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IMPACT FACTORS OF FECUNDABILITY PATTERN IN BANGLADESH: A LOGISTIC REGRESSION ANALYSIS

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Abstract

The human reproduction process can be distinctively characterized by the age at which a woman enters into marriage, her fecundability, frequency of coitus, use of contraceptives, number of conceptions, fetal wastages, number of live births duration of gestation and post-partum amenorrhea period, etc. The concept of fecundability derives its importance for the study of human fertility from the fact that it is one of the principal determinants of fertility and is a major standard by which the impact of fertility regulation can be assessed. Very few attempts have been made in Bangladesh for estimating fecundability. The logistic regression analysis has been used to find out the effects of the selected demographic and socio-economic factors. From the stepwise logistic regression analysis technique the age at first birth, region, total children ever born, respondent current age, husband's education level, number of sexual intercourse in the last month, currently breastfeeding, residing with husband, mass media contact, uses of contraceptive and marital duration have the significant effect on marriage to first birth interval.

Keywords: Impact factor, Fecundability, Coitus, Contraceptive, Logistic regression

Introduction

In the human reproductive study, the term fecundability refers to the chance of a woman conceiving within a given period especially during a specific month or menstrual cycle (Bogue, 1971). In near conformity with a pattern suggested by Henry (1965), natural fecundability is assumed 0 before age 12, increasing linearly from 12 to 20, remaining constant from 20 to 30 and declining linearly to 0 at age 48. Natural fertility rates also depend on husband's age though not nearly so closely as wife's age. Under natural fertility conditions, last birth intervals tend to be longer than would be expected on age considerations alone, and to a lesser extent, this is true of penultimate birth intervals (Anderson, 1975). To explain this behavior, it is necessary to postulate that fecundity is sensitive to the approach of onset of natural sterility as well as to the wife's age. It would seem that some sterilizing conditions are progressive with the last birth interval most seriously affected (Leridon, 1977). Page (1977) has documented with Swedish data a

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secondary dependence of natural fertility on marriage duration. Further evidence is cited that coital frequency, the primary determinant of natural fecundability responsive to the interval from marriage as well as to ages of the spouses (Menken, 1979).

Marriage is the leading social and demographic indicator of the exposure of women to the risk of pregnancy. Marriage in Bangladesh marks the point in a woman's life when childbearing becomes socially acceptable. Age at first marriage has a major effect on childbearing because the risk of pregnancy depends primarily on the age at which women first marry. Women who marry early, on average, are more likely to have their first child at a young age and give birth to more children overall, contributing to higher fertility. The purpose of the present study is to estimate the mean conception delay, mean and corresponding variance of fecundability of the Bangladeshi women. This study attempts to evaluate the impact factor of fecundability and identify the factors affecting fecundability in Bangladesh based on national level Bangladesh Demographic and Health Survey (BDHS) 2011.

Materials and Methods

In this study the Logistic regression model was performed to identify significant determinants of fecundability in Bangladesh. Logistic regression is used to model the relationship between a binary response variable and one or more predictor variables, which may be either discrete or continuous. The logistic regression model is a multivariate technique for estimating the probability that an event occurs. The model is now widely used to assess the influence of various socio-economic characteristics controlling for the effect of other variables on the likelihood of the occurrence of the event of interest. In a linear logistic regression model, the dependent variable is a dichotomous one, coded as 1 (event occurring) and 0 (event not occurring. All most applications, the dependent variable may be dichotomous one, and one or more explanatory variables are qualitative or measured in nominal or ordinal scales, and the assumption of normality is violated. To solve this problem, a very interesting and appropriate technique is the linear logistic regression method. Cox (1958) is the pioneer of the logistic regression model. Subsequently, this model was developed by Worker and Duncun (1967) and Cox (1970). More recently, Lee (1980) and Fox (1984) have further modified the Cox's model.

The dependent variable in logistic regressions is usually dichotomous, that is, the dependent variable can take the value 1 with a probability of success θ, or the value 0 with a probability of failure $1 - \theta$. The relationship between the predictor and response variables is not a linear function in logistic regression; here logit transformation of θ is given by:

$$\hat{\theta} = \frac{e^{(\propto + \beta 1X1 + \beta 2\ X2 + \ldots\ldots\ldots + \beta i\ Xi)}}{1 + e^{(\propto + \beta 1X1 + \beta 2\ X2 + \ldots\ldots\ldots + \beta iXi)}}$$

where, α = the constant of the equation and β = the coefficient of the predictor variables.

