

Full Length Research Paper

Health status and modeling of rural aged population of Kushtia District in Bangladesh

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Aged population is an emerging issue in Bangladesh. It is a frightening problem of rural area in Bangladesh as well as a national problem. It has many socio-economic effects on national development. So, the aim of this study is to identify the determinants of health status of aged population in Kumarkhali Thana of Kushtia District in Bangladesh. Furthermore, an effort has been made here to fit mathematical model for aged population due to ages. For this, a total number of 250 rural aged populations have been interviewed through a structured questionnaire by purposive sampling technique. In this study, logistic regression model and polynomial model are applied. In logistic analysis, it is indicated that the respondent's sex, type of family, occupation of the family head and suffering any diseases have significant effects for taking treatment on aged population. It is seen that age associated with aged population follow third degree polynomial model explaining more than 99% coefficient of determination.

Key words: Aged population, socio-economic variables, logistic regression analysis, polynomial model, Bangladesh.

INTRODUCTION

Aged population is defined as the group of population who belong to the age group of 60 years and more (BAG, 2003). Furthermore, population ageing is defined as an increase in the proportion of population, which is elderly. It is a product of history, individual experiences and social forces (Morgan and Kunkel, 2001). Aged population in Bangladesh is viewed as natural outcome of demographic transition from high fertility and mortality to low fertility and mortality. Until the year 1961, the sequence of high birth rate followed by high death rate kept the proportion of population aged 60 years and above at a low level. In the years, steady decline in birth rate accelerated the ageing process. It is likely to reach 9.1% in 2010 (Hossain, 1996) and in terms absolute number aged person would be 13.3 million in 2010. Between 1997 and 2010, the share of the population under fifteen years is expected to decline by about 19% under the assumption of replacement level fertility; whilst the share of elderly population during the same period will increase by about 50%. Similarly, the share of the working age population will increase by about 38%. The process of

aging is expected to accelerate in the coming decades, mainly because the large cohorts born in 1950s and 1960s respectively will be joining the ranks of 60 years and beyond during this period. The decline in mortality, particularly at young ages, also means that a higher proportion of the large cohorts will survive to old age (Kabir, 2005). Aged population creates problems in every sector. In economic area, it creates problems on pension scheme, savings, retirement, employment etc. In political area, it is retards to change leadership. Since many years ago aged people are a social problem in developed countries but it is now-a-days a new problem in developing countries. In Bangladesh, the statistical data represent that from the year 1974 - 2001 the number of aged population has increased from 1.38 million to 6.05 million and at present 7.59 million of the total population are aged (BBS, 2003). It is expected that the number of aged people will be 7.2% of the total population by 2021 years (Kabir and Humayan, 1994). About 5.052 million aged people are living in rural areas in Bangladesh and among them 2.305 million are aged women (BBS, 2000). Aged people of rural area in Bangladesh are suffering from mental torture, permanent illness and physically depression (Cain, 1991). Abedin (1998) studied socio-economic and psychophysical conditions of the aged

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population in which the study was based on 424 aged persons of whom 219 are in rural area and 205 are in urban area. In which it was investigated that most of the aged population, in particular, rural aged people were belonging to a low incoming group and the overall economic condition of aged people was not encouraging. Therefore, the fundamental objectives of the present work are addressed in the following:

- 1.) To identify the determinants of health status of aged population in rural area of Kumarkhali Thana of Kushtia District, Bangladesh.
- 2.) To build up mathematical model to aged population, and to apply cross-validity prediction power (CVPP) and F-test to this model to verify the validity of the model.

SOURCES OF DATA

In this study, a total number of 250 aged populations were questioned during the survey period in 2008. The respondents were randomly interviewed by some selected questions from several villages in the rural areas of Kumarkhali Thana of Kushtia District, Bangladesh by purposive sampling technique. Various socio-economic and demographic variables were considered at time of data collection.

