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Unwanted Pregnancies among Rural Women in South of Iran: A Model Based Approach

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Abstract: Unwanted pregnancy (UP) is a common problem in all societies and it is a pregnancy that is not desired by a parent or both parents. Despite the success of family planning programs during recent years in Iran, some surveys indicate a significant proportion of pregnancies are unwanted. In this study, we determined the effects of relevant socio-demographic variables on the number of UP among the rural women by zero inflated models. The history fertility of 1124 ever married women aged 15-49 years in the rural districts of Shiraz (south of Iran) were collected. We used zero-inflated models to determine the effects of socio-demographic variables on the number of unwanted pregnancies. Almost 24.3% of woman experienced at least one UP. The results clearly demonstrated the influence of the number of live-born boys and girls, the mean interval between pregnancies and the number of abortions on UP. It is essential to identify the determinants of UP to help policy makers and program managers design modules and services.

Key words: Unwanted pregnancy · Rural · Iran · Poisson regression · Negative binomial · Zero-inflated

INTRODUCTION

Unwanted pregnancy (UP) is the one that is not desired by a parent or both parents. It is a common problem in all societies [1]. Most of the studies show that UPs have a lot of side effects on the health of mothers and unwanted children [1-4]. Mothers with UP may avoid prenatal care and they may have a lot of stress and suffer from depression during the pregnancy and after [5]. UP may increase the rate of infant mortality and maternal morbidity, schizophrenia in infants and child persecution. The relationship quality between mother and child may decrease in the case of UP and it can reduce the chance of breastfeeding for the child. These children are likely to have more mental and physical problems during childhood and may have criminal behaviors [6-9].

Ups cause inappropriate growth of population and can be a threat for family economics so the quality of life will decrease and it is a threat for the whole society [10]. The majorities of abortions are related to UP [6, 7]. One important factor that may cause UP is using contraception incorrectly or do not using them at all [11].

Despite the success of family planning programs during recent years in Iran, some surveys show a significant proportion of pregnancies are unwanted [12]. There are some descriptive studies on UP in Iran [10, 12-15]. Studies of this nature often fail to use appropriate methods for evaluating a count variable, such as number of UP, so the purpose of this study was to determine the effect of relevant socio-demographic variables on the number of UP among the rural women in Fars province, south of Iran. Since the main response variable was count, this study highlights the application of zero-inflated negative binomial (ZINB) and zero-inflated Poisson (ZIP) model because of over-dispersion and zero inflated data.

MATERIALS AND METHODS

In a cross-sectional study, we used a multistage design to obtain representative samples from the rural districts of Shiraz (largest city in south of Iran) in 2008. The childbearing behaviors of 1124 ever married women aged 15-49 years were collected. The rural district of Fars

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province includes people with low socio-economic status (because of drought in the past several years). A general self-administered questionnaire was applied (e.g. age at marriage, number of years of education, menstrual age, family income, height, length of marriage …) Furthermore, within a rural subsistence based society, the economic condition of any household is unlikely to vary drastically from each other. Women do not work heavily in the fields and smoking and alcohol consumption are none existent or very rare.

The number of UPs was considered as the main response and marriage duration (months), woman's age at marriage, years of study, the mean interval between pregnancies (years), the mean duration of breastfeeding (months), the number of live-born girls, the number of live-born boys and the number of abortions were considered as explanatory variables.

Commonly, a Poisson regression model is used when the dependent variable is a count or rate data to describe the probability of occurrence of count data. Poisson distribution assumes the equality of the conditional variance and the conditional mean (equidispersion). The density function of a Poisson distribution is:

$f(y_i| x_i)= e^{-\mu_i} \mu_i^{x_i}/ x_i!$; $y_i= 0, 1, 2, ...$ with mean and variance:

$$var(y_i| x_i)= E(y_i| x_i)= \mu_i = x_i\beta$$

The effects of explanatory variables (x_i's) on y_i are modeled through the parameter μ_i. In real situations, when there is a random effect for the individuals or a tendency for observations to cluster or there are a large number of zeros, this assumption may be rejected. Some problems may occur; over-dispersion (variance> mean), under-dispersion (variance< mean) or inflated zero. In this study we have zero inflation (75.7% of women did not have any UP) and some degree of overdispersion.

