AN APPLICATION OF MULTIPLE LOGISTIC REGRESSION MODEL FOR PREDICTION OF UNMET NEED FOR FAMILY PLANNING OF MARRIED WOMEN IN KALABURAGI DISTRICT, KARNATAKA STATE, INDIA.

Sujatha Inginshetty[1], Deepak Jamadar[2]
[1]Professor, Dept. of Statistics, Gulbarga University, Kalaburagi.
[2]Research Scholar, Dept. of Statistics, Gulbarga University, Kalaburagi

Abstract

A valuable indicator for assessing the achievements of national family planning progrmme is the unmet need for family planning. The objective of this paper is to make a prediction of unmet need for family planning of married women in the age group of 15-49 years of Kalaburagi district of Karnataka state, India, using multiple logistic regression model and stepwise forward logistic regression model. Estimates of the parameters of the model, odds ratios and log likelihood values are computed. Testing of hypothesis of goodness of fit of the model is carried out by Hosmer and Lemeshow test.

Key words: unmet need for family planning, multiple logistic regression model, stepwise logistic regression model.

1. Introduction

With a population of 1,210,193,422 as per 2011 Census, India is the second most populous country in the world. This alarming increase in population is a threat to the socio-economic development of the country, lowering the quality of life, degrading our environment. Over the past 45 years, there have been significant advances in contraceptive methods and services. However contraceptive practices are not widely used. Many factors are responsible for under utilization of contraceptives. Many women who are sexually active want to avoid pregnancy but are not using any method of contraception. These women are considered to have an unmet need for contraception (Robey et.al. 1996). Unmet need for family planning is a valuable indicator for assessing the achievement of national family planning programme. According to NFHS-3 (2005-06), the unmet need for family planning is 13% in India and 9.6% for Karnataka. It has reduced when compared to NFHS-1 (20%) and NFHS-2(16%). Keeping in view the above points, the present study was conducted to make a prediction of unmet need for family planning for the effective implementation of family planning programmes.

2. Materials and Methods

The present study was conducted in rural and urban areas of Kalaburagi district of Karnataka State. 1200 married women in the age group of 15-49 years were the study participants who were selected using multistage sampling. The data pertaining to the study was collected through pre-designed, structured questionnaire. The respondents were also interviewed about their knowledge of contraceptive methods, past and current use of contraceptives and whether they want to use contraceptives in future. Based on use of contraceptives, the respondents were classified into met and unmet need groups. Met group of contraception were those married women of reproductive age group who were using contraceptives and satisfied. Unmet need group of contraception were those married women of reproductive age group who do not want to use contraceptives. The present study was carried out to predict unmet need for family planning of married women in Kalaburagi district of Karnataka state using multiple logistic regression model and step wise forward logistic regression model.

3. Results and Discussion

In this section, parameter estimates, odds ratios and log likelihood values are obtained for multiple logistic model for total sample and are presented.