An alternative form of the logistic regression equation is:

$$Y = Logit\ [\ \theta(X)] = Log\ [\frac{\theta(X)}{1-\theta(X)}]$$

$$= \propto + \beta 1X1\ +\ \beta 2\ X2 + \ldots\ldots\ldots + \beta i\ Xi$$

Where Y is the dependent variable assigning 1 if respondent's marriage to first birth interval is greater than a particular value (cut off point) and 0 if less than or equal to that value . In this analysis, the median interval from marriage to first birth, which is 22 months was taken as the cutoff point.

For test, the significance of the coefficients the present study used the wald's test statistics. To test the hypothesis $H_o : \beta_i = 0$ vs. $H_1 : \beta_i \neq 0$, the wald's test statistics is given by;

$$W = \frac{\hat{\beta}_i}{SE(\hat{\beta}_i)} \sim N(0,1)$$

Or equivalently, $$W = \frac{\hat{\beta}_i^2}{[SE(\hat{\beta}_i)]^2} \sim \chi_1^2 \text{ under } H_0$$

where $SE(\hat{\beta}_i)$ can be obtained from the inverse of the observed information matrix. i.e., $Var(\hat{\beta}) = [I(\hat{\beta})]^{-1}$.

Results and Discussion

As marriage to first birth interval is categorized as a dichotomous numeric variable, this study makes an attempt to find out the significant factors affecting on fecundability through a binary logistic regression model. The results of the logistic regression analysis are presented in Table 1. The estimate of the logistic regression coefficient (β), S.E, Wald test, p-value, odds ratio are calculated for each of the categorical variables. According to the fitted model, there are eleven variables appear as the significant predictors in case of marriage to the first birth interval. The variables age at first birth, region, total children ever born, respondent current age, husband's education level, number of sexual intercourse in the last month, currently breastfeeding, residing with husband, mass media contact, use of contraceptive and marital duration have the significant effect on marriage to the first birth interval. On the other hand, husband's age, Body mass index, residence, respondent education level, spousal age difference, and respondent work status have an insignificant effect on marriage to the first birth interval.

Age of women at first birth has appeared as a significant factor affecting marriage to first birth interval positively. The odds ratios of age at first birth are 5.462 and 33.319 with 95% confidence interval which indicates that marriage to first birth interval will be 5.462 and 33.319 times higher for those respondents whose age group 17-20 years and 21 years

& above than those respondents whose age group 11-16 years (reference category). The region has appeared as a significant factor affecting marriage to first birth interval negatively. The odds ratios of region are 0.510, 0.740, 0.817, 0.821, 0.809 and 0.366 respectively with 95% confidence interval. It indicates that marriage to first birth interval will be 0.510, 0.740, 0.817, 0.821, 0.809 and 0.366 times lower for those respondents who live in Chittagong, Dhaka, Khulna, Rajshahi, Rangpur and Sylhet divisions than who lives in Barisal division.

Total children ever born are found to have a highly significant influence on affecting marriage to first birth interval negatively. The odds ratios of the total child ever born are 0.738 and 0.620, with 95% confidence interval. It indicates that marriage to first birth interval will be 0.738 and 0.620 times lower for those respondents who have 3-4 children and 5 & more children ever born than who have 1-2 children ever born. More interesting that the respondent's current age is the negative and most significant factor affecting marriage to the first birth interval but respondent age group 40 year & above are not significant. From Table 3.2, the odds ratios of the respondent's current age are 0.746 and 0.705 respectively with a 95% confidence interval. It indicates that marriage to first birth interval will be 0.746 and 0.705 times lower for those respondents whose age group 21-29 years and 30-39 years than those respondents whose age group ≤ 20 years (reference category).