METHODS

Logistic regression model

Logistic regression is a form of regression, which is used when the dependent is a dichotomy and the independents are of any type. In logistic analysis, aged people taking treatment is considered as dependent variable where respondent's age group, education, sex, religion, type of family, condition of house, occupation of the family head, sanitation, income and suffering for diseases are treated as independent variables. This technique expresses a qualitative dependent variable as a function of several independent variables, both qualitative and quantitative. The dependent variable is considered for this model is categorized in the following:

$$Y_i = \begin{cases} 1, & \text{if taking treatment} \\ 0, & \text{otherwise} \end{cases}, i = 1, 2, 3, \dots, n.$$

The results of logistic model are demonstrated in Table 2.

Smoothing of age data

If the aged population by ages is plotted in the graph paper then it is found that there exist some distortions in the data. Therefore, an adjustment is important and needed to minimize these unpredicted distortions before going to fit the model to this data set. In consequence, a modification is made here using the Package Minitab Release 12.1 by the most latest smoothing technique "4253H, twice" (Velleman, 1980). After that, the smoothed data are used to fit model for aged population and these observed, smoothed and predicted data is launched in Table 3.

Model fitting

Using the scattered plot of aged population by age group in years (Figures 1), it is observed that aged population can be fitted by polynomial model with respect to different ages. Therefore, an nth degree polynomial model is considered and the form of the model is

$$y = a_0 + \sum_{i=1}^n a_i x^i + u;$$

Where, x is the mean value of the age group; y is aged population; a_0 is the constant; a_i is the coefficient of X^i ($i = 1, 2, 3, \dots, n$) and u is the stochastic error term of the model. Here, a suitable n is chosen for which the error sum of square is least amount.

Model accuracy test

The cross validity prediction power (CVPP) is applied to evaluate the accurateness and reliability of the model. The arithmetical formula for CVPP is precised by

$$\rho_{cv}^2 = 1 - \frac{(n-1)(n-2)(n+1)}{n(n-k-1)(n-k-2)} (1 - R^2).$$

Here, n is the number of classes, k is the number of explanatory variables in the fitted model and the cross-validated R is the correlation between observed and predicted values of the dependent variable (Stevens, 1996). The shrinkage and contraction of the model is the positive value of $\lambda = (\rho_{cv}^2 - R^2)$; where ρ_{cv}^2 is CVPP & R^2 is the coefficient of determination of the model. $1 - \lambda$ is the stability of R^2 of the model. Closer the value of λ to zero, the better is the prediction. The estimated CVPP related to their R^2 and information on model fittings are presented in the result and discussion section. CVPP was employed as model validation or accuracy test by Islam (2003 and 2005) and Islam et al. (2003 and 2005).

F-test

To measure the overall significance of the fitted model as well as the significance of R^2 , the F-test is employed at this juncture (Gujarati, 1998).

RESULTS

Percentage distribution of aged population

The distribution and percentage distribution of aged population based on socio-demographic as well as health related characteristics of this study are demonstrated in Table 1. These characteristics are, in brief and are explained in the discussion part of this paper.

