

# Discriminating Patients Suffering from Non-Communicable Diseases : A Case Study Among Bangladeshi Adults





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## Abstract

Although half of annual mortality and almost half of the burden of disease in Bangladesh are for NCDs, less evidence are available to identify the variables responsible for NCDs. The aim of the present work is to identify the factors associated with NCDs in a representative sample of families of students of American International University - Bangladesh (AIUB). The most important variables responsible for the presence of non-communicable diseases among the Bangladeshi adults were age followed by marital status, body weight, level of education and other variables. These variables were identified by discriminant analysis. The study was based on 785 adult respondents from families of 2% randomly selected students. The students themselves collected the information through a pre-designed and pre-tested questionnaires. The collected information were residence, sex, age, height, weight, education, occupation, marital status, physical work, monthly income, family size, smoking habit and food habit along with suffering of any non-communicable disease and its treatment. Body Mass Index (BMI) was calculated from the collected data. The association of NCDs with social factors and BMI were observed using Chi-square test and hence identified the associated factors with NCDs.

The prevalence of NCDs was observed among 49.4% respondents and 85.3% of them were exclusively diabetic. Another 4% were suffering from diabetes and heart disease. Among the NCDs affected respondents 91.2% belonged to obese and overweight group of respondents. The odd ratio indicated that the prevalence of diabetes was 1.76 times higher among obese and overweight group of respondents compared to other groups.

**Keywords:** NCDs; Socioeconomic Variables; Discriminant Analysis

## Introduction

Non-communicable disease (NCD) is a medical condition or disease that is non-infectious or non-transmissible. NCDs can refer to chronic diseases which last for long periods of time and progress slowly. Sometimes, NCDs result in rapid deaths such as autoimmune diseases, heart diseases, stroke, cancer, diabetes, chronic kidney disease, osteoporosis, Alzheimer's disease, cataracts and others. These diseases are the major health burden in the industrialized countries and are increasing rapidly in the developing countries owing to demographic transitions and changing lifestyles among the people. More than 36 million people die annually from NCDs (63% of global deaths), including 14 million people who die too young before the age of 70 years [1,2]. More than 90% of these premature deaths from NCDs occur in low- and middle-income countries. Like many low-income countries around the world, Bangladesh is in the midst of an epidemiologic transition where the burden of disease is shifting from a disease profile dominated by infectious diseases, under-nutrition and conditions of child birth to one increasingly characterized by NCDs [3]. The NCDs are responsible for half of

annual mortality (51%) and almost half of the burden of disease (41%) [4]. Recent estimate observed in 2006 indicate that NCDs represent 68% of total death as against only 11% of total deaths due to communicable diseases [3]. The major causes of death in Bangladesh gradually shifted from acute infectious and parasitic diseases to NCDs.

Diabetes is one of the major components of NCDs. It is associated with prolonged ill health and death due to vascular diseases [5-8]. Around 415 million people have diabetes in the world and 78 million people are in South-east Asia region; by 2040 this will rise to 140 million. Bangladesh is one of the 6 countries of South-east Asia. There were 7.1 million cases of diabetes in Bangladesh in 2015. The prevalence of diabetes in adults (20-79 years of age) was 7.4% in Bangladesh [9]. The risk factors for cardiovascular disease are glucose and lipid abnormalities and the prevalence of this disease is a major factor due to diabetes in both developed and developing countries [10]. Diabetes is prevalent among 10% people of Bangladesh and according to the International Diabetes

Federation, the prevalence will be 13% by 2030 [10]. Tobacco smoking is another component of NCDs. It is widely used addictive substance with an estimated 1.3 billion smokers worldwide and a global projected tobacco-induced death at over 6 million annually [12]. A household survey in Bangladesh estimated that tobacco-related illness was responsible for 16% of all deaths in the country [13]. It is observed from studies that some socioeconomic characteristics are responsible to enhance the diabetes and diseases related to tobacco smoking. In this paper our attempts is to identify socioeconomic characteristics responsible for NCDs.

