

# A 23-Year Analysis of Dependency Ratio in Rural Population in Fars Province during 1990-2012: A Trend Analysis Study

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## Abstract

**Background:** The dependency ratio (DR) is defined as the ratio of the non-working population to the economically active population. Dependency ratio is calculated by the sum of population under fifteen years and over 65 years divided by 15-64 year old population. The interpretation of DR variation gives us the impact of health care services and some reproductive interventions. This study analyzed a 23-year DR trend in rural population of Fars province and the effect of some fertility variables on it.

**Methods:** In this study, using data from vital horoscope and regression analysis, we analyzed a 23-year period of DR and some fertility indicators.

**Results:** The total DR significantly declined from 102.5% in 1990 to 41.4% in 2012 ( $P<0.001$ ). Most of this reduction is attributed to reduction in young DR. Old dependency ratio (population of 65 years and more) was significantly growing ( $P<0.035$ ). Number of rural health house, family planning coverage, total fertility rate and general fertility rate was significantly associated with total dependency ratio ( $P<0.009$ ).

**Conclusion:** We passed the first stage of demographic transition, i.e. young dependency ratio declining. But the old dependency ratio slowly increased; it is recommended that the health care services should be promoted in future, especially services for old age people.

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## Introduction

The Primary Health Care (PHC) plays a determining role in improving health in a society and its development in all aspects. The main objective of PHC is to provide more and better health for everybody.<sup>1</sup> According to the World Health Organization, health is defined as: "State of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity". Amongst the main ways of achieving this goal are death rate reduction and birth control. Irregular population growth is one of the main reasons of failure in achieving the goals of multi-aspect development, especially in countries that

have just started their development. In general, the goals of PHC are first to reduce the morbidity and mortality, particularly infant mortality, reduce fertility and overall mortality, and increase life expectancy. Therefore, we will encounter a gradual decrease in the percentage of young population and then an increase in the number of the elderly population.

Dependency ratio indicates inactive population ratio compared to active population ratio in terms of economy and employment. To estimate dependency ratio, people under the age of 15 and above the age of 65 are often used<sup>2</sup> but in some countries people who are under the age of 20 or even 25 are used as young

dependent population while those who are 60 or 69 or even 74 years old are used as old dependent population. Dependency ratio is affected by at least two issues: 1. the population younger than 15 years old; 2. the 65-year-old or older population. Hence, the increase or decrease of this index is not interpretable alone and one must consider which aspect of dependency has increased or decreased. Therefore, like crude death ratio, either the increase or decrease of dependency ratio index can be desirable or undesirable (3). In general, dependency ratio is affected by some factors including health, economic and social factors. The increase of this ratio means that more people are economically dependent on the productive individuals. But if the increase occurs mainly among young people, it means that the birth rate has been high and the need for jobs and earnings will increase in future. On the other hand, if the increase occurs mainly among the elderly, it suggests an increase in the elderly and patients' care as well as life expectancy.<sup>4</sup>

According to the census in 2006, the dependency ratio in Iran was 43% while it was announced to be 94% in 1986.<sup>5</sup> That is to say, in 1986 each 100 people who were at the age of working and profitability had to make a living not only for themselves but also for 94 other people who were not at the age of working and economic profitability, but in 2006 the number of dependent people had decreased to 43.

