Biological Variables Controlling Family Size
Which women are at risk of conceiving?

The following five diagrams use a population pyramid to display the proximal factors determining the number of sexually active fertile women

- A population pyramid displays the number of people in each 5-year group (the example chosen is the country of Malaysia, representative of many developing nations)
- As a rule of thumb, fertile women make up 20% of any population.
The age of puberty varies (from about 10 to 20)
...as does age of menopause (from about 45 to 55).
Between puberty and the menopause not all women are sexually active.
Infertility

Source: U.S. Census Bureau, International Data Base.
Within this population of sexually active, potentially fertile women who do not use a contraceptive will have a number of pregnancies before reaching the menopause.
Proximate (near) and distal (far) factors that determine family size

• Proximal factors
  – Age at puberty
  – Sexual activity
  – Infertility of either partner
  – Anovulation (not ovulating) associated with breastfeeding
  – Contraceptive use
  – Spontaneous abortion
  – Induced abortion

• Distal factors
  – Income
  – Education
  – Urbanization
  – Job opportunities
The pregnancy interval

The interval between two conceptions consists of three items:

– The time taken to conceive – median 3 months
– The duration of the pregnancy – 9 months for a term delivery, usually fewer than 3 months for an abortion
– The time taken for ovulation to return – highly variable depending on how long the woman breastfeeds
In a hunter-gatherer society a woman may breastfeed for several years. Since breastfeeding in a hunter-gatherer society often results in a pregnancy interval of several years the average woman will only have 4 to 6 children even without contraception.

- Time taken to conceive
- Duration of pregnancy
- Anovulation

*Suppression of ovulation due to breastfeeding*
In a modern agricultural or urban society a woman is likely to breastfeed for less time and therefore the pregnancy interval is shorter. In the absence of breastfeeding, the TFR can increase to 10 or more children.
In the case of abortion the pregnancy interval is greatly reduced. A woman can have several abortions in the time it takes to conceive, carry and breastfeed one baby. In the absence of contraception in order to have a small family a woman will need numerous abortions in her lifetime. In some cases up to 30.
Since all contraceptives have a failure rate, one can look at contraception as a way to extend the time it takes to conceive.
The mixture of contraception and abortion is very different from the use of abortion without contraception. When a woman uses contraception, even when it fails, many fewer abortions are needed to achieve a small family than without contraception.

- **Time taken to conceive**
- **Duration of pregnancy**
- **Anovulation**

[Diagram showing the comparison between time taken to conceive, duration of pregnancy, and anovulation with and without contraception.]
Abortion is an important proximal factor determining family size. Abortion may be ...

<table>
<thead>
<tr>
<th>Spontaneous – (miscarriage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The highest rate of embryonic loss is immediately following fertilization.</td>
</tr>
<tr>
<td>• Many spontaneous abortions involve abnormalities of development.</td>
</tr>
<tr>
<td>• Approximately 15% of recognized pregnancies (the woman knows she has missed her period) end in spontaneous abortion.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Induced –</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe abortions, where a trained professional uses modern techniques can be up to 1000 times safer than abortions performed by inserting a twig, a rubber tube or an umbrella rib, or using dangerous drugs such as high doses of quinine.</td>
</tr>
</tbody>
</table>
The role of induced abortion in the demographic transition is:

• Sometimes ignored because of lack of data and is a highly charged topic
• Sometimes misunderstood because in the absence of contraception it takes many abortions to achieve a small family.
• The interrelationship between contraception and abortion are is not sufficiently understood
While data about abortion is difficult to collect, it is certain that abortion is common

Abortion rate/1000 women per year age 15-44:

- Global 35 / 1000
- Developed countries 39 / 1000
- Developing countries 34 / 1000

“This implies a lifetime average of about one abortion per woman”

Abortion rates (per 1000 women 15-45) vary with access to contraception (percentage women using a modern method)

Access to contraception reduces abortion
Changing Explanations for the Demographic Transition
The disputes over the demographic transition

There is broad agreement on what factors change death rates (such as vaccination of children or access to clean water)

However, there is disagreement over what factors change the birth rate
Factors in Demographic Transition

Many of the first demographic transitions (Europe, America) were been associated with development of socio-economic factors such as industrialized job opportunities, high urbanization, high education levels, and low child mortality.
However questions remain…

How much do distal (far) factors really impact fertility?

– Income
– Education
– Urbanization
– Job opportunities

• Is a change in a regions’ income, education, etc necessary to change fertility?
• Does fertility change even when these other factors do not change?
Is it cause or coincidence that:

• Wealthy families often have fewer children than poor families?
• Well educated families often have fewer children than less educated families?
• Smaller families often have a lower infant mortality rate?
The Standard Theory: *Development drives fertility decline*

Assumption: Couples want many children, until change in exogenous (outside) factors spur their desire to limit childbearing – such as:

- Education (specifically girls’ education)
- Economic development (e.g. higher income, urbanization)
- Employment opportunities for women
- Reduced child mortality

…and after having made a rational decision about childbearing, couples can find a way to control family size.
The Standard Theory

The standard theory is based on a demand-side model: family planning will increase when there is an increased demand for smaller families.

This model may acknowledge some barriers to accessing family planning, but this is not a central feature.
Correlation or Causal?

Since there are often correlations between education and economic development and reduced fertility in many countries it is often assumed to be a causal relationship i.e. educating women makes them reduce their family size or rich people want few children. However....
New observations by the United Nations Population Division

“In a number of countries we are seeing fertility decline that can’t be explained by education or economic development.”

