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** Mandatory fields*

* Name: Mahfuzar Rahman

* Job title: Head of the Health, Nutrition and Environment Research Unit, BRAC, Bangladesh

* Organisation/institution:

* Email address:

Telephone number:

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Chronic Multi-Morbidity among Bangladeshi Adult Population

Nusrat Khan, Kaosar Afsana, Mahfuzar Rahman

Abstract

Background

Increasing number of patients with multimorbidity is a growing concern all over the world. These chronic conditions challenge the health system's capacity and account for economic burden at individual level. It is still a less explored area globally and in Bangladesh as well.

Methods

A cross-sectional study was employed encompassing 12,338 male and female respondents of 35 years and above to determine the current status of chronic multimorbidity in the country. Crude and adjusted prevalence risk ratios were estimated to assess the association between multimorbidity and its potential risk factors using log binomial regression models.

Results

Prevalence of chronic multimorbidity was 8.36% in the study population and in terms of individual chronic diseases hypertension (30.14%) and diabetes (10.62%) had the highest prevalence. Mean age of the multimorbid population was 58.54years. Prevalence of multimorbidity was significantly higher in females (8.94%) compared to males and also higher in currently single respondents (11.45%) than currently married respondents respectively. People of the richest quintile and with higher education were more likely to have multimorbidity than the poor and less educated. Overweight and obese people had a higher prevalence compared to normal weight people. Nearly 8.08% multimorbid people were used to unhealthy lifestyle habits such as tobacco smoking and taking extra salt with food. People with higher BMI had 88% more chances to develop multimorbidity than people with normal BMI. People, who reported average to high physical activity per week, had less risk of having multimorbidity than less active people.After adjusting for all covariates, higher age, higher educational, economic status and higher BMI were found to be significantly associated with multimorbidity.

Conclusion

Data on global burden of multimorbidity is scarce. There is no satisfactory documentation of its status in developing and under developed countries. A detailed exploration of current status is an urgent need to meet the health care need of the aging population and also improvement of the healthcare system.

Keywords: Aging, Chronic disease**,** Healthcare, Multimorbidity, Risk Factors.

Introduction

Increasing number of elderly population suffering from multimorbidityis a growing health issue and poses a major challenge to health care systems around the world. It is commonly defined as presence of two or more chronic medical conditions in an individual which can present several challenges in health care particularly with higher numbers of coexisting conditions and related polypharmacy [4].

Multimorbidity leads to several adverse outcomes. Many reports on multimorbidity or comorbidity have documented that this phenomenon influences outcomes in many areas of health care and wellbeing in multiple ways [6].

At first, it leads to decreased disability adjusted life years. Patients with multimorbidity have a high treatment burden in terms of understanding and self-managing the conditions. It is associated with decreased quality of life, functional decline and increased healthcare utilization, including emergency admissions, particularly with higher numbers of coexisting conditions. The management of multimorbidity with drugs is often complex, resulting in polypharmacy with its associated risks. This includes primary care, secondary care outpatient visits, and hospital admissions. This is also true of potentially avoidable acute admissions, which are increased by multimorbidity, deprivation and mental health problems. Managing multimorbidity is hard work for patients and for practitioners, especially when compounded with socioeconomic deprivation. Managing patients with multimorbidity is also financially costly. The longer term conditions a patient has then the greater their use, and thus cost, of health care [5, 13, 14].

There is a growing recognition that with increasing levels of multimorbidity, the sustainability of current healthcare systems around the world is under threat. Many risk factors found to have been associated with this condition. Lifestyle factors have been associated mostly with individual chronic diseases. Many of them such as smoking, obesity, diet, alcohol etc. have been linked with multimorbidity on different studies [12, 18].

Most of the researches and guidelines on the management of long term conditions have routinely focused on single diseases, than multimorbidity. Population-based estimates of multimorbidity are also not readily available, which makes future planning a challenge [14].

A large scale study in Canada documented the prevalence of multimorbidity among Ontarians rose from 17.4% in 2003 to 24.3% in 2009, a 40% increase. This increase over time was evident across all age groups. Within individual chronic conditions, multimorbidity rates ranged from 44% to 99% [10].Another study in Catalonia, Spain reported when all chronic conditions were included in the analysis, almost 50% of the adult urban population had multimorbidity [17].In Portugal, multimorbidity was present in 72.7% of the population. In China the prevalence is above 50% in elderly population [16]. The number of people with three or more long-term conditions is predicted to rise from 1.9 million in 2008 to 2.9 million in 2018 in the UK [12].

There is very less representation of developing countries in multimorbidity research. South Asians have already been shown to be an inherently high-risk group for developing cardio metabolic and other chronic diseases, and thus multimorbidity may be significantly prevalent in these populations [4].