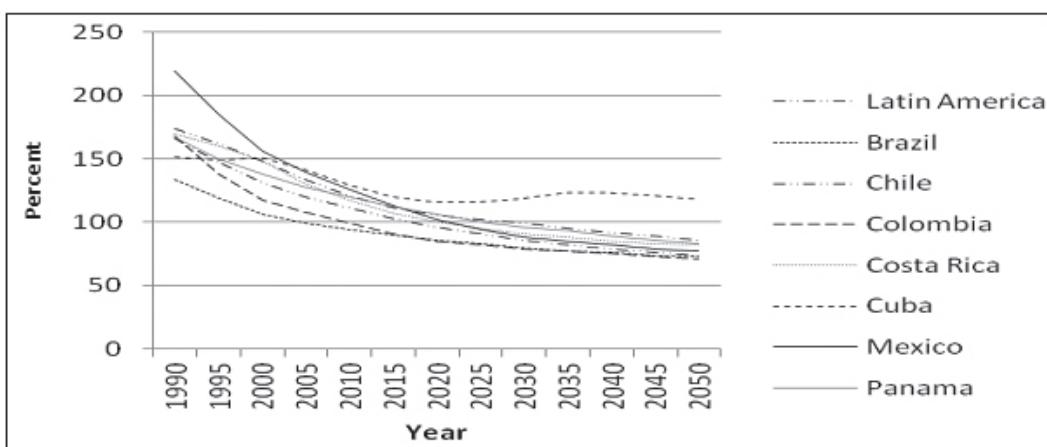
The development procedure of the developed countries is as follows: first the rapid population growth and the young population percentage are decreased and then the 65-year-old and older population gradually increases, and generally the dependency ratio decreases in the first stage (due to the decrease of younger-than-15-year-old population) and in longer stages it increases due to the increase of 65-year-old and older population. According to the investigations, in developed countries like Japan the dependency ratio decreased from 68% in 1950 to its lowest amount, i.e. 43% in 1992. Then it increased again and reached 56% in 2010.<sup>6</sup> This increase of the dependent population in Japan is related to the increase of 65-year-old and older population percentage so that it reached from 5.3% in 1920 to 12.1% in 1999 and it is predicted that in 2010 and then in 2090 it will reach 21.3% and 25%, respectively.<sup>7</sup> It means that they have first decreased the under-15-year-old population as much as possible but because of appropriate health and medical care and improved lifestyle, the percentage of 65-year-old and older population has increased. However, according to the investigations done, not all developed countries have worked like Japan but it can be said that most of them have passed the stage of under-15-year-old population decrease.<sup>6</sup> During the last 60 years, a developing country like Iran has reached from 69% in 1950 to its highest amount which is 97.7% in 1988 but then it started to decrease and in 2010 it reached 39%. In some other developing countries such

as Malaysia, Turkey and Cuba the dependency ratio has changed from 93.5%, 85% and 76.7% in 1970 to 54.1%, 17.8% and 42.3 in 2010, respectively.<sup>6</sup> The underdeveloped countries including some African countries have first had an increasing trend during the last 60 years and then, in the middle of their way, they had a decreasing procedure and now they have reached 70%.<sup>6</sup> It is predicted that in future most countries of the world will experience an increasing trend after a decrease in dependency ratio (due to the birth rate decrease), but the beginning of the increasing trend will vary among them.<sup>8</sup> Such a prediction can also be expected for a country like India. The dependency ratio in India was 44.5% in 1950 but it will reach 35.1% and 40.8% in 2020 and 2050, respectively.<sup>9</sup> This trend can also be observed in Latin America and Central America, (Figure 1).

One of the most significant determinants of dependency ratio is accomplishment of Family Planning programs and, following that, fertility reduction.<sup>10, 11</sup> In addition to the accomplishment of Family Planning programs and birth control, preventing mothers' and infants' mortality and contagious diseases, and preventing and appropriately curing non-contagious diseases all result in birth rate reduction first, and then increase in life expectancy.<sup>12</sup> Besides death rate reduction, one of the most important determinants of dependency ratio is fertility rate reduction.<sup>4</sup> If the fertility rate decreases, the 15-year-old population and, in general, the dependency ratio will decrease. Through the fertility rate reduction, Family Planning programs cause the dependency ratio to decrease. On the other hand, as life expectancy, old population, and dependency ratio increase, we must get sensitive to retirement period and related issues<sup>13</sup> such as diseases and cares for the elderly. This study has been done with the aim of analyzing dependency ratio procedure during the last 20 years in rural societies and determining the effects of some family planning and fertility criteria on that procedure.

## Materials and Methods

In this trend analysis study, we used the ecologic data such as all components of DR, Total Fertility Rate (TFR), General Fertility Rate (GFR), and percentage of women using family planning methods from vital horoscope of rural areas in Fars province, located at southern Iran, to analyze total, young and old dependency ratios during 1990 to 2012. We also investigated the effects of variables such as the number of health-houses, TFR, GFR, and percentage of women using family planning methods on dependency ratio and its components. Vital horoscope is a statistical panel for monitoring some important vital statistics and health events. The increase in health care services (in this study, the number of health-centers has been considered as an indication



**Figure 1:** Estimating dependency ratio in some countries of Latin and Central America from 1950 to 2050.

of health services and investment in health sector) and, following that, the increase of family planning programs coverage might decrease total and general fertility rates and eventually influence the age composition of the population. In order to investigate the correlation and determine the effects, we used the correlation coefficient and regression coefficient, respectively. The fertility and family planning data were gathered from vital horoscope of Fars province. The significance level in all statistical tests was considered lower than 0.05.

#### Definitions

The percentage of under-coverage women using family planning methods refers to the number of under-coverage married women between the ages of 15 to 49 who use one of the reliable methods of contraception divided by the number of all under-coverage married women between the ages of 15 to 49100.