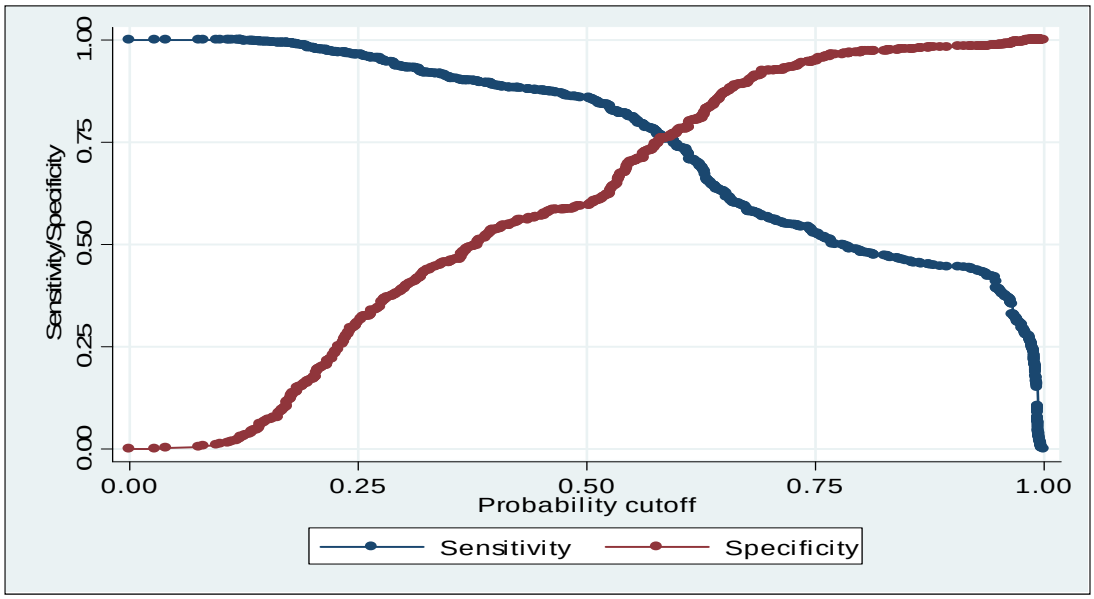
The following table presents parameter estimates and their standard errors of explanatory variables of multiple logistic regression model for the unmet need for family planning of married women. A total of 28 explanatory variables are included in the model, in which only 8 explanatory variables (29.00%) are found to be significant regression coefficients i.e., age, education of married women, type of family, ideal age for marriage, ideal age for pregnancy, still birth, are you pregnant now, permanent family planning methods, at normal level of significance ($p<0.05$). These significant explanatory variables exhibited significant regression coefficients, indicating that these are significant predictors of unmet need for family planning of married women.

Table 3.1: Multiple logistic regression coefficients for the relationship between unmet need and its determinants among married women in Kalaburagi district.

Independent variables	Estimates	Std error	p-value	Odds	95% C.I.for odds	
					Lower	Upper
Location	-0.0580	0.1530	0.7060	0.94	0.70	1.27
Age	0.4640	0.2120	0.0290*	1.59	1.05	2.41
Religion	-0.1100	0.1750	0.5310	0.90	0.64	1.26
Education of married women	-1.2910	0.1960	0.0001*	0.28	0.19	0.40
Education of husband	-0.3820	0.2170	0.0780	0.68	0.45	1.04
Occupations	1.1320	0.7820	0.1480	3.10	0.67	14.37
Occupations of husband	-0.4870	0.6350	0.4440	0.62	0.18	2.14
Family size	0.3090	0.5200	0.5530	1.36	0.49	3.77
Family income	0.1980	0.1920	0.3040	1.22	0.84	1.78
Type of family	-0.6210	0.2410	0.0100*	0.54	0.34	0.86
Ideal age for marriage	0.5770	0.2500	0.0210*	1.78	1.09	2.91
Ideal age for pregnancy	-0.6160	0.2560	0.0160*	0.54	0.33	0.89
Age at time of marriage	0.0000	0.2160	0.9980	1.00	0.66	1.53
Completed marriage years	-0.3380	0.5770	0.5580	0.71	0.23	2.21
No of pregnancies	-0.7230	0.9800	0.4610	0.49	0.07	3.32
Total living children	0.4910	0.2650	0.0640	1.63	0.97	2.75
Abortion	0.4450	0.3290	0.1770	1.56	0.82	2.98
Infant deaths	1.1480	0.6640	0.0840	3.15	0.86	11.57
Still birth	2.9130	0.6670	0.0001*	18.42	4.99	68.05
Physical deformity baby	0.5840	0.9660	0.5450	1.79	0.27	11.91
Age of last child	0.3080	0.2740	0.2600	1.36	0.80	2.33
Are you pregnant now	1.1860	0.4280	0.0060*	3.27	1.42	7.57
Ideal gap between child	0.2890	0.3820	0.4500	1.34	0.63	2.82
Family planning methods	0.2430	0.4990	0.6270	1.27	0.48	3.39
Know family planning methods	-0.2400	0.3790	0.5270	0.79	0.37	1.65
Permanent family planning methods	-4.3970	0.4110	0.0001*	0.01	0.01	0.03
Contraceptives used in past	-0.0210	0.2220	0.9240	0.98	0.63	1.51
Using contraceptive to avoid next birth	-0.0580	0.1530	0.7060	0.94	0.70	1.27

