Population projection by level of education
For Egypt 2006 – 2051

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The XXVI conference

IUSSP 2009

Poster Session 5

Friday, October 02

12:00 PM - 1:30 PM

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Abstract

This study applies a very powerful demographic methodology—called multi-state population projections- which was developed at IIASA and can model the dynamics of population change not only by age and sex, but also by additional dimensions such as the level of educational attainment. It also considers the fact that women with different levels of educational attainment tend to have different levels of fertility.

The analysis is carried out at the national level, the data is based on the 1996 census, the 2000 and 2005 Demographic and Health Surveys. It presents projections of the future size and composition of the population by age, sex, and level of educational attainment using assumptions about future trends in fertility, mortality, and migration (and how they differ by level of education), as well as future trends in progression to higher educational attainment categories by age and sex, which is closely related to the frequently-used indicator of school enrolment rates.

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Introduction:

Population projections are the basic tools for a wide range of decision makers and planners in many sectors: education, health, manpower, human development and services in any country.

Population projections may be prepared by using either subjective or objective methods; earlier methods are those in which data, technique and assumptions are not clearly identified, one of those objective method is structural models; demographers often face questions that can not be answered using projection methods solely involving demographic factors, here is the role of the structural models because population projections developed by this method can account for factors such as the economy, education etc (Siegle et al., 2004).

Egypt is a developing country suffering from the over population problem, in which the Egyptian government has considered population development as an important key to overcome this problem, one of the most significant factors in the developing process is the education. Higher percentage of educated persons means higher level of development.

This study produces a projection for population by level of education in Egypt up to 2051. It applies the methodology of multi-state population projection to calculate the proportions by levels of educational attainment for five-year age groups of men and women for the period for the whole of Egypt.

Back ground:

(1) Population size and growth in Egypt:

The population of Egypt accounts for one-fourth of the population in the Arab world. Population size is increased almost by 50% between 1986 and 2006, from about 48 million to about 73 million in 2006.

During the past two decades, fertility in Egypt had decreased by more than two births from about 5 births to about 3 births.

Fertility levels differ according to the level of education. Demographic surveys show that TFR decreases with the increase of educational level. Even a few years in school are sufficient to reduce fertility. For instance in 1992, women with no education had an average of 5.0 children, whereas women with an incomplete primary education had 4.0 children. The differentials have been diminishing over the last 17 years; the difference between the lowest and the highest category was 2.2 children in 1988 and only 0.8 in 2005. This is mainly due to the rapid decline in the fertility of women with no education (from 5.4 children in 1988 to 3.8 children in 2005) and with uncompleted primary education (from 4.8 in 1988 to 3.4 in 2005). A study conducted by the CDC (2006) shows that the gender bias toward boys and the desire to have three children, added to the pressure from the close surrounding communities, are the main reasons given by the interviewed participants for having more than two children among the educated people in Egypt.

Total fertility rates by level of education in Egypt (1988-2005)

Survey					
Education status	EDHS 1988	EDHS 1992	EDHS 1995	EDHS 2000	EDHS 2005
No education	5.38	5.03	4.57	4.09	3.8
Some primary	4.76	3.98	3.72	3.78	3.4
Primary through Secondary	3.61	3.03	3.07	3.36	2.9
Completed Secondary	3.15	2.91	3	3.22	3

Source: Ministry of Health and Population, Egypt Demographic and Health Survey 1988, 1992, 2000, and 2005

Like fertility, mortality is a basic component of the population growth. Levels of mortality in Egypt during the last two decades in terms of life expectancy at birth show that life expectancy for males increased from 60.5 years in 1986 to 69.2 in 2006 and for females it increased from 63.5 years to 73.6 years during the same period

The level of education for mothers plays a significant role in the value of IMR. Demographic and health surveys show that IMR of children for mothers with no education declined from 97.8 per 1000 live births to 52.1 per 1000 live births in 2005 and IMR of children for mothers with completed secondary or higher declined from 35.8 per 1000 live births to 26.8 per 1000 live births; so we can say that IMR for mothers with no education is about twice of completed secondary or higher.

Infant and child mortality rates by sex in Egypt (1992-2005)

Survey	Infant Mortality rate IMR 1q0		Child Mortality Rate 4q1	
	Male	Female	Male	Female
EDHS 1992	84.4	75.3	24.6	36.1
EDHS 1995	72.5	73.3	21.7	28.1
EDHS 2000	55	54.5	14.6	16.1
EDHS 2005	43.3	37.1	9.6	10.4

Source: Ministry of Health and Population, Egypt Demographic and Health Survey 1988, 192, 2000, and 2005

Population by level of education

One of the most important factors of the development components is the education status of the population, in addition to the significant role that education attainment plays (as many scientific research proved), it is associated with many other factors, ranging from reproductive behaviour, use of contraceptives, health of children, morbidity and mortality, as well as a large range of economic and development factors.

