Using Cox Model on Tempo and Influential Factors in Women of Bahram Abad Village

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Abstract

Objective: Tempo is the average waiting time to next birth for a woman. Role of fertility as the most important phenomenon determining population fluctuations due to the studies of it compared with other demographic phenomena be important and review the multifarious socioeconomic factors of it share a large effective population studies. General purpose of this study is fitting the Cox model to determine factors that influence the birth of second child and too calculate the tempo in second to eight births on Bahram Abad rural women.

Materials and methods: Population under study are all married women with 15–45 years old that live in Bahram Abad village's and have had at least two children. This study is a cross sectional study. In the present study birth of each child is considered as a disaster and because survival data generally have not symmetrical distribution then the Cox regression model (Proportional hazard model) is used for effects of variables on survival and hazard.

Results: In this research 228 mothers were studied and they have had 669 children. Mean number of children is 3 and 42% of these children are girls and others are boys. Maximum tempo is from labor fifth to labor sixth (63.32) and the least is from the sixth to seventh of childbirth (57).

Conclusion: In the final model from available variables only the age difference of parent had a positive impact on tempo.

Keywords: Fertility, Cox model, Hazard, Tempo

Introduction

Currently more than 6.9 billion human beings live on earth and experts believe that within 7 years the population of the world will pass 7 billion and it should be considered that 86% of this population belongs to the under–developed countries. This increase in the population may lead to blatant educational as well as health problems (1).

The Islamic Republic of Iran has experienced dramatic changes in fertility and population growth rates during the past 30 years. A change in population policy immediately after the revolution resulted in the suspension of the family planning program and led to a huge rise in fertility and population growth rates.

Following the revival of this program in 1989, the fertility rate declined significantly and by late 2000 there were indications that the fertility rate had dropped

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to around replacement level (a total fertility rate of 2.1 per woman) in all urban areas as well as some rural districts. The growth rate during 1975–2000 was high enough to lead to a doubling of the country's population during.

The huge cohort of 31 million children born during 1991–1997 continues to present the country with problems. The proportion of the elderly (age group 65+) has risen to 5% and may soon pose major challenges for the social security system. The past 30 years have also seen a significant rise in the urbanization rate of the population. In 2006, 71% of the population (just above 52 million) lived in urban areas.

After Pakistan, the Islamic Republic of Iran is the second largest host country for refugees in the world. As estimated in January 2007, there are 968 registered refugees (and approximately 2 million unregistered) in Iran, equivalent to 14 refugees for every 1000 (2). The flood of immigrants toward Tehran city has lead to the extremely high growth in population of the city. The civil experts believe that the population of Tehran will grow twice within 7 years and will reach 14 million (1).

The main target of this study is Cox fitted Model for determining the factors influencing the birth of 2nd child as well as calculating the acceleration of fertility (Tempo) on 2nd to 8th children in women of Bahram Abad village.

Material and Methods

In a cross–sectional study the information of 228 mothers were collected from the Bahram Abad village, one of the suburbs of Eslamshahr township.

The populations under study are all the married women between 15–49 years old, who are fertile and have at least 2 children.

The city of Eslamshahr is located approximately 15 KM apart of south west of Tehran. This township has been under attention for many years because of the good and fertile farmlands, Karaj River and vicinity to Tehran as well. This township has an area of approximately 195 Square kilometers (3).

Bahram Abad village is one of the main villages in this township with the population of 1770 person according to the census of 1385s. Due to its closeness to Tehran the main occupation of the people are self–employment jobs.

The covariates were: the age difference of the parents, the gender of the 1st child (boy = 1, girl = 0), occupation of the mother (housewife = 0, employed = 1), father's and mother's education (uneducated, primary school, guidance school, high school, academic studies), and occupation of the father (jobless, worker, or employee).

Some medical and demographic studies concern the time to occurrence of an event like time to first pregnancy, which named survival or failure time. In the current study the birth of each child is considered as an event and time between successive birth as failure time. In this case the Cox regression model (proportional hazard model) is appropriate for evaluating the effect of variables on survival or hazard rate.

If the model will be applied on the ith person from n persons, the hazard function $\lambda_i(t) = \lambda_0(t) \text{ Exp } (\beta_1 z_{1i} + ... + \beta_k z_{ki})$. Where $z_i = (z_{1i},...,z_{ki})$ is the vector of covariates described for ith person and $\lambda_0(t)$ will be the baseline hazard function.

To answer the following questions; how much is the acceleration of fertility (Tempo) between the births and what are the factors influencing it? Tempo was calculated and for selecting the effective covariates we used the Cox model.

Tempo is the average waiting time to next birth for a woman. If this time it short is means a high tempo and vice versa. There are different ways to calculate tempo and all of them use the time gap between the two births. In this study the Toki way has been used and it has been calculated separately for each births. In this approach which has been applied by Rodriges Hambgraft (4).

The 3 average will be used for calculating tempo. This 3 average is like $(q_1+2q_2+q_3)/4$ where q_1,q_2 and q_3 are 1st, 2nd, 3rd quarters of the time birth distribution.

Results

In this study 228 mothers has been studied who were having 669 children at the time of study. The average and standard error for the number of children respecttively are 3 and 1.05.

42% of these children are girl and the rest are boy. Only one mother has 7 children and the rest has less than 7 children. Approximately 75.6% of the mothers are literate and for fathers the percentage is 86.2%.

About 4.2% of fathers are jobless and most of the mothers (98.7 %) are housekeeper.

Table 2 shows the children gender distribution according to the birth order. As you may see the percent age of girls are more than boys and in 3rd birth it is almost two times but that is not meaningful (p–value >0.5).