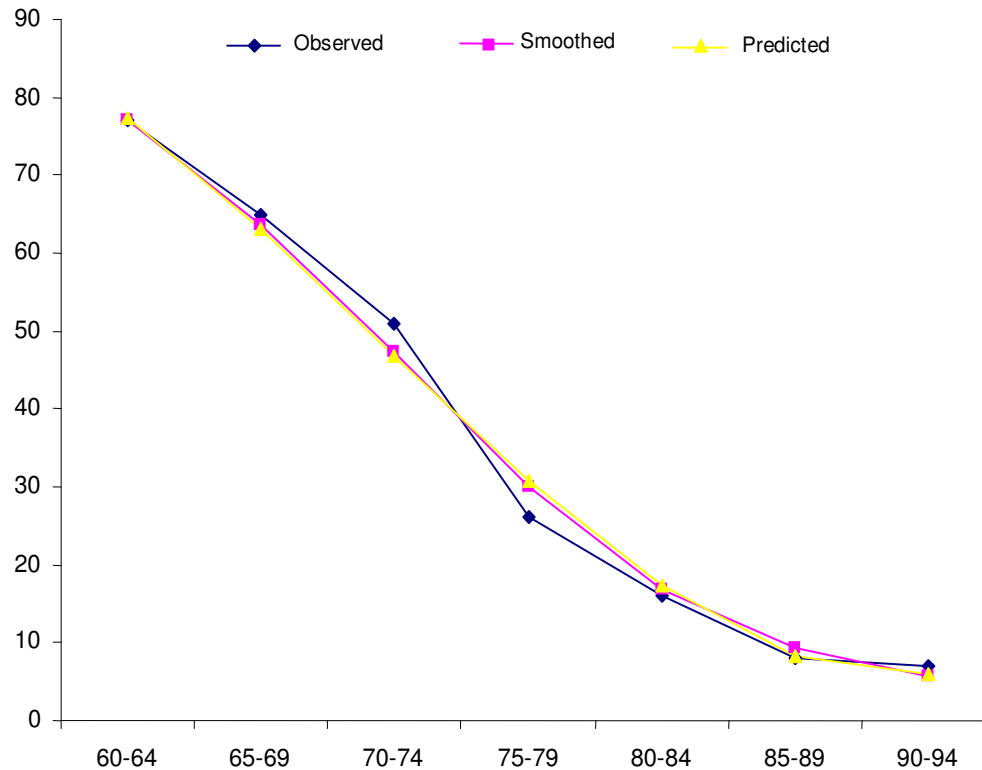


Figure 1. Observed, smoothed and predicted aged population of Bangladesh. X axis is age group and Y axis indicates population.

Determinant of health status of the aged population using logistic regression model

Results of the logistic regression model, where treatment is taken as dependent variable and age, education, sex, type of family, structure of house, sanitation facilities, family head occupation, monthly income and suffer any disease are considered as independent variables, are presented in Table 2 and findings are discussed in the discussion section.

Results of modeling fitting

The results of model fitting, that is, observed, predicted and residual are shown in Table 3 and the graph of observed, smoothed and predicted by age group is depicted in Figure 1 and the findings of model fitting are described in discussion section.

DISCUSSION

It is observed that most of the respondents are falling in the age group of 60-69 years, which is 56.8% and rest of the respondent is 43.2% in the age group 70 years and over. Education is the single most important indicator of

the socioeconomic status of an individual, which affects almost all aspects of human life, including demographic health behavior. Usually an educated person lives a better life than an illiterate person. It is obvious that 40% of the respondents have no education and 60% respondents are educated. In our present study, the information suggests that 77.2% respondents are engaged in agriculture and 22.8% are engaged others occupation such as business, service, job etc. Religion is a very important characteristic in relation to the aging of person particularly for Islamic believes. It is an important community characteristic. Majority people of Bangladesh are Muslim. Also other people are Hindu, Buddha, and Christian. In this paper, 94.4% respondents belong to Muslims community and only 5.6% belong to Hindu community. Healthy and comfortable residence is essential for sound, body and mind. Unhealthy house is responsible for health hazard and diseases, so it is an important factor for human being. The information suggests that most of the house are tin which is 82.8 and 17.2% are others house such as katcha, boom house etc. The overall observations indicate that maximum of the respondents come from lower economic level. An unhygienic environment is enormously important causes of bad health of aged people. Aged population would be free from environmental hazards if the sanitary condition of a locality is better. The overall sanitation arrangements

Table 1. Percentage distribution of population according to selected characteristics.

Characteristic	Observed	Percentage
Age group		
60 - 69	142	56.8
70+	108	43.2
Education	100	40.0
Illiterate	150	60.0
Literate		
Sex	114	45.6
Male	136	54.4
Female		
Religion	236	94.4
Muslim	14	5.6
Non-Muslim		
Type of family	71	28.4
Unit	179	71.6
Joint		
Condition of houses	207	82.8
Tin	43	17.2
Others		
Occupation	193	77.2
Agriculture	57	22.8
Others		
Sanitation	185	74.0
No	65	26.0
Yes		
Income	50	20.0
<3000	189	75.6
3000-9900	11	4.4
10000+		
Suffering from diseases	7	2.8
No	243	97.2
Yes		

of the respondents are not so good in this study because it is seen that 26% are hygienic and 74% are unhygienic. Majorities (71.2%) are living in joint family and rest of them is living in unit family.