Husband's education level has also come out as a most significant factor affecting marriage to first birth interval negatively, but higher education level is not significant at all. The odds ratios of husband's education level are 0.887 and 0.851 with 95% confidence interval, which indicates that marriage to first birth interval is 0.887 and 0.851 times lower for those women whose husband have primary and secondary education than those women whose husband are illiterate. The number of sexual intercourse in the last month has appeared as a significant factor affecting marriage to first birth interval negatively. The odds ratios of the number of sexual intercourse in the last month are 0.265 and 0.047 with a 95% confidence interval. It indicates that marriage to first birth interval will be 00.265 and 0.047 times lower for those respondents whose number of sexual intercourse in the last month has 6-10 times and 11times & more, than less than 5 times (reference category). Currently breastfeeding is also an important factor affecting marriage to first birth interval negatively. The odds ratio of currently breastfeeding is 0.778 with 95% confidence interval, which indicates that marriage to first birth interval will be 0.778 times lower for those respondents who are currently breastfeeding than who are not.

Residing with husband has also come out as a most significant factor affecting marriage to the first birth interval. The odds ratio of residing with husband is 2.656 with 95% confidence interval, which indicates that marriage to first birth interval will be 2.656 times higher for those respondents who are currently residing elsewhere than those who residing with husband. Mass media contact has appeared as a significant factor affecting marriage to the first birth interval.

Table 1. Results of logistic regression analysis for the simultaneous effects of all factors in the model of marriage to the first birth interval in Bangladesh.

Variable	β	S.E.	Wald test	d.f.	p-value	Odds ratio (OR)	95% C.I. for OR	
							Lower	Upper
Age at 1st birth								
11-16 (ref)			1.793	2	0.000	1.000	-	-
17-20	1.698	0.049	1.186	1	0.000	5.462	4.959	6.017
≥ 21	3.506	0.093	1.422	1	0.000	33.319	27.769	39.979
Region								
Barisal (ref)			198.731	6	0.000	1.000	-	-
Chittagong	-0.674	0.078	75.230	1	0.000	0.510	0.438	0.594
Dhaka	-0.301	0.076	15.576	1	0.000	0.740	0.637	0.859
Khulna	-0.202	0.078	6.730	1	0.009	0.817	0.702	0.952
Rajshahi	-0.197	0.079	6.282	1	0.012	0.821	0.704	0.958
Rangpur	-0.211	0.078	7.256	1	0.007	0.809	0.694	0.944
Sylhet	-1.004	0.086	135.348	1	0.000	0.366	0.309	0.434
Husband's age								
≤ 25 (ref)			3.765	3	0.288	1.000	-	-
26-34	-0.028	0.109	0.065	1	0.798	0.973	0.786	1.204
35-43	-0.139	0.130	1.140	1	0.286	0.870	0.674	1.123
≥ 44	-0.231	0.157	2.178	1	0.140	0.794	0.584	1.079
Total children ever born								
1-2 (ref)			45.542	2	0.000	1.000	-	-
3-4	-0.304	0.054	31.314	1	0.000	0.738	0.664	0.821
≥ 5	-0.477	0.076	39.016	1	0.000	0.620	0.534	0.721
Respondent current age								
≤ 20 (ref)			18.292	3	0.000	1.000	-	-
21-29	-0.293	0.094	9.793	1	0.002	0.746	0.621	0.896
30-39	-0.349	0.123	8.073	1	0.004	0.705	0.554	0.897
≥ 40	-0.161	0.145	1.236	1	0.266	0.851	0.641	1.131
Husband's education level								
No education (ref)			9.764	3	0.021	1.000	-	-
Primary	-0.120	0.055	4.825	1	0.028	0.887	0.797	0.987
Secondary	-0.161	0.061	7.035	1	0.008	0.851	0.755	0.959
Higher	-0.035	0.087	0.164	1	0.685	0.966	0.815	1.144
No. of sexual intercourse in the last month								
≤ 5 (ref)			687.449	2	0.000	1.000	-	-
6-10	-1.329	0.080	277.513	1	0.000	0.265	0.226	0.309
≥ 11	-3.052	0.117	682.951	1	0.000	0.047	0.038	0.059