## Methods

The present analysis was conducted in the American International University - Bangladesh (AIUB) using the data collected from 785 respondents. The respondents are the family members of age 18 years and above of the randomly selected students of the university. Out of 10344 students during Fall 2015-16 semester, 2% (207) were selected at random and were asked to collect information from their family members of age 18 years and above through a pre-designed questionnaire. Among the respondents, 388 (49.4%) are suffering from at least one of the non-communicable diseases. The questionnaire contains questions related to socio-demographic characteristics of each person. It also contains questions related to type of disease, duration of suffering from the disease and information related to treatment. Some of the variables are qualitative in nature. For analytical purpose, all the variables were measured in nominal scores. In some studies, it was mentioned that Body Mass Index

$[BMI = Weight (in kg) / Height (in cm^2)]$  and obesity was associated with NCDs [6,14]. Accordingly, we tried to relate BMI with NCDs. The association of BMI with NCDs was studied by chi-square test. Association of BMI and diabetes were also studied here. Discriminant analysis was performed to discriminate the NCD affected and non NCD affected adults. The data was analyzed using SPSS version 20.

## Results

Among the 785 respondents 388 (49.4%) were suffering from one or more of NCDs. The investigated units were classified by BMI and by other socioeconomic characteristics. The classification was also done by the presence of NCD and by other socioeconomic characteristics. The classified results were used to test the independence of any two characters. As shown in Table 1 86.6% respondents were from urban area and among them the prevalence rate of NCDs was 47.8% against the overall prevalence rate of NCDs 49.4%. The differentials in prevalence of NCDs and residence

were significant  $[\chi^2 = 5.421, p\text{-value is } 0.02]$ . The odd ratio [1.64] indicated that the urban people had 1.64 times more chance than the rural people to be affected by NCD. Among the respondents 68.8% were males and 47.2% of them were suffering from NCDs. The percentage of female respondents (54.3) who were suffering from NCDs was more. However, the differentials in proportions of male and female patients of NCDs were not statistically significant

$[\chi^2 = 3.364, p\text{-value is } 0.067]$ .

**Table 1:** Distribution of respondents by prevalence of NCDs and some socioeconomic factors.

Residence	Prevalence of NCDs				Total	
	Yes		No		n	%
	N	%	n	%		
Rural	63	60.0	42	40.0	105	13.4
Urban	325	47.8	355	52.2	680	86.6
Total	388	49.4	397	50.6	785	100.0
<b>Sex</b>						
Male	255	47.2	285	52.8	540	68.8
Female	133	54.3	112	45.7	245	31.2
Total	388	49.4	245	50.6	785	100.0
<b>Marital Status</b>						
Married	233	60.2	154	39.8	387	49.3
Unmarried	146	38.0	238	62.0	384	48.9
Widow & Divorced	9	64.3	5	30.8	14	1.8
Total	388	49.4	397	50.6	785	100.0
<b>Religion</b>						
Muslim	345	49.1	358	50.1	703	89.6
Hindu	40	54.1	34	45.9	74	9.4
Others	3	37.5	5	62.5	8	1.0
Total	388	49.4	397	50.6	785	100.0
<b>Age Groups (in Years)</b>						
< 20	15	48.4	16	51.6	31	3.9
20 - 25	124	40.1	185	59.9	309	39.4

25 - 30	18	30.0	42	70.0	60	7.5
30 - 45	64	48.5	68	51.5	132	16.9
45 +	167	66.0	86	34.0	253	32.3
Total	388	49.4	397	50.6	785	100.0
<b>Level of education</b>						
Illiterate	15	68.2	7	31.8	22	2.8
Primary	33	66.0	17	34.0	50	6.4
Secondary	65	56.0	51	44.0	116	14.8
Graduate	216	45.0	264	55.0	480	61.1
Post – graduate	59	50.4	58	49.6	117	14.9
Total	388	49.4	397	50.6	785	100.0
<b>Occupation</b>						
Agriculture	8	40.0	12	60.0	20	2.5
Business	44	62.9	26	37.1	70	8.9
Service	82	45.8	97	54.2	179	22.8
Retired	25	61.0	16	39.0	41	5.2
Housewife	76	75.2	25	24.8	101	12.9
Students	142	40.2	211	59.8	353	45.0
Others	11	52.4	10	47.6	21	2.7
Total	388	49.9	397	50.6	785	100.0
<b>Monthly Family Income (in Thousands)</b>						
< 10	30	36.1	53	63.9	83	10.6
10 – 20	37	45.1	42	54.9	82	10.4
20 – 30	27	43.5	35	56.5	62	7.9
30 – 40	32	60.8	19	39.2	51	6.5
40 – 50	27	69.2	12	30.8	39	5.0
60 +	36	55.4	29	44.6	65	8.3
No income	200	49.6	203	50.4	403	51.3
Total	388	49.4	397	50.6	785	100.0
<b>Smoking Habit</b>						
Yes	61	48.8	64	51.2	125	15.9
No	320	49.4	328	50.6	648	82.5
Not Applicable	7	58.3	5	41.7	12	1.5
Total	388	49.4	397	50.6	785	100.0
<b>Physical Labour</b>						
Yes	194	47.2	217	52.8	411	52.4
No	194	51.9	180	48.11	374	47.6
Total	388	49.4	397	50.16	785	100.0
<b>Habit of Taking Processed Food</b>						
Yes	191	45.0	233	55.0	424	54.0
No	197	54.6	164	45.4	361	46.0
Total	388	49.4	397	50.6	785	100.0
<b>Level of BMI</b>						
< 20	6	23.1	20	76.9	26	3.3
20 – 25	28	34.6	53	65.4	81	10.3
25 – 30	191	48.0	207	52.0	398	50.7
30 +	163	58.2	117	41.8	280	35.7
Total	388	49.4	397	50.6	785	100.0