Total fertility rate refers to the average live infants to whom a woman gives birth during her lifetime.

The general fertility rate refers to the number of live children born by 1000 women between the ages

of 15 to 49 in a single year.

Total Dependency Ratio (TDR) means:

$$TDR = [(Population (0-14) + Population (65+)) / Population (15-64)] \times 100$$

Young-Dependency Ratio (YDR) means:

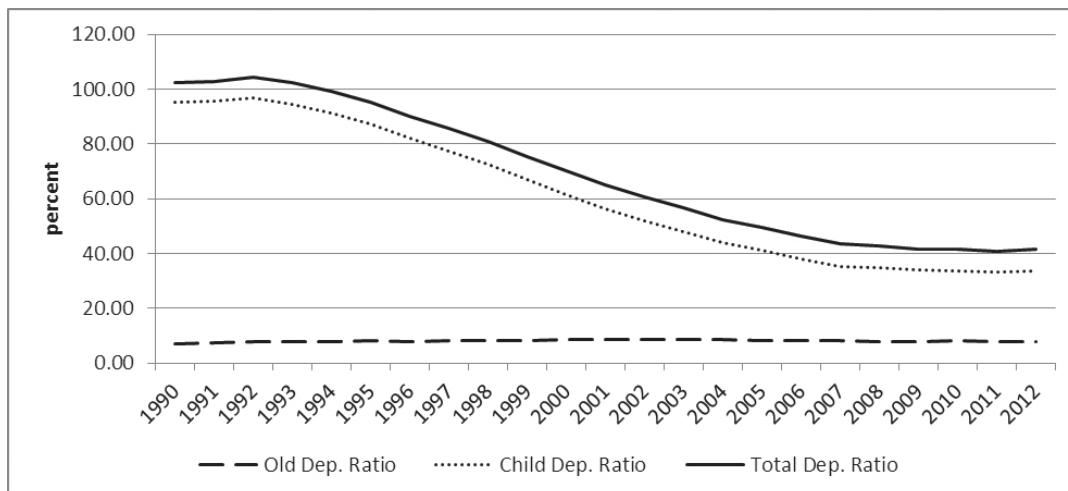
$$YDR = [Population (0-14) / Population (15-64)] \times 100$$

Old-Dependency Ratio (ODR) means:

$$ODR = [Population (65+) / Population (15-64)] \times 100$$

#### Results

During the study period, TFR and GFR reduced from 3.5 and 114 to 1.7 and 58, respectively. Number of health centers also reduced from 543 to 1000. Family planning coverage increased from 43% to 63% in Fars province at that period. The trends toward dependency ratio in rural population of Fars province during 1990 to 2012 is shown in Figure 2. The total dependency ratio has had a significant descending trend during this 23-year period ( $P<0.001$ ). It has decreased from 102.5% in 1990 to 41.6% in 2012 (at least 60% decreasing). The regression analysis was used to study this decrease in time more accurately. The regression coefficient ( $\beta$ )=-3.77. As can be seen in Figure 2,



**Figure 2:** Trend of total, child and old dependency ratios in rural areas of Fars province, 1990-2012.

the young-dependency ratio (YDR) trend had a negative slope and  $\beta$  was -3.8 and it was decreasing with  $P<0.001$ ; also, Old-Dependency Ratio (ODR) had a positive slope and  $\beta$  was 0.03 and it was significantly increasing during the study period ( $P<0.035$ ).

As can be seen in Figure 3, the largest dependent population belonged to the population under the age of 15, and during this 23-year period, the population under the age of 15 gradually decreased while the 65-year-old and older population increased but with a slight growth. The trend of YDR compared to ODR shows that it has changed from 13.5 times as much in the beginning of that period to 4.3 as much at the end of it ( $P<0.001$  and  $\beta=-0.52$ ).

We used the correlation coefficient to show the relationship among these variables together (Table 1). As seen, there is a significant correlation among all these variables. Since TFR and GFR could be affected by family planning coverage with using bivariate regression analysis, a significant relationship ( $P<0.001$ ) was observed between family planning coverage with TDR and YDR. This analysis also showed that only the number of health centers had a significant relationship with ODR ( $P<0.033$ ). As shown, there is a positive correlation between ODR

and life expectancy. In this study, we also obtained such finding,  $r=0.58$  with  $P<0.01$ .