In half of the families under the study the parents

Table 1: The fertility indices in Eslamshahr and Bahram Abad village in 1386 (population information of health houses of Eslamshahr health network 1386)

Indexes	Rural areas of Eslamshahr	Bahram Abad Village
Normal population growth	0.15	1.24
Raw birth rate	10.99	11.28
General fertility 15–49 years	46.27	35.41
General fertility 10–49	39.07	31.58
Total fertility 10–49	1.56	1.26
Net reproduction rate	0.70	0.42

have age difference of 60 months at least.

The acceleration of fertility (Tempo)

According to table 3 the highest tempo is for 5th and 6th births (32.63) and lowest one is for 6th and 7th (57). But since only one of the mothers who have 7 children it is not reasonable to consider the lowest tempo for it and therefore for that we can mention 1st and 2nd birth (48.25)

Estimation of hazard function for the birth of 2nd child

Proportional assumption for Cox model was checked and the results are shown in table 4.

By using backward elimination finally the age differences of parents had the significant effect on the gap of inter births (p=0.008), i.e., with adding one year to the parents age difference the pregnancy gap will become Exp(0.0005) = 1/0005.

Discussion

Considering the above given information and comparing them in table 1 we get to know two significant points; 1st that as we were expecting the raw rate of birth in Bahram Abad is more than rural areas of Eslamshahr and therefore the natural population growth should also be more. And the 2nd point is that the net reproduction rate is less than 1 for both populations and it is a warning for demographists regarding the decrease in birthing to girl babies and which leads to not having another reproduction. Of course the recent event in table 2should also be noted, because in all the births the percentage of boys is more than girls **but that is not meaningful (p–value >0.5)**.

The average and standard error of the tempo is respectively 42.77 and 8.56 and this shows a gap of 3.5 years for the birth of each child. Of course considering the fact that average number of children in these women are 3 and also due to its closeness to Tehran and having urban occupations having the city way of life is expected in this village and in a way having the gap of 3.5 years can be seen as one of these influences.

As it was seen in the primary model of Cox, the variables of the parents age difference, the father's educational level and the gender has positive effect on the gap between each two births and therefore leads to decrement in the number of children and the rest of the variables follow the contrary of this.

With adding one year to the parents age difference the pregnancy gap will become Exp(0.0005) = 1/0005, that in spite of having meaning, it shows so much little growth.

Eventually considering final model, among the variables under discussion only the difference in the age of parents variation has a positive effect on the gap between births and in the remaining model and the final

Table 2: Children's gender distribution in women of Bahram Abad village

Birth order	Number of children	Percentage of boys	Percentage of girls
1st birth	228	59.6	40.4
2nd birth	228	58.8	41.2
3rd birth	128	53.1	46.9
4th birth	60	60	40
5th birth	19	68.4	31.6
6th birth	5	40	60
7th birth	1	–	100
Total	669	58.1	41.9

Table 3: Estimation of tempo for each birth as per month in women of Bahram Abad village

Birth order	1st Quarter	2nd Quarter	3rd Quarter	Tempo
2 nd birth	27	47	72	48.25
3 rd birth	24	36	60	39.00
4 th birth	27	36	62	40.25
5 th birth	30	40	48	39.50
6 th birth	22.5	31.5	45	32.63
7 th birth	57	57	57	57

model is equal to:

$\lambda (t/z) = \lambda_0(t) \text{Exp}(0.0005)$ (the difference of the parents age)

The positive influence of the parents age difference on the gap between births and its negative influence on the number of children can be interpreted in this way: with the increment in age difference, the age of the mother or father is increased and as we know as we get older the inclination towards having a child will decreased.

In a general glance and considering the limited variables, we can conclude from the represented results that since in Bahram Abad village the high number and priority of boy children has resulted in a kind of decrement in birthing children. Therefore it can be said that in bearing children they are following the city style of life, while the contrary is seen in other villages.

A more extensive study in this subject done in 1384s shows that the most significant influencing variables on the gap between pregnancies are: The age at the time of marriage, the age at the time of child delivery, duration of breast feeding and the mother's education (5).

In another study done by Faghihzadeh and others (6) the most significant factors were considered to be the age at the time of first marriage and the mother's educational level. Other studies done in other countries which are not as comprehensive as the recent work and has studied less variables, but they have reached the same results. One of this studies which has been done in 1974 was about the gap between births during 1951 until 1966 in England and Wales, done by S.M. Farid. The mentioned study proved that the relation between the age of marriage and the gap between the marriage and the birth of the first child in England and Wales are like the image of a capsized U. i.e. as the age of marriage is increased the gap between the birth of the first child and marriage is also increased (7).

The reason that this relation holds true is that the marriage in upper ages for women results in decreasing their fertility period and therefore the average of the gap between their births is less than the women who are getting married at lower age. Also the numerous studies done in America regarding the gap between giving births which the most comprehensive of them has been done in 1974 by Katheline Ford has shown more fertility between the marriage time and the first birth for the women who has got married in lower ages comparing to women who has got married older ages (8).

In another study done in 2003 in Netherland the most important factors are considered to be the behavior taken after the parents and also the economic situation of the society (9). In this field another study has been done in Canada which considers the most important factors of delaying the pregnancy to be, first the educational level and the belief of the society (10).

Table 4: Primary estimation of Cox model parameters in the women Bahram Abad village

Variation	Coefficient	Meaning / Result
Parents age difference	+0.0004	0.017
Mother's education	–0.1563	0.110
Mother's occupation	–0.1295	0.630
Father's occupation	–0.0140	0.730
Father's education	+0.0877	0.360
Gender	+0.0364	0.800
N = 228 P = 0.131	Df = 6	LR = 9.85

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