To study the pattern of education status during the last two decades, we used the census data for those people 10+ years- old. Next table shows population distribution 10+ by sex and level of education. It reveals that the percent of illiterate has declined significantly during the period from about 50% of population aged 10 + years to about 30%, specifically for females it declined from more than 60% to about 37%. For those who have completed the secondary or higher education stage, it is clear that there is an increasing trend; the percentage had doubled during the last two decades from 16% to about 38%, but for females the percentage had doubled 3 times in 2006 in comparison to 1986, which has a significant influence on the remarkable decline in the total fertility rates during the same period. (1986 -2006).

Population distribution by level of education and sex in Egypt
1986 -2006

Year	illiterate			Read & write			Basic Education			Secondary +		
	male	female	total	male	female	total	male	female	total	male	female	total
1986	37.6	62.8	49.9	24.0	15.0	19.6	17.0	11.5	14.2	21.4	10.7	16.3
1996	29.1	50.3	39.4	22.7	14.6	18.7	19.6	15.6	17.7	28.6	19.5	24.2
2006	22.4	37.3	29.7	13.4	10.5	12	20.8	18	19.4	42.1	33.5	38

Source: Central Agency of Public Mobilization and Statistics, Census for Population and Houses 1986,1996, and 2006

Methodology:

   The projection of human capital stock by age and sex is an example of the application of the multidimensional cohort-component model, since education tends to be acquired at younger ages and then moves along cohort lines. Changes in the educational composition of the total population (aged 10 and older) are typically caused by depletion (through mortality) of less-educated cohorts and the entry of more-educated younger cohorts (Goujon and Lutz 2004).

   The multi-state model chosen for this study subdivides the Egyptian population into five distinct groups according to educational status. Each subpopulation is stratified by age (five-year age groups) and sex.

 There are three other parameters for this model: Fertility by educational status; number of international migrants by age, sex, and educational status; and mortality by age and sex.

   Data on the population by age, sex, and   education for the base year were extracted from the results of the 1996 Egypt census (CAPMAS 1998). Data on the age-specific fertility rates by education for the base year were estimated from the Egypt Demographic Health Surveys 2000 and 2005 (El-Zanaty and Way 2001, 2006) and vital statistics. Data on mortality by age and sex were taken from vital statistics; and data on migration were taken from the Egypt censuses 1986 (CAPMAS 1986) and 1996 (CAPMAS 1998) and from migration surveys in Egypt, as well as using the United Nations estimates for the total number of migrants for the whole of Egypt The

projections were made for the period 1996-2051 (it is important to indicate that the base year for that study was 1996 as the final results for the 2006 census was not declared , but results from this study was compared to final results for 2006 census after the declaration of it and it is found that the results of our projection for the period 1996-2051 gave an accurate projection for the year 2006) according to a set of scenarios as detailed in the following pages. Input data for projection by level of education consists of five components: 1) population by age, sex, and education; 2) age and education-specific fertility rates; 3) age-, sex-, and education-specific mortality rates; 4) age-, sex- and education-specific net number of migrants; and 5) age- and sex specific transition probabilities.

Main Assumptions:

Age- and education-specific fertility rates:

Age-specific fertility rates, i.e., the number of children per 1,000 women during a specific year, are used to calculate total fertility rates. For the calculations of the base period (1996-2001) we depended on data from vital statistics and the 2000 Egypt Demographic Health Survey (El-Zanaty and Way 2001). After the data became available from the 2005 DHS (El-Zanaty and Way 2006), we updated the next period (2001-2006).

The data had to be adjusted because of the differences in the definitions of education. The categories used in the DHS do not match our education categories, especially at the lowest and highest levels of education.

Total fertility rates by education category from DHS 2000 and DHS 2005 and adjusted TFR.

DHS education categories	TFR[1] 1997-2001	TFR[2] 2002-2005	Education categories	Adjusted TFR[3] 1996-2001	Adjusted TFR[3] 2001-2006
No education	4.09	3.80	Illiterate	3.82	3.48
Primary incomplete	3.78	3.40	Read and write	3.44	3.11
Primary complete/some secondary	3.36	2.90	Basic	3.25	2.88
Secondary complete and higher	3.22	3.00	secondary	3.02	2.69
Total	3.50	3.10	Tertiary	2.92	2.60
			Total	3.5	3.10

Sources: (1) El-Zanaty and Way (2001); (2) El-Zanaty and Way (2006); (3) authors' calculations.