## Discussion

Total dependency ratio had a significant ( $P<0.001$ ) decreasing trend during this 23-year period. It has reached from 102.5% in 1990 to 41.4% in 2012. It has been indicated in many studies that this decreasing trend has existed in many countries during these recent decades.<sup>6, 14</sup> This decrease is more attributed to the decrease of young dependency ratio as a result of the decrease in fertility rate as well as the success of family planning goals, so that the percentage of under-coverage women using family planning methods and general fertility rate has changed from 43% and 3.5 in the beginning of the period to 61.3% and 1.79 at the end of it, respectively. As mentioned before, interpreting general dependency ratio per se is not correct and it must be taken into consideration which part of total dependency ratio (young or old) is changing. Generally, the dependency ratio change trend in most developed countries could be divided into two stages: the first stage mainly included decreasing changes in young dependency ratio and then the increase of old dependency ratio occurred with a slower growth.<sup>7, 8</sup> Regarding the values and slope of

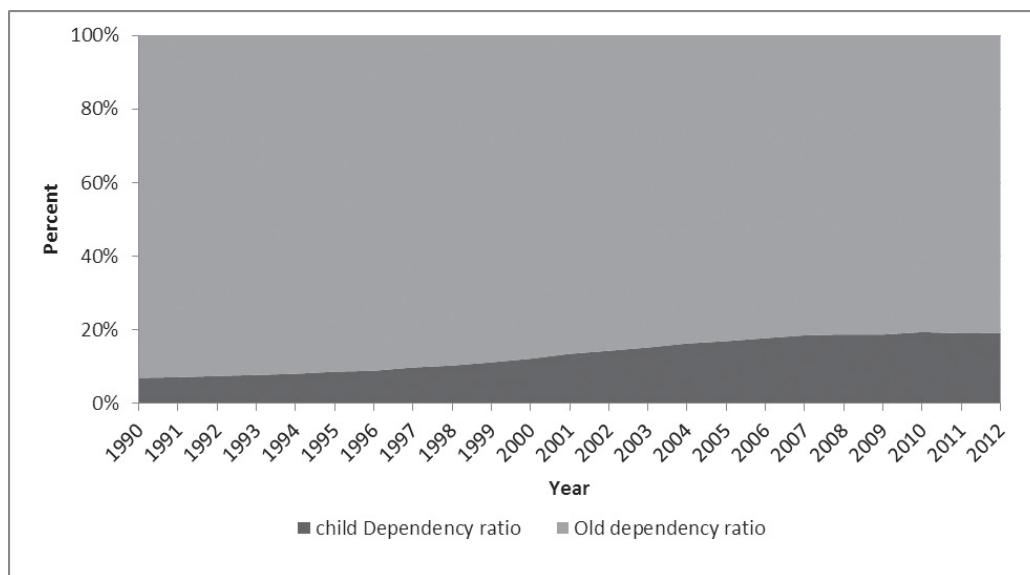


Figure 3: Trend of child and old dependency proportions in rural areas of Fars province, 1990-2012.

**Table 1:** Pearson correlation coefficient of predictive variables on dependency ratio

Variables effective on dependency ratio	General fertility rate	Total fertility rate	Family planning coverage (%)	Number of health-houses
General fertility rate	1			
Total fertility rate	0.993 $P<0.001$	1		
Family planning coverage (%)	-0.967 $P<0.001$	-0.974 $P<0.005$	1	
Number of health-houses	-0.64 $P<0.001$	-0.694 $P<0.001$	0.9 $P<0.001$	1

dependency ratio curve in Figure 2 and comparing it with the trends in developed countries it can be estimated that we are almost in the beginning of the second stage and from now on, we should expect the increase of old dependency ratio and, gradually, the increase of total dependency ratio.<sup>15</sup> Results of this study showed that by increasing health services and family planning coverage and then decreasing fertility rate, the dependency rate, which was mainly due to the decrease of under-15-year-old population, may be decreased. This way, the fertility rate decrease might play the role of increasing welfare level of families as well as economic growth of societies.<sup>16, 17</sup> The significant decrease of YDR first results in a decrease in income and expenditure difference, and finally promotes social justice for providing childhood services and care, and this suitability has caused a significant decrease ( $P<0.01$ ) in under-one-year-old infants' mortality.<sup>18</sup>

Vital horoscope was first applied in 1988 in health-houses. The data obtained from vital horoscope, especially population data (birth and death), has an acceptable quality.<sup>19</sup> One limitation of the present study was that it just studied rural areas. In case of combining urban areas' statistics with the present statistics (under the title of total statistics of Fars province), more reliable and generalizable results could be obtained. The other important point is that ecologic data were used in the present study. All ecologic studies have potentially a limitation, called ecologic fallacy, i.e. a relationship might exist between variables in group level but not in individual level and vice versa. On the other hand, it is not possible to control confounding variables.<sup>20</sup> However, this study did not mainly aim to confirm the hypotheses; instead, it showed the correlation between some variables and dependency ratio. Therefore, if there seems to be a need for investigating the causal relationship between some variables and dependency ratio, doing analytical studies and appropriate multi-level analyses is necessary.