Dr. Larry Heligman, United Nations, Population Division, April 2002
A new model for fertility decline

**Reduced Barriers Theory**

The degree of freedom that women have to obtain fertility regulation technologies (the presence or absence of barriers to these), along with correct information about their use, probably influences fertility decline more than any exogenous societal condition or change.
Reduced Barriers Theory:

Builds on the fact that there is a large unmet need for family planning worldwide.

“a conservative estimate of 125 million women around the world- a population the size of Japan or Nigeria- are sexually active, do not want to become pregnant, and yet are not using contraception.”

Definition: Unmet Need for Family Planning

The number of married woman who would prefer to avoid pregnancy (either because they do not want to have any more children or because they do not want a child in the next year), but are not using any form of family planning.
The Standard Theory assumes that fertility decisions are made out of a rational process

For example one researcher argued:
“The decision to have another child is simply too important and too costly for contraceptive costs to play a major role. In economic terms, fertility is inelastic with respect to contraceptive costs because contraceptive costs are so small in comparison to the cost of children.”

However…. 
Fertility is often not made by rational choice but as a result of ONE passionate moment.
Cost of contraception IS NOT small

• Access to family planning depends on wealth and the cost of contraception can be a barrier to use

• There is a turning point in contraceptive use: If the cost represents 1% or more of the total household income there is a sharp decline in use.
% Who Cannot Afford Family Planning
(assuming 1% income rule)

**Full cost:** All money necessary to obtain contraception such as transportation, registration in hospital including the contraceptive cost

- Commodities: just the products such as pills, condoms or IUDs

---

<table>
<thead>
<tr>
<th>Region</th>
<th>Full Cost</th>
<th>Only Commodities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-Saharan Africa</td>
<td>90%</td>
<td>75%</td>
</tr>
<tr>
<td>Arab States/Europe</td>
<td>70%</td>
<td>40%</td>
</tr>
<tr>
<td>Latin America</td>
<td>60%</td>
<td>20%</td>
</tr>
<tr>
<td>Asia</td>
<td>90%</td>
<td>40%</td>
</tr>
<tr>
<td>All aid-dependent nations</td>
<td>80%</td>
<td>40%</td>
</tr>
</tbody>
</table>

---

**Legend:**
- Green: Full cost
- Purple: Only commodities
Around the world couples face many barriers to fertility regulation, including:

**Medicalization of contraception including:**
- Unnecessary rules about prescription status for oral contraceptives
- Requirements that women have expensive tests and pelvic exams before receiving contraceptives (for example in Senegal the tests to get oral contraceptives cost the equivalent of 5 months income)

**Miseducation and misconceptions about contraception including:**
- Misconceptions about risks of contraceptives
- Misconceptions about side effects

**Limited access to contraception including:**
- High prices
- Unnecessary rules about who can receive oral contraceptive such as minimum number of children a woman has already had, or that a woman must be menstruating
- Limited access to sterilization, for example in many countries to be sterilized a woman’s age times the number of children she has had must equal or be more then 120 (i.e. if she is 30 she must have 4 kids)
- Limited method options (for example, women may have access to sterilization, but not reversible methods, or access to pills but not injectables)
- Rules limiting the advertising of family planning
- Excluding young unmarried females are excluded from services.
Reduced Barriers Theory argues couples need help separating sex from childbearing
Comparing the Theories

<table>
<thead>
<tr>
<th>Standard Theory</th>
<th>Reduced Barrier Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Couples make a decision to have fewer children based on socio-economic changes around them – education, wealth, employment opportunities. Somehow couples will then find a way to implement that decision. Result: This leads people to believe that population growth is a “given” factor in development – or that we have to tell people to have smaller families.</td>
<td>Women’s interest in having fewer children rises when they see they have a realistic options for doing this – through safe contraception, no misinformation, actual supply at affordable cost. Education is valuable for its own sake – and helps women climb over the many barriers to fertility regulation. Average family size can be – and has been many times – reduced within a human rights framework.</td>
</tr>
</tbody>
</table>
Where barriers to contraception use have been removed, as in Thailand, there is virtually no difference in contraceptive use between illiterate women and educated women. However where many barriers exist, like in the Philippines, there are significant differences in contraceptive use between the educated and uneducated women.
Evidence supporting the Reduced Barriers Theory

Reduced Barriers Theory has been able to explain the rapid fertility decline in many developing nations which the Standard Model could not predict.
Total fertility rate in 1960 and 1990 for selected countries:

Notice the drop in fertility rates in countries with good services in 1990.
Conclusions

• There is a large unmet need for family planning world wide

• Family size is greatly impacted by the degree to which women have easy access to contraception and abortion

• Reducing average family size does not require abridging anyone’s rights- instead it requires letting people (especially women) have the freedom to manage their childbearing.
“In our judgment, humanity’s ability to deal successfully with its social, economic, and environmental problems will require the achievement of zero population growth within the lifetime of our children.”
Credits

Malcolm Potts MB, BChir, PhD
Martha Campbell, PhD
Kate Bedford, MPH

University of California, Berkeley
Bixby Center for Population, Health and Sustainability
The Global Health Education Consortium gratefully acknowledges the support provided for developing these teaching modules from:

**Margaret Kendrick Blodgett Foundation**  
**The Josiah Macy, Jr. Foundation**  
**Arnold P. Gold Foundation**

This work is licensed under a Creative Commons Attribution-Noncommercial-No Derivative Works 3.0 United States License.