Zero-inflated count models offer a way to model the excess zeros. When the data shows over-dispersion too, the zero inflated negative binomial is appropriated [16, 17]. A zero inflated count model, supposes that the zero count comes from two sources [16, 17]. In a zero-inflated specification for UP, one source of zeros consists of the women who did not experience UP due to the fact that they were childless because their marriage durations were very short or they were sterile, while the other source consists of women who had not any UP because of using contraception in the correct way or wanted to have more children. In the first case, the zeros are random and in the second case absolute.

A logit or probit model is used to determine the probability count outcome to be zero. The zero-inflated probability density function is given by

$$P[y_i = 0] = F(\boldsymbol{z_i}\gamma) + (1 - F(\boldsymbol{z_i}\gamma)) f(0 \mid \boldsymbol{x_i}),$$
$$P[y_i = r] = (1 - F(\boldsymbol{z_i}\gamma)) f(y_i \mid \boldsymbol{x_i}), \qquad r = 1,2,....$$

where $F(z_i\ \gamma)$ is called the zero-inflated link function and can be specified as logistic or probit function. z_i is the vector of zero-inflated covariates and γ is the vector of zero-inflated coefficients to be estimated. The z_i may be the same or different from explanatory variables x_i. $f(y_i / x_i)$ is the density of a count regression model with explanatory variables. When the density of $f(y_i / x_i)$ is Poisson, the model is called the zero-inflated Poisson (ZIP) model and when it is negative binomial, the model is zero-inflated negative binomial (ZINB) model.

In this model, mean and variance is as follows:

$$V(y_i) = [1-F(z_i\gamma)][\mu_i + F(z_i\gamma)\ \mu_i^2],\ E(y_i) = \mu_i\ [1-F(z_i\gamma)]$$

Here y_i is the number of UP; and the x_i's are explanatory variables like marriage duration (months), woman's age at marriage, years of study, the mean time between pregnancies (years), the mean duration of breastfeeding (months), the number of live-born girls, the number of live-born boys and the number of abortions; and z_i is the number of pregnancies.

RESULTS AND DISCUSSION

Among the studied women, 24.3% experienced at least one UP. T-tests showed that the mothers with at least one UP and women who had no UP at all, differ significantly in the number of live-born boys ($P < 0.001$) and girls ($P < 0.001$) (child ever born), the number of abortion ($P = 0.04$), the average time spacing (years) ($P < 0.001$), woman's age at marriage ($P < 0.001$), marriage duration (months) ($P < 0.001$) and the years of woman study ($P < 0.001$). In other words, the mothers who experienced UP had more children and the number of abortions for these women was greater than mothers with no UP. UP is more common among illiterate women. The women with at least one UP married soon and their marriage duration was long. The average time spacing for these women was less than mothers with no UP. But there was no significant difference in average breastfeeding duration ($P = 0.09$).

Table 1: Comparison of characteristics of women

	Women without UP Mean±SD	Women with at least one Up Mean±SD	Total women
Number of live-born boys	0.97±1.06	1.85±1.43	1.18±1.22
Number of live-born girls	1.00±1.15	1.78±1.40	1.19±1.26
Number of abortions	0.08±0.35	0.13±0.41	0.10±0.37
Average time spacing between pregnancies (years)	3.90±2.02	3.23±1.70	3.67±1.98
Average breastfeeding duration (months)	18.63±6.63	17.85±5.83	18.42±6.43
Age at marriage	18.63±3.91	17.56±3.67	18.37±3.38
Marriage duration (months)	130.60±101.90	209.00±105.94	149.87±108.40
Education (years)	6.09±3.51	4.75±3.49	5.76±3.55