In general, results of this study revealed that dependency ratio of Fars province's rural population has significantly decreased during the 23-year period and compared to the statistics of developed and even some developing countries, we have passed the first stage of dependency ratio changes (young dependency ratio decrease) with an acceptable success and now we are in the beginning of the second stage. In other words, we are in a demographic transition and must increase life expectancy and old dependency ratio through the increase of cares for the old and chronic diseases. Regarding the importance of this criterion, it seems necessary to make efforts in order to improve this criterion by promoting health services level, increasing health services budget, increasing knowledge level, retaining family planning coverage and fertility rate at the current level, improving cares during old age,

and increasing availability of health services.

**Conflict of Interest:** None declared.

## References

- 1 World Health Organization. Primary health care. Available at URL: [[http://www.who.int/topics/primary\\_health\\_care/en/](http://www.who.int/topics/primary_health_care/en/)] Cited Aug 10 2011.
- 2 Coggon D, Rose G, Barker DP. Epidemiology for the Uninitiated. 5<sup>th</sup> ed. London: British Medical Journal Publications, 2003.
- 3 Gerstman BB. Stratification and adjustment in epidemiology kept simple: An introduction to modern epidemiology. A John Wiley & Sons, Inc. Publication. New York 1998; 108-120.
- 4 Kogel T. Youth dependency and total factor productivity. *Journal of Development Economics* 2005; 76: 147- 73.
- 5 Khosravi A, Najafi F, Rahbar MR, Motlagh ME, Kabir MJ. Health indicators in Islamic Republic of Iran, 2009, (Persian). Available at URL: [[http://siasat.behdasht.gov.ir/uploads/291\\_1350\\_simayei-salamat.pdf?siteid=291&siteid=291&pageid=31805](http://siasat.behdasht.gov.ir/uploads/291_1350_simayei-salamat.pdf?siteid=291&siteid=291&pageid=31805)] Cited Aug 11 2011.
- 6 Gapminder, World 2009. Wealth & Health of Nations. Available at UR: [<http://www.gapminder.org/data>] Cited Aug 17 2011.
- 7 Kojima H. Aging in Japan: Population Policy Implications. *Korea J Popul Dev* 1995; 24(2): 197-214.
- 8 United Nations. World population to 2300. ST/ESA/SER.A/236. Available at URL [<http://www.un.org/esa/population/publications/longrange2/WorldPop2300final.pdf>] Cited Aug 17 2011.
- 9 UN 2001, World Population Prospects. The 2000 Revision volume 1.
- 10 USAID. Family Planning Improves Quality of Life and Opportunities for Women, issue brief. July 2009.
- 11 Raleigh VS. World population and health in transition. *BMJ* 1999; 319: 981-4.
- 12 Do Health and Longevity Create Wealth? ILC Working Paper (New York: ILCUSA, 2004).
- 13 Lacomba JA, Lagos F. Population aging and legal retirement age. *J Popul Econ* 2006; 19: 507-19.
- 14 United Nations. 1996. World Population Prospects: The 1996 revision. Annex I: Demographic indicators. United Nations Department for Economic and Social Information and Policy Analysis, Population Division, New York.
- 15 Gapminder, World 2009. Wealth & Health of Nations, Available at URL:[<http://www.gapminder.org/data>] Cited Aug 12 2011.
- 16 Gauthier A, Hatzius J. Family Benefits and Fertility: An Economic Analysis. *Population Studies* 1997; 51: 205-306.
- 17 Becker G, Barro R. A Reformulation of the Economic Theory of Fertility. *The Quarterly Journal of Economics*

- 1988; 103(1): 1-25.
- 18 Peña R, Wall S, Persson L. The effect of poverty, social inequality, and maternal education on infant mortality in Nicaragua, 1988-1993. *Am J Public Health* 2000; 90: 64-9.
- 19 Khosravi K, Motlagh ME, Emami Razavi SH. The Iranian Vital Horoscope; Appropriate Tool to Collect Health Statistics in Rural Areas. *Iranian J Publ Health* 2009; 38: 74-80.
- 20 Schwartz S. The fallacy of the ecological fallacy: the potential misuse of a concept and its consequences. *Am J Public Health* 1994; 84: 819-24.