Age- and sex-specific mortality rates

The information on child mortality by the mother's level of education was used to produce life expectancy at birth by level of education and by sex.

Life expectancy at birth by level of education for males and females, 1996-2001.

Level of education	Life of expectancy at birth	
	Males	Females
Illiterate	62.8	64.1
Read and write	62.8	64.1
Basic	64	65.4
secondary	66.3	67.6
Tertiary	69.6	71.7

Source: Authors' calculations

Age-, sex- and education-specific net number of migrants

The results of the Push and Pull Factors of International Migration (PPFIM 1997) were used to obtain the age, education, and sex profile of the migrants. This was applied to the United Nations estimate for net migration for the starting period 1996-2001. The net number of migrants was further distributed by five year age groups using the same age distribution as in the 1996 census.

Age- and sex-specific transition probabilities

Transition probabilities represent the probability for an individual to move from one education category to the next.

Transition probabilities estimated for 1996-2001, both sexes.

Level of education [a]	males		females	
From 1 to 2 [b]	0.78	0.48	0.71	0.27
From 2 to 3 [c]	0.59	0.75	0.59	0.77
From 3 to 4 [d]	0.50	0.81	0.54	0.83
From 4 to 5 [e]	0.42	0.21	0.41	0.10

Source: Authors' calculations.

(a) 1 = Illiterate; 2 = Read and write; 3 = Basic; 4 = Secondary; 5 = Tertiary, **(b)** Ages 5-9 and 10-14

(c) Ages 10-14 and 15-19, (d)   Ages 15-19 and 20-24, (e) Ages 20-24 and 25-29

Scenarios for projections

The projections of the total population by level of education for Egypt were conducted by using three scenarios for the period 1996-2051.

a) Constant Scenario:

This scenario assumes that all components (fertility, mortality, migration, and education transition) remain constant over the projection period at the same level as they were in the base year. It provides a benchmark for comparison. It is especially useful to see the improvements in education already embedded into the population.

b) Goal Scenario:

This scenario reproduces goals set by the government and international agencies on the demographics and education of Egypt. Fertility was assumed to follow the national target set by the National Population Policy and Strategies (2002-2017) (Ministry of Health and Population 2002), which aims to reduce the total fertility rate from 3.5 in the base period (1996-2001) to the replacement level of 2.1 children by 2017. This will occur in the period 2016-2021, where it would stabilize until the end of the projection period.

Mortality will decline during the whole projection period, with life expectancy at birth increasing by two years every decade for both sexes for all education categories. It is assumed that migration will be constant at the starting year level during the whole projection period. As to education, it was assumed that the Millennium Development Goals would be successfully achieved, which includes the full intake into primary education and completion of basic education for all by 2015 (implemented in 2011-2016) (UN 2003). The gender gap will be eliminated at the primary and secondary levels by 2005 (implemented in 2001-2006) and at all levels of education by 2015 (implemented for the period 2011-2016). Transition probabilities will remain constant thereafter until the end of the projection period. Other transition probabilities (above basic education) will remain constant for the whole projection period. Since the transition probabilities are dependent on the population in the departing state, this assumption will mean an increase in persons with secondary and tertiary education.

c) Trend Scenario

This scenario reproduces the trend observed in education and fertility in the last years.

Fertility follows the trend observed in Egypt through several rounds of fertility surveys between 1995 and 2005, fitting an exponential curve. The total fertility rate was observed to reach the level of 1.7 in 2051. We assumed that the relative difference between the TFR for the whole of Egypt and the other categories would be kept at the level observed in 2001-2006.

Education trends were calculated for the whole of Egypt, we calculated the trend to 2031 looking across three cohorts in 1996 based on the proportions by levels of education. The values for the proportions in 2031, obtained through the extension of the trend shown by the cohorts, were used to calculate new transition probabilities for the target period of 2026-2031 then we extended the trend to 2051 for the whole of Egypt.

Main results:

The population of Egypt will increase rapidly within the next few decades. In all scenarios, it will reach a level of approximately 90 million inhabitants in 2015. By 2031, the population will be between 104 and 115 million, and between 121 and 151 million in 2051. The constant scenario gives the highest population (151 million) which would mean more than a doubling of the 2006 Population, whereas the two other scenarios have closer absolute population levels: 128 million according to the trend scenario and 121 million according to the goal scenario.