As for Bangladesh, there is scarce documentation on the status of multimorbidity. Many chronic conditions lead to a multimorbid status with increasing age. As per WHO NCD Report 2011, more than 52% of deaths in Bangladesh are caused by different non communicable disease and more than 27% of them are due to cardiovascular causes. In the NCDs risk factors survey conducted in 2010 by the Ministry of Health and Family Welfare, almost 99% of the Bangladeshi population had minimum one NCD risk factor and of them, 29% had three or more risk factors. In a recent study it was projected that by 2025, death rate from CVDs would increase 21 times[15]. A study on rural population aging more than 60 years in Bangladesh, documented 53.7% prevalence of multimorbidity [9].

Most of these studies reported multimorbidity is a common occurrence in the general adult population, and is not limited to the elderly. Future prevention programs and practice guidelines should take into account the common patterns of multimorbidity.

Methodology

BRAC has been pioneer in its health initiatives since its inception. Through its flagship health intervention, health nutrition and population program (HNPP), it has come up with comprehensive health care package to the vulnerable population of the country with an affordable cost. A study was conducted from October 2014 to January 2015 which aimed at exploring the status of selected health care indicators (in line with the Strategic Partnership Arrangement of BARC) in HNPP working areas of BRAC. One very important component was non-communicable disease (NCD) and information related to chronic diseases and multiborbidity was collected from nationwide sample covering both rural and urban areas.

Study Design

This cross sectional study was undertaken at the selected unions from 531upazilas (sub-districts) where different components of the HNPP program are being implemented. This covered 58 districts (out of 64) of Bangladesh.

A stratified multi-stage cluster random sampling procedure was employed consisting of union, village and households as different cluster level. Different BRAC program areas were considered as stratum/domain. However, at each successive level, random sampling was done for selection purposes. For instance, 30 unions were selected randomly from each domain then 2 villages were

randomly drawn from each unionand at the final stage 30 households were drawn at random from each selected village.

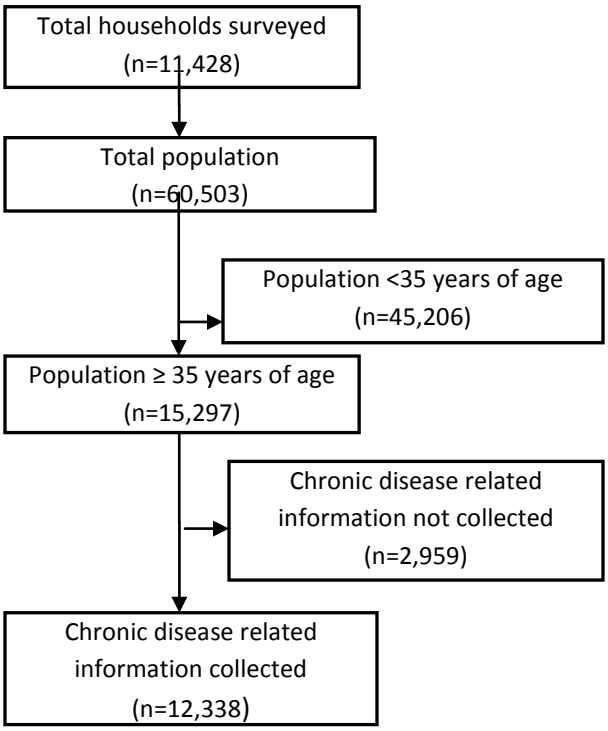
Individual data were collected from 11 October 2015 to 6 January 2016 through face-to-face interview with a respondent using a pre-tested structured questionnaire. The questionnaire was installed in tablet PC using ODK Collect (version 1.4.5 software and data collection was carried out. The application was developed by the BRAC ICT program.

Sample Selection

Recruitment of respondents for the study required the creation of a study base for systematic sampling from cohorts based on demographic characteristics and program interventions. To recruit eligible survey members, a pre-cohort survey of the study population was undertaken. The household census was carried out of a total 11,448 household to identify respondents, who were eligible for the household survey. The household census was carried out using a structured questionnaire between 22thAugust and 5th September 2015.

The required sample size was calculated for an observed rate, associated margins of error (5%) and a non-response rate. A sample size around 15,297 was found to be sufficient. The sample size was calculated considering 5% statistical significance and a design effect of 1.5 and 5% non-response rate. Among them 12338 people have given anthropometric measurement, and their blood pressure and urinary glucose has been assessed.