Currently breastfeeding								
No (ref)			54.215	1	0.000	1.000	-	-
Yes	-0.251	0.045	31.416	1	0.000	0.778	0.713	0.850
Residing with husband								
Living with her (ref)	0.977	0.071	214.456	1	0.000	1.000	-	-
Living elsewhere			187.802		0.000	2.656	2.310	3.054
Marital duration								
≤ 9 (ref)			253.858	3	0.000	1.000	-	-
10-19	0.871	0.072	145.648	1	0.000	2.390	2.075	2.753
20-29	1.477	0.098	226.782	1	0.000	4.380	3.614	5.308
≥ 30	1.424	0.096	221.948	1	0.000	4.153	3.444	5.009
Residence								
Urban (ref)						1.000	-	-
Rural	0.036	0.045	0.619	1	0.431	1.036	0.948	1.133
Respondent education level								
No education (ref)			2.238	3	0.525	1.000	-	-
Primary	-0.073	0.056	1.704	1	0.192	0.930	0.834	1.037
Secondary	-0.084	0.067	1.592	1	0.207	0.919	0.807	1.048
Higher	-0.042	0.115	0.134	1	0.715	0.959	0.765	1.202
Spousal age difference								
≤ 4 (ref)	0.107	0.061	3.666	2	0.160	1.000	-	-
5-10	0.059	0.077	3.011	1	0.083	1.112	0.986	1.225
≥ 11			0.579	1	0.447	1.060	0.912	1.223
Respondent work status								
Not working (ref)	-0.012	0.061	0.037	1	0.848	1.000	-	-
Working						0.988	0.876	1.115
Constant	-1.115	0.137	65.963	1	0.000	0.328		

The odds ratio of mass media contact is 3.494 with 95% confidence interval, which indicates that marriage to first birth interval will be 2.656 times higher for those respondents who are used mass media contact than those who are not used mass media contact. Use of contraceptive is also an important factor affecting marriage to first birth interval negatively. The odds ratio of use of contraceptive is 0.899 with 95% confidence interval (0.826, 0.978), which indicates that marriage to first birth interval will be 0.899 times lower for those respondents those are using contraceptive than those are not using contraceptive. It appears that the respondent's marital duration is the most significant factor affecting marriage to the first birth interval. From Table 1, the odds ratios of marital duration are 2.390, 4.380, and 4.153 with a 95% confidence interval. It indicates that marriage to first birth interval will be 2.390, 4.380 and 4.153 times higher for those respondents whose marital duration 10-19, 20-29 and 30 & more, than those respondents whose marital duration ≤ 9 (reference category).

Conclusion

In logistic regression analysis the age at first birth, region, total children ever born, respondent current age, husband's education level, number of sexual intercourse in the last month, currently breastfeeding, residing with husband, mass media contact, uses of contraceptive and marital duration have the significant effect on marriage to first birth interval. Marriage to first birth interval is lower for those respondents who live in Chittagong, Dhaka, Khulna, Rajshahi, Rangpur and Sylhet divisions than who lives in Barisal division and marriage to first birth interval is higher for those respondents who are currently residing elsewhere than those who are residing with husband. Based on the findings, the study concludes that the age at first marriage is increasing and the age at first conception and age at first birth both are also increasing, and conception wait is decreasing. As a result, fecundability is rising.

As a result, the trend of mean fecundability is increasing in Bangladesh. It may happen due to social and behavioral factors health status improvement, low contraceptive use rate, lack off effective use of contraception. It may occur due to different health sector programs by government and development partners and NGOs. Women with no children are severely neglected by their family as well as by the society in Bangladesh. A slightly increasing trend in fecundability was noticed in recent years in Bangladesh. But compared to other developed and developing countries, the fecundability in Bangladesh is very low.

References

Anderson, B. A. 1975. Male Age and Fertility, Results from Ireland Prior to 1911. Population Index, 41, 4, 561-566.

Bogue, D. J. 1971. Demographic Techniques of Fertility Analysis. FPRE Manual 2. University of Chicago.

Bangladesh Bureau of Statistics BBS). 1994. Bangladesh Population Census Report, 1991, National volume, Dhaka, Bangladesh.

Henry, L. 1965. 'French Statistical Research in Natural Fertility', Public Health and Population Change, edited by M. C. Sheps and J. C. Ridley, p.342.

Leridon, H. 1977. Human Fertility: The Basic Components. University of Chicago Press, Chicago and London.

Menken, J. 1979. Natural Fertility. Ordina Editions, Liege Belgium, pp. 3-13.

National Institute of Population Research and Training (NIPORT), Mitra and Associates, and ORC Macro. 2011, Bangladesh Demographic and Health Survey, 2011. Dhaka, Bangladesh.

Page, H. J. 1977. Patterns Underlying Fertility Schedules: A Decomposition by Age and Marriage Duration. Population Studies, 31, 85-106.