*$p<0.05$

Figure 3.1: The plot of sensitivity and specificity versus criterion value for the response variable in the model



The area under ROC curve of the response variable for the model is 0.8440. It provides a summary of the accuracy of the diagnostic test which is nearly 85%. The accuracy of the test in the means of ROC has been presented in the following figure.

Figure 3.2: The accuracy of the test in the means of ROC for the model

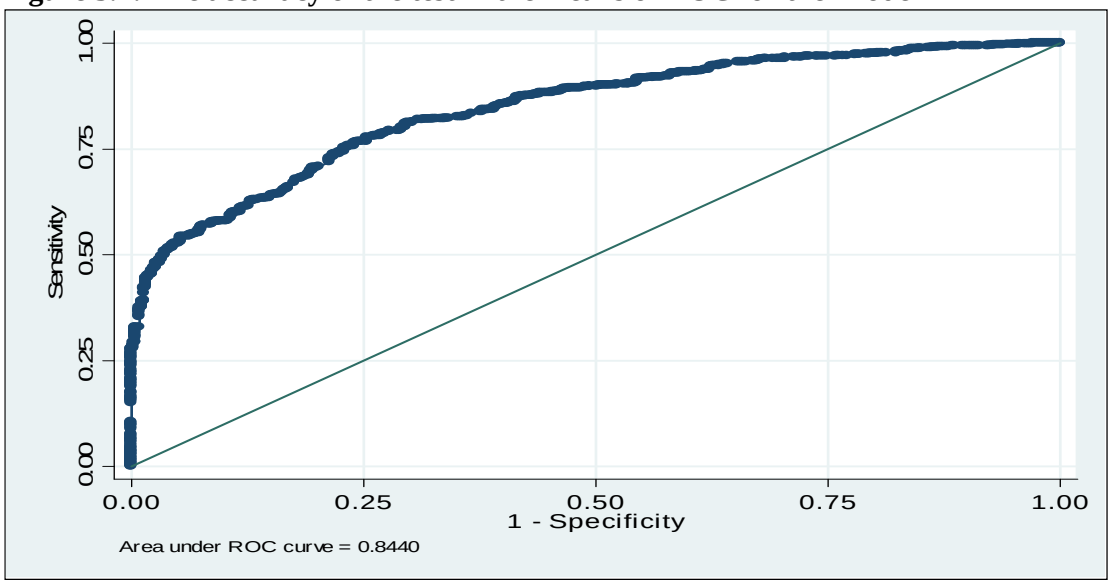


Table 3.2: Model Summary

-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1102.1750	0.3740	0.4980

From the results of the above table, the value of -2 Log likelihood is 1102.1750, Cox & Snell R Square is 0.3740 and Nagelkerke R Square is 0.4980. It means that the model is useful in prediction of unmet need for family planning and fits well.

Table 3.3: Hosmer and Lemeshow Test

Chi-square	df	Sig.
6.1460	8	0.6310

Further, the Hosmer and Lemeshow test also clearly shows that, the chi-square value is 6.1460 with p-value 0.6310 (<0.05), indicating that the above model is a good fit.