The males were less exposed [odds ratio = 0.75] to NCD compared to females. Among the respondents 49.3% were married. The prevalence rate of NCDs among them was 60.2%. The prevalence was also higher among widow and divorced respondents. The differentials in prevalence rate by marital status of the respondents were significant [ $\chi^2 = 40.994$ ,  $p$ -value was 0.000]. The chance of suffering of married person by NCD was more than two times than that of single person [odds ratio = 2.37]. As usual most respondents (89.6%) were Muslims but the prevalence rate (49.1%) among them was not higher compared to the prevalence rate (54.1%) among the Hindus. However, the differentials in prevalence rate by religion were not statistically significant [ $\chi^2 = 1.124$ ,  $p$ -value is 0.57]. The Muslims were less exposed to NCD than their non-Muslim counterpart [odds ratio = 0.87].

Most of the respondents (39.4%) were in the age group 20 years and above but less than 25 years and among them prevalence rate of NCDs was 40.1%. A big group (32.2%) of respondents was of age 45 years and above and 66% of them were experienced of any of the

NCDs. The differentials in prevalence rate by age of the respondents were significant [ $\chi^2 = 47.631$ ,  $p$ -value is 0.000]. Those who were of age group 45+ years were more exposed to NCD than the persons of other ages [odds ratio = 2.73]. Among the respondents 61.1% were graduates and the prevalence rate of NCDs among them was 45%. Among illiterate and primary educated people, the prevalence rates were higher and the differentials in prevalence rate according to level of education were significant [ $\chi^2 = 14.426$ ,  $p$ -value is 0.006]. The illiterate people are 2.24 times more exposed to NCD than the literate people. Among the respondents 45% were students followed by service persons (22.8%). The prevalence rate of NCDs among students was 40.2% and 45.8% among service persons. The worst affected group by NCDs was housewives followed by business persons and retired persons. In a separate study [15] the prevalence of diabetes was observed in higher rates among the similar three groups. In the present analysis, it was seen that diabetes was the main cause of NCDs (Table 2) and prevalence of diabetes was observed in higher rates among these three groups of respondents mentioned above.

**Table 2:** Distribution of respondents according to their residence and types of disease.

Types of Disease	Residence				Total	
	Rural		Urban			
	N	%	n	%	n	%
Diabetes	46	13.9	285	86.1	331	85.3
Heart disease	10	29.4	24	70.6	34	8.8
Diabetes and Heart disease	5	35.7	9	64.3	14	3.6
Hypertension	1	16.7	5	83.3	6	1.5
Others	1	33.3	2	67.7	3	0.5
Total	63	16.2	325	83.8	388	100.0

The differentials in prevalence rate by occupation of the respondents were significant [ $\chi^2 = 47.852$ ,  $p$ -value is 0.000]. The farmers were less exposed to NCD than the people of any other profession [odds ratio = 0.675]. Only 5% respondents had income above take 40 to 50 thousands and higher proportion of this group of respondents was affected by NCDs. The next higher affected group was observed among the respondents having income Taka 30 to 40 thousands (60.8%). The proportions of affected groups of respondents having different levels of income were significantly different [ $\chi^2 = 17.003$ ,  $p$ -value is 0.009]. The heart diseases are associated with smoking habit [5,15] and heart diseases are components of NCDs. In our study it was observed that among the smokers the prevalence rate of NCDs was 48.8%. This proportion was higher (58.3%) among the respondents for whom there was no question of smoking. However, the proportions of prevalence of NCDs among smokers and non-smokers were not significantly different. Smokers and nonsmokers were almost similarly exposed to NCD [odds ratio = 0.97].