Table 2: The results of modeling with the ZINB and ZIP models

	The model for the probability of always zero is specified in the inflate () option.					
	ZINB model			ZIP model		
Variables	Coefficients	SE	p>|z|	Coefficients	SE	p>|z|
Unwanted pregnancies						
Constant	-1.64	0.52	0.002	-1.64	0.52	0.002
Number of live born boys	0.29	0.05	<0.001	0.29	0.05	<0.001
Number of live born girls	0.28	0.05	<0.001	0.28	0.05	<0.001
Education (year)	0.03	0.02	0.09	0.03	0.02	0.09
Age at marriage	0.007	0.02	0.69	0.007	0.02	0.69
Marriage duration(months)	0.001	0.001	0.179	0.001	0.001	0.179
Average time spacing between pregnancies(years)	-0.08	0.04	0.02	-0.08	0.04	0.02
AverageBreastfeeding duration (months)	-0.012	0.01	0.189	-0.012	0.01	0.189
Number of abortions	0.24	0.11	0.042	0.24	0.11	0.042
Inflate						
Marriage duration(months)	0.008	0.004	0.065	0.008	0.004	0.049
Constants	-3.80	1.75	0.03	-3.60	1.48	0.015
Ln alpha	-3.76	4.412	0.39	*	*	*
Alpha	0.023	0.102		*	*	*

Alpha is overdispersion parameter.

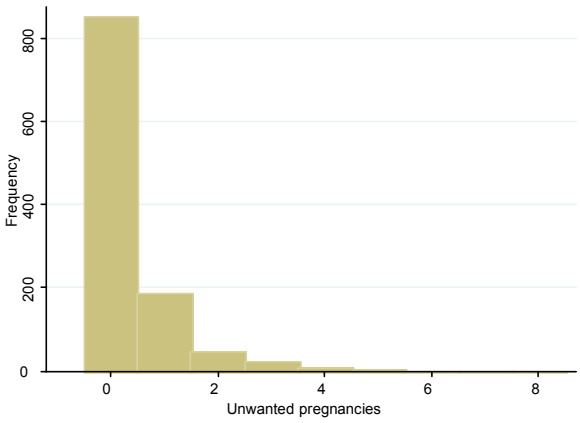

Fig. 1: Frequency distribution of unwanted pregnancies

The mean number of UP was 0.37 and its variance was 0.68. This means that the unconditional data are slightly overderdispersed. Our data contain a great relative excess of zeros too (75.5%); the Poisson model predicts that only 61% of woman had experienced UP. Clearly the Poisson model underestimates the probability of zero counts. So this model is not appropriate for this data. Therefore, the zero-inflated models seem to be suitable.

Table 2 shows the results of the modeling the number of UP with ZINB and ZIP models. According to this table, the over-dispersion parameter alpha is not significant, so it seems that the ZIP model can be an appropriated model.

In the two models, the estimation of the parameters are the same, but the model for the probability of always zero, in the ZIP model, the variable of marriage duration is significant at the level of 0.05 but it is not significant in the ZINB model.

To compare the models, the Akaike's Information Criterion (AIC), was calculated (not shown). For the ZIP model, the AIC was 1349.3945 and for the ZINB model it is equal to 1351.3389. So it is concluded that the ZIP model fits better to this data.

According to the results, the numbers of live born boys and girls and the number of abortions have a positive and statistically significant effect on the number of UP. On the other hand, the average time spacing, had a negative impact on UP. The results show that an increase in the number of children ever born (both boys and girls) and the number of abortions reduces the likelihood of women to experience UP. However, increasing the average time spacing between pregnancies increases the chance of UP.

Most of the studies concluded that the UPs among the illiterate women are more common than educated mothers [10, 15]; but in this work like some other studies [18, 19], the level of education was not statistically significant. This result may be due to the fact that the number of years of education for the women in this study is not very varied and most of them (62.6%) were illiterate or only had elementary education.

Our focus has been on modeling UP by using the zero-inflated count data model; that takes into account possible dual processes for zero counts. Two possible processes for zero counts could be explained by there being, first, women who did not experience UP because they knew how to prevent it and second, women who did not have any UP because their marriage duration was very short.

CONCLUSIONS

The results clearly demonstrated the influence of the number of live born boys and girls, the mean of time spacing between pregnancies and the number of abortions on UP. That means that families with more children may experience UP more and women whose time spacing between pregnancies were longer have less UP. Women who had more abortions they had a greater chance of experiencing UP.

Restriction: It is essential to identify the determinants of UP to help policy makers and program managers to design modules and services especially for women who rely on traditional methods and pill in rural areas which have the highest likelihood of having UP.

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