In logistic model, sex, type of family, structure of house, family head's occupation and suffers any diseases are found as significant variable. It is found that aged people who lived in a joint family had taken 3.577 times more treatment than that of unit family. Female respondents

have taken treatment 3.237 times more than the male respondents. Aged people who are engaged in agricultural sector taking treatment 0.393 times less than others occupation. Other independent variables such as age group, education, religion, sanitation, house conditions and income are statistically insignificant.

The polynomial model is assumed for age associated with aged population of Bangladesh and the fitted model is:

Table 2. Logistic regression estimates of the effects of different selected characteristics on taking treatment

Characteristic	Co-efficient (β)	Odds ratio
Age group		
60 - 69 (r.c)	...	1.000
70+	0.795	2.215
Education		
Illiterate (r.c)	...	1.000
Literate	-0.047	0.954
Sex		
Male (r.c)	...	1.000
Female	1.175**	3.237
Religion		
Muslim (r.c)	...	1.000
Non-Muslim	-0.557	.573
Type of family		
Unit (r.c)	...	1.000
Joint	1.274*	3.577
Condition of houses		
Tin (r.c)	...	1.000
Others	0.844	2.325
Occupation		
Agriculture (r.c)	...	1.00
Others	-0.934***	0.393
Sanitation		
No (r.c)	...	1.000
Yes	0.484	1.622
Income		
<3000 (r.c)	...	1.000
3000-9900	-0.826	0.438
10000+	-0.957	0.384
Suffering from diseases		
No (r.c)	...	1.000
Yes	3.741*	42.154
Constant	-5.330*	0.005

*Significance at 0.01 **Significance at 0.05 ***Significance at 0.10 r.c = Reference category.

Table 3. The observed and fitted aged population by age group.

Age group (x)	Mid value of x	Observed	Smoothed	Predicted	Residual
60 - 64	62.5	77	77.00	77.26	-0.26
65 - 69	67.5	65	63.56	63.12	0.44
70 - 74	72.5	51	47.34	46.91	0.43
75 - 79	77.5	26	30.02	30.86	-0.84
80 - 84	82.5	16	16.73	17.21	-0.48
85 - 89	87.5	8	9.36	8.20	1.16
90 - 94	92.5	7	5.61	6.05	-0.44

$$y = -832.998 + 43.24692x - 0.64528x^2 + 0.002982x^3$$

t (3)	-3.407	4.49330	-5.15490
	5.541437		
p-level	.042	.02057	.01415
			.011585

Providing $R^2 = 0.99936$, $\rho_{cv}^2 = 0.996343$, shrinkage coefficient = 0.003017143, F-test = 1561.5. This is the third degree polynomial model, that is, cubic polynomial model. From these statistics, it is seen that the shrinkage coefficient is very small. Hence, it is concluded that the model is better fit.

CONCLUSION AND RECOMMENDATIONS

In this study, majorities (71.2%) are living in joint family and rest of them is living in unit family. The overall observations indicate that maximum of the respondents come from lower economic level. The information suggests that most of the house are tin which is 82.8 and 17.2% are others house such as kacha, boom etc. In logistic analysis, it is showed that aged people lived in a joint family had taken 3.577 times more treatment than that of unit family. Female respondents have taken treatment 3.237 times higher than the male respondents. Aged people population who engaged agriculture they have taken 0.393 times less treatment than others occupation. It is observed that third degree polynomial model is fitted to aged population relating to age of Bangladesh.

The findings of this study may have some policy implications that would help the planners and policy makers of the Government to take necessary steps in identifying necessary conditions of the aged population. The following recommendations should be suggested for policy implications:

(1) The government should take proper steps to enhance the care giving capacity of family through appropriate programs. The traditional joint family system should be strengthened as well as encouraged in order to provide basic needs and psychosocial support to the aged people.

(2) Government should boost more economic security (like pension, medical allowance, recreational facility etc.) for geriatrics. The government be supposed to take essential steps for the welfare of the aged by taking mass education programs and awakening the people about the duty towards aged people. Government and NGOs have to build care and available recreational facilities for the aged people.

(3) Access to treatment facilities should be available and inexpensive for aged people and special emphasis on care of geriatrics should be taken every health centers, medical colleges and community clinics in both rural and urban areas. Government should provide latrine in low-priced rate to improve health and sanitation facility and necessary curriculum should be included in the national text.

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