In many studies it is reported that diabetes is significantly related to non-involvement of physical labour [6,7] and the disease is an important cause of NCDs. In the present analysis, it was seen that 52.4% respondents were involved in physical la-

bour and prevalence rate of NCDs among this group of people was 47.2%. The corresponding figure for other group of people was 51.9%. This proportion of prevalence of NCDs among the respondents who did not do any physical labour was slightly higher. But the differentials in proportions were not statistically significant [ $\chi^2 = 1.708$ ,  $p$ -value is 0.191] [odds ratio = 0.83]. Most of the respondents (54%) were habituated in taking canned or processed food from the market. The prevalence rate among them was 45%. The corresponding figure among the respondents who were not habituated with canned or processed food was 54.6%. This difference in proportions was significant [ $\chi^2 = 7.075$ ,  $p$ -value is 0.008]. The result did not indicate that processed food was responsible for NCDs as the prevalence of it was less among the respondents who were habituated with processed food. Obesity (BMI  $\geq$  30, [14]) is generally associated to a significantly higher risk of arterial hypertension, diabetes, hepatic steatosis and other diseases of NCDs.

In our present analysis we observe that the level of BMI is significantly associated with the prevalence of NCDs [ $\chi^2 = 23.355$ ,  $p$ -value is 0.000]. Among the NCDs patients 85.3% (Table 2) were suffering from diabetes. This percentage was higher as most of the respondents were from urban area. It indicated that urban people were more diabetic. This finding is similar with the

finding observed at national level [15] and in other sample study [16], where more urban people were diabetic patients [15,16]. This study also indicated that diabetic was one of the biggest causes of NCDs [1]. The differentials in types of disease by residence was significant [ $\chi^2 = 10.222, p\text{-value} = 0.037$ ]. It is seen that higher rates of prevalence were observed among over weight (BMI 25 to less than 30) and obese group of people [15]. The prevalence of NCDs

among these two groups was 52.2%. The prevalence rate was 2.52 times more among these two groups (OR=2.52) compared to other two groups. Confidence interval for OR is 1.52 to 3.63. The present analysis also indicated that diabetes was the main factor of NCDs (85.3% are exclusively diabetic). Among the diabetic patients overweight and obese group of respondents was higher in proportion (90.3%) (Table 3).

**Table 3:** Distribution of respondents according to level of BMI and prevalence of diabetes.

Level of BMI	Prevalence of Diabetes				Total	
	Yes		No			
	N	%	n	%	n	%
< 20	6	23.1	20	76.9	26	3.3
20 – 25	27	33.3	54	66.7	81	10.3
25 – 30	166	41.7	232	58.3	398	50.7
30 +	132	47.1	148	52.9	280	35.7
Total	331	43.7	454	56.3	785	100.0

The differences in proportions according to level of BMI and prevalence of diabetes were significantly different [ $\chi^2 = 9.355, p\text{-value} \text{ is } 0.025$ ]. The prevalence of diabetes among the obese and overweight group of people was 1.76 times higher compared to other groups [16]. Confidence interval for OR is 1.14 to 2.72. Around 32% respondents were of age greater than or equal to 45 years and 50.6% of them were exclusively diabetic (Tables 4 & 5). This proportion of diabetic patients was lower among the respondents of other age groups. The odds ratio (1.65) indicated that the prevalence of diabetes among the respondents of age greater than or equal to 45 years was 1.65 times than that of other age groups. The 95% confidence interval for odds ratio is 1.30 to 2.10. The lowest prevalence of diabetes (30%) was observed among the

agriculturists. The highest prevalence rate (47.1%) was observed among the business persons. The differences in proportions of prevalence of diabetes according to different levels of profession were statistically significant [ $\chi^2 = 15.204, p\text{-value} \text{ is } 0.019$ ]. The result of odds ratio (1.25) indicated that the prevalence of diabetes was 1.25 times more among business persons compared to persons of other professions. The 95% confidence interval for odds ratio is 0.76 to 2.04. The most important variables to discriminate status, weight, education, etc. The importance between NCD affected people and non- of variables were studied by the magnitude of affected people were age followed by marital the correlation coefficient of the variables and the discriminant function score [19].