These converging results in terms of population are due to the convergence of fertility rates to 2036-2041 as can be seen in the next figure, although the TFRs diverge again afterwards.
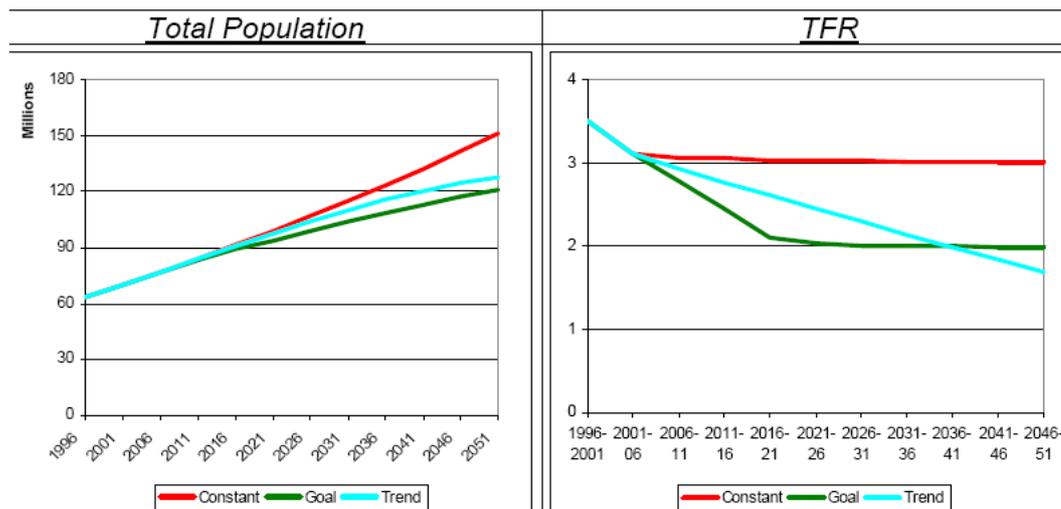
If we look at the age structure and the dependency ratios, we can see that the population will remain young over the next 50 years; although the results show that the old age dependency ratio will increase substantially, especially after 2030 when it will increase from 10 percent to about 20 percent according to the trend and goal scenarios.

The fertility decline envisaged through the trend and goal scenarios will lead the young age dependency ratio from 65 percent in 1996 to 30-32 percent in 2051.
 The working-age population (aged 15-64) will increase to 67 million in 2026, according to both the goal and the trend scenarios. In 2051 it will increase to 79 million, according to the goal scenario and 85 million, according to the trend scenario.