Respondent Selection for Chronic Disease



Data Collection and Processing

The data processing began shortly after fieldwork commenced. Data processing consisted of office editing, and editing of inconsistencies found by the computer program. Data processing commenced on 7th January 2016 and ended on 30th January 2016.

Assessment of Outcome Variable

The primary outcome variable for this study was multimorbidity which included two or more of the following non-communicable diseases- hypertension, diabetes, COPD, cancer, heart diseases and stroke. These were all previously diagnosed by physicians. Hypertension prevalence included respondents who were previously diagnosed as hypertensive by registered doctor or currently taking medication or found to be hypertensive by measurement. For diabetes, people who were diagnosed by doctors as diabetic or on medication or positive on strip test were included.

Assessment of Risk Factors

Risk factors were selected on documented evidence of risk factors for different chronic diseases. Among the demographic variables age, sex, educational status and wealth index were considered. Other factors associated with higher risk of multimorbidity included physical inactivity, BMI, tobacco and smokeless tobacco smoking, sleeping habit, fruit and vegetable intake, fish and meat intake etc [2]. Sleeping time was catagorised by standard average sleeping hour of 8 hours. BMI was calculated using standerdized scale of height and weight by the trained enumerators.

Statistical Analyses

We estimated prevalence of multimorbidity in the study population. Distribution of potential risk factors was compared between respondents with and without multimorbidity using chi squared test of independence. The association (risk ratio) between potential risk factors and chronic disease was estimated using binomial regression model with a log link function.In case of convergence failure with log binomial model, Poisson regression with robust standard error was used as proposed by Zou [20]. All data analysis was done using STATA (version 12) statistical software.

Data Management and Analysis

Data for this study were transferred to STATA (version 12.0) for converting them into different categories based on the cut-off point for that particular age. BMI and hemoglobin level were also categorized in STATA. The values for above mentioned items were compared between rural and urban areas and test for significance were performed where necessary using a preset Poisson regression model which is a class of generalized linear model (GLM). However, to estimate the relative risk (association between potential risk factors and multimorbidity), binomial regression and Poisson regression are usually recommended. Since there was a convergence problem in binomial regression model, it is recommended, for rare events when subjects are followed for a variable length of time, to use Poisson regression model with robust standard error. This is why, we use Poisson regression model with robust standard error as proposed by Zou for independent data and Yelland for clustered data [20, 21].Besides, all anthropometric measurements data were subjected to consistency check before analysis.

Quality Control

To ensure validity of such a large dataset, highest level of monitoring was upheld throughout the survey period. Considering the fact that our main respondents were women and we had to collect reproductive and child care information, we recruited experienced female field enumerators for data collection to minimize any information bias. We employed 21 teams working throughout the country headed by an experienced monitor for each for supervision of data collection action. A portion of the lead research team was stationed at headquarter to check data, appeared in an extrapolated excel sheet to warrant enumerators of any discrepancies that arrived in the dataset.

Ethical Consideration

The ethical approval was obtained from the Bangladesh Medical Research Council (BMRC). The purpose of the study was described to the participants. Both verbal and written consent were provided by participants prior to the baseline and end line interview and the respondents were ensured of the confidentiality of information provided.

Results

Prevalence of Chronic Diseases

Prevalence of individual chronic diseases is shown in Table 1. Individual prevalence were found as: Hypertension 30.14%, Diabetes 12.69 %, Cardiovascular Diseases 3.17%, Cancer 0 .12%, Stroke 1.78% and COPD 0.94% in the study population. These were all previously diagnosed by physicians and reported by the respondents during interview. Details of their current medication status are also reported. More than 60% of diagnosed CVD, Cancer, Stroke and COPD patients are on regular medication.

Prevalence of Multimorbidity

In terms of multimorbidity, 8.36% of the study population had two or more of the above-mentioned diseases and 35.69% of them were taking medicines for more than two diseases.28.64% of the respondents had any of the six diseases.

Next in table 2 we mentioned different disease combinations in cluster approach. Hypertension and diabetes cluster was found to have the highest prevalence of 5.68%%. About 1.90% respondents had hypertension cardiovascular disease together. 0.62% respondents suffered from hypertension, diabetes and cardiovascular disease together.

Relationship of Multimorbidity with Demographic Variables

Our next aim was to find out the association with different demographic variables and risk factors with multimorbidity (Table 3). Mean age of the multimorbid population was 58.54 years and they represented 13.00 % of the study population. Female had a higher prevalence of 8.94% compared to male. Currently single individuals (includes never married, divorced, separated or widowed respondents) seemed to have highest prevalence of 11.33% in terms of marital status. Richest quartile of the population had highest prevalence of 14.86%. With increase of educational status, number of people having multimorbidity also increased.

For