**Table 4:** Distribution of respondents by prevalence of diabetes and demographic factors.

Age Groups (in Years)	Prevalence of Diabetes				Total	
	Yes		No			
	n	%	n	%	n	%
< 20	15	48.4	16	51.6	31	3.9
20 – 25	123	39.8	186	60.2	309	39.4
25 – 30	45	25.0	45	75.0	60	7.6
30 – 45	50	37.9	82	62.1	132	16.8
45 +	128	50.6	125	49.4	253	32.2
Total	331	42.2	454	57.8	785	100.0
<b>Profession</b>						
Agriculture	6	30.0	14	70.0	20	2.5
Business	33	47.1	37	52.9	70	8.9
Service	69	38.5	110	61.5	179	22.8
Retired	15	36.6	26	63.4	41	5.2
Housewife	42	41.6	59	58.4	101	12.9
Student	141	39.9	212	60.1	353	45.0
Others	8	38.1	13	61.9	21	2.7
Total	331	42.2	454	57.8	785	100.0

**Table 5:** Standardized discriminant coefficient and the correlation coefficient of variable and discriminant function score.

Variable, $x_i$	Discriminant Coefficient	Correlation Coefficient of Variable and Discriminant Function Score	Wilk's $\Lambda$	$\chi^2$ Value	p-Value
Age	0.480	0.701			
Marital status	-0.340	-0.570			
Weight	0.392	0.307			
Education	-0.279	-0.307			
Process food	0.148	0.281			
Height	-0.230	-0.270			
Residence	-0.221	-0.246			
Income	0.475	0.205			
Gender	0.010	0.194			
Restaurant food	-0.010	0.191			
Physical work	0.147	0.138			
Food habit	0.008	0.047			
Smoking	-0.027	0.036			

## Discussion

The study was based on data collected from 785 adult respondents of 207 families. The families were the families of randomly selected students of American International University - Bangladesh (AIUB). Among the respondents 388 were suffering from at least one of the non-communicable diseases. Among this group 85.3% were exclusively suffering from diabetes. Similar higher rate of diabetic group among NCDs affected people were also observed in other studies [5-8]. Among the diabetic patients 91.2% respondents were of obese and overweight group. Similar to other studies, tobacco smoking is another source of NCDs [12]. In the present analysis 15.9% were smokers. This percentage among the respondents who were exposed to NCDs is 15.7. The study indicated that tobacco smoking was not significantly associated with NCDs. The NCDs were significantly associated with residence, marital status, age, education, occupation, income, physical labour and BMI. Discriminant analysis also supported this fact. The association was studied by  $\chi^2$  test. The prevalence rate of NCDs among urban people was 47.8%. But this rate was higher (60%) among the rural people. The prevalence of NCDs was observed higher (60.2%) among the married respondents.

Among the respondents 32.2% were of the age group 45 years and above and 66% of them were exposed to NCDs. Major NCDs exposed respondents were diabetic and among the diabetic patients 38.7% were of age group 45 years and above. This finding is similar to that observed in home and abroad [15,16,18]. The prevalence of NCDs among illiterate people was the highest (68.2%) followed by primary and secondary level educated respondents. Among housewives the prevalence of NCDs was the highest (75.2%) followed by business persons and retired persons. Among the respondents 19.7% were of income group 30 thousand or more per month and among them the prevalence of NCDs was 56.8%. The prevalence of NCDs was significantly different among respondents of different income levels. The prevalence of NCDs was low among the respondents (47.2%) who were involved in any type

of physical work. Among the respondents obesity and overweight (BMI  $\geq$  25+) were more prevalent (86.4%). The prevalence of NCDs was significantly more among these two groups of respondents. This obesity is one of the risk factor of prevalence of NCDs and it enhances arterial hypertension, diabetes, renal failure etc [14]. In this study also it was observed that higher prevalence rate (90%) of diabetes was observed among respondents of obesity and overweight. The discriminant analysis showed that the variables age, followed by marital status and weight were the most important variables in discriminating the two groups of adults. Similar findings were observed in both home and abroad [1,3,4,15,16]. NCDs are the major health burden in both developed and developing countries. The incidence of NCDs cannot be avoided, but its prevalence can be reduced by implementing appropriate action plan. The following actions are very important to reduce the prevalence rate. These are

- Halt the rise in diabetes by encouraging people to participate in blood screening programs and to encourage them to do some sorts of physical labour.
- Motivation campaign is to be conducted to reduce tobacco consumption by informing the people about the health hazard of tobacco consumption.
- To motivate eligible people to join counseling campaign for drug therapy so that heart attacks can be reduced.
- To take action for availability of affordable basic technologies and essential medicines to treat major non-communicable diseases.
- To motivate people so that they become careful about the danger of obesity and its adverse effect of health. The public health authority can play a decisive role for the above steps.

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