  Under the constant scenario, the proportion of population with a secondary and higher education will increase from 31percent in 1996 to 60 percent in 2051, almost double. This increase will happen mostly at the level of secondary education because the progress in tertiary education is more modest. According to the same constant scenario, tertiary educated persons would account for 15 percent in 2051, up from 10 percent in 1996. Under the goal scenario and the trend scenario, the population with a secondary education would increase to 55 percent and 51 percent, respectively; the values for tertiary education would be 28 percent and 17 percent, respectively.
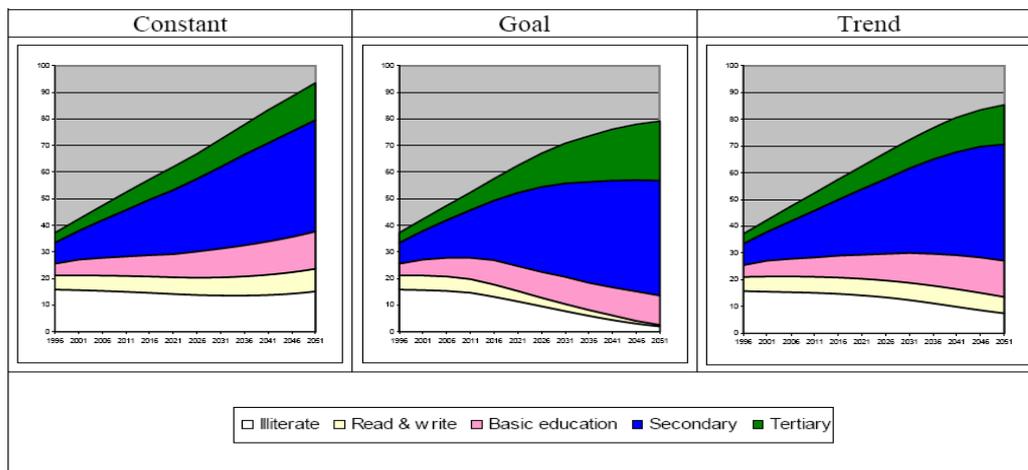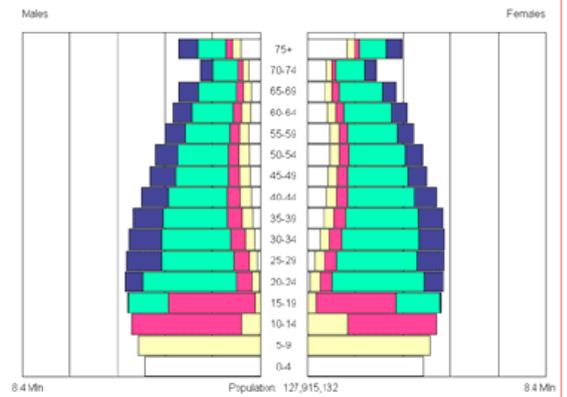
Constant Scenario 2051
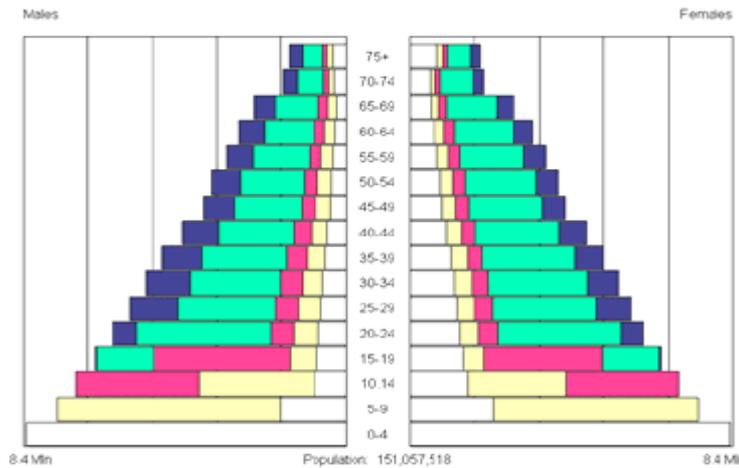
Goal Scenario 2051
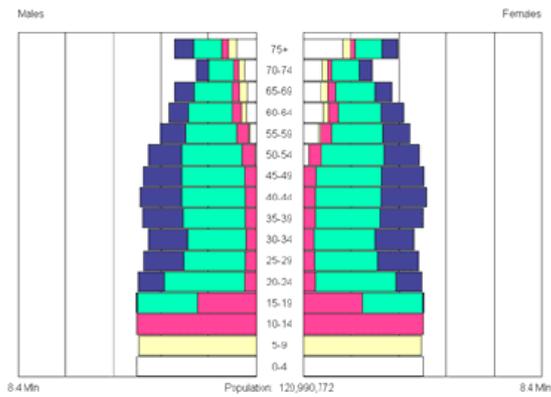
Trend Scenario 2051

☐ Illiterate   ☐ Read & Write   ■ Basic education   ■ Secondary   ■ Tertiary

   Our projections for Egypt are in line with other projections. The constant fertility scenario of the United Nations (2005) gives larger population numbers for 2050 as compared to ours, but this is mostly due to the assumption that fertility is kept at a constant level of 3.3, whereas the IIASA/CDC fertility in this scenario goes down to 3.0 by 2046-2051. Our trend scenario and the UN medium scenario give very close results: 128 million and 126 million, respectively, in 2050/2051. The official CDC scenarios that are implemented until 2021 (CDC 2000) show a smaller population increase than both the UN and the IIASA/CDC projections. This is mostly due to the starting population that is estimated lower in the official CDC projection, where little adjustment has been made especially for underestimation of the first age groups.

Conclusion:

Education could be a crucial input to help Egypt reach its development goals; we developed scenarios to look at the future human capital until 2051 for the whole of Egypt .it is found that the total population in Egypt will to reach 99-104 million in 2026 and 121-128 million in 2051, depending on the scenarios.

The proportion with secondary and tertiary education will increase from 31 percent in 1996 to 60 percent in 2051, which is almost double. This increase will happen mostly at the level of secondary education, because progress in tertiary education is more modest. The gender gap that is linked to the full participation of women in the society will not have been fully closed by 2051.

It is especially prominent in the illiterate category, where 11 percent of the female working age population would still be illiterate. The gender gap is also noticeable at the tertiary level. Only under the goal scenario is it clear that most of the gender differentials in levels of educational attainment would disappear.

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