Prediction of unmet need for family planning of married women by stepwise logistic regression model

A stepwise forward logistic regression is carried out using 28 explanatory variables and parameter estimates, odds ratios and log likelihood values in particular are obtained. The results of stepwise forward logistic regression analysis are presented in the following table

Table 3.4: Results of stepwise logistic regression analysis of unmet need for family planning of married women

variables	Estimates	Std error	p-value	Odds	95% C.I.for odds	
					Lower	Upper
Step 1 (Model 1)						
Age groups	0.7520	0.0800	0.0001*	2.12	1.81	2.48
Step 2 (Model 2)						
Age groups	1.3780	0.1100	0.0001*	3.97	3.20	4.92
Contraceptives used in past	-0.8670	0.0980	0.0001*	0.42	0.35	0.51
Step 3 (Model 3)						
Age groups	0.5740	0.1360	0.0001*	1.78	1.36	2.32
Physical deformity baby	3.3030	0.3450	0.0001*	27.19	13.83	53.45
Contraceptives used in past	-3.6680	0.3450	0.0001*	0.03	0.01	0.05
Step 4 (Model 4)						
Age groups	0.3970	0.1450	0.0060	1.49	1.12	1.98
Education of married women	-1.4450	0.1520	0.0001*	0.24	0.18	0.32
Physical deformity baby	4.1790	0.3670	0.0001*	65.29	31.81	134.01
Contraceptives used in past	-3.9100	0.3520	0.0001*	0.02	0.01	0.04
Step 5 (Model 6)						
Age groups	0.4100	0.1460	0.0050*	1.51	1.13	2.00
Education of married women	-1.4790	0.1540	0.0001*	0.23	0.17	0.31
Abortion	0.7070	0.2370	0.0030*	2.03	1.28	3.22
Physical deformity baby	3.6640	0.3980	0.0001*	39.03	17.88	85.21
Contraceptives used in past	-4.0290	0.3560	0.0001*	0.02	0.01	0.04
Step 6 (Model 6)						
Age groups	0.4080	0.1460	0.0050*	1.50	1.13	2.00
Education of married women	-1.5260	0.1560	0.0001*	0.22	0.16	0.30
Abortion	0.6960	0.2370	0.0030*	2.01	1.26	3.19
Physical deformity baby	3.6830	0.4000	0.0001*	39.78	18.18	87.03
Ideal gap between Childs	0.9670	0.4000	0.0150*	2.63	1.20	5.76
Contraceptives used in past	-4.0570	0.3570	0.0001*	0.02	0.01	0.04
Step 7 (Model 7)						
Age groups	0.3980	0.1460	0.0070*	1.49	1.12	1.98
Education of married women	-1.5030	0.1570	0.0001*	0.22	0.16	0.30
Type of family	-0.4650	0.2220	0.0360*	0.63	0.41	0.97
Abortion	0.7160	0.2380	0.0030*	2.05	1.28	3.26
Physical deformity baby	4.1000	0.4490	0.0001*	60.36	25.04	145.52
Ideal gap between Childs	0.9630	0.4030	0.0170*	2.62	1.19	5.77
Contraceptives used in past	-4.0860	0.3570	0.0001*	0.02	0.01	0.03
Step 8 (Model 8)						
Age groups	0.3720	0.1470	0.0120*	1.45	1.09	1.94

Education of married women	-1.5130	0.1570	0.0001*	0.22	0.16	0.30
Type of family	-0.5310	0.2250	0.0180*	0.59	0.38	0.91
Abortion	0.6370	0.2400	0.0080*	1.89	1.18	3.03
Still birth	1.3880	0.6380	0.0290*	4.01	1.15	13.99
Physical deformity baby	2.9650	0.6560	0.0001*	19.40	5.37	70.14
Ideal gap between Childs	0.9600	0.4030	0.0170*	2.61	1.19	5.75
Contraceptives used in past	-4.1840	0.3660	0.0001*	0.02	0.01	0.03

*p<0.05

The stepwise forward method was carried out using the following explanatory variables i.e., location, age, religion, education of married women, education of husband, occupations of married women, occupations of husband, family size, family income, type of family, ideal age for marriage, ideal age for pregnancy, age at time of marriage, completed marriage years, number of pregnancies, total living children, abortion, infant deaths, still birth, physical deformity baby, age of last child, are you pregnant now, ideal gap between child, family planning methods, know family planning methods, permanent family planning methods, contraceptives used in past and Using contraceptive to avoid next birth, to predict the probability of unmet need for family planning of married women. The final model was achieved in 8th step. The final model includes eight explanatory variables namely age groups, education of married women, type of family, abortion, still birth, physical deformity baby, ideal gap between child, contraceptive used in past significant achieved in 8th step.

The model fit summary includes -2 log likelihood, Cox & Snell R Square and Nagelkerke R Square which are presented in the following table. It is clear that first two models do not fit well with response variable but model 3 to model 8 are good fit for prediction of unmet need for family planning

Table 3.5: Model Summary

Models	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
Model 1	1568.4020	0.0760	0.1020
Model 2	1482.9200	0.1400	0.1860
Model 3	1245.1870	0.2940	0.3920
Model 4	1147.8280	0.3490	0.4660
Model 5	1138.7770	0.3540	0.4720
Model 6	1132.7290	0.3570	0.4770
Model 7	1128.2470	0.3600	0.4800
Model 8	1123.3250	0.3620	0.4830

The Hosmer and Lemeshow test statistic of all eight models are presented in the following table. We observed that, the first two models do not fit well with the response variable, but model 3 to model 8 are fit well with the response variable.

Table 3.6: Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
Model 1	0.0000	0	.
Model 2	186.6080	2	0.0001*
Model 3	7.6390	3	0.0540
Model 4	4.7810	6	0.5720
Model 5	4.8510	7	0.6780
Model 6	4.7630	7	0.6890
Model 7	5.9600	8	0.6520
Model 8	4.3580	8	0.8240

*p<0.05

4. Conclusion

In this paper an attempt has been made to predict the unmet need for family planning of married women of Kalaburagi district using multiple logistic regression and stepwise forward logistic regression models. The estimates of the model parameters and odds ratios were obtained. It is observed that the model is a good fit to the sample data. Also the more prominent predictors of unmet need for family planning were identified using stepwise logistic regression analysis. The prediction of unmet need for family planning is useful in controlling the population growth by creating awareness of contraceptive methods like different methods, their usage and their availability, among the people to motivate them to use the contraceptives.

References:

1. David W Hosmer and Stanley Lemeshow.(1989): Applied Logistic Regression. John Wiley and Sons.
2. Geoffrey J Bourke, Leslie E Daly and James McGilvary. Interpretation and Uses of Medical Statistics. 3rd edition, Blackwell Scientific Publications.
3. Geoffrey R Norman and David L Streiner(2000): Biostatistics-The Bare Essentials. 2nd Ed. B C Decker Inc.,
4. James A Hanley and Barbara J Mc Neil.(1982): A meaning and use of the area under receiver operating characteristics (ROC) curve. Radiology; 143: 29-36.
5. Linda S Erdreich and Elisa T Lee.(1981): Use of relative operative characteristic analysis in epidemiology. Am J Epidemiol; 114(5): 649-662.
6. Marija J Nourusis.(1997): SPSS Professional Statistics 7.5. SPSS Inc.,.
7. Metz C. E.(1978): Basic principles of ROC analysis. Seminars in Nuclear Medicine,; 8: 283-298.
8. National family health survey NFHS-3(2005-06): International Institute of Population Sciences Mumbai India.
9. N J D Nagelkerke.(1991): A note on a general definition of the coefficient of determination. Biometrika.; 78; 3: 691-692.
10. Robey B, Ross J, bhushan I.(1996): Meeting unmet need; new strategies. Popul Rep series J:Family Planning Prog,;(43):1-35.
11. Stanley Lemeshow and David W Hosmer.(1982): A Review of Goodness of fit Statistics for Use in the Development of Logistic Regression Models.; 115: 1: 93-184
12. Sylvan Wallenstein and Carol Bodian(1987):Epidemiologic Programs for Computers and Calculations-Inferences Based on standard regression programmes, Am. J. Epidemiology,; 126: 246-355
13. Zweig M.H. and Campbell G(1993): Receiver-operating characteristic (ROC) plots, a fundamental evaluation tool in clinical medicine. Clinical Chemistry,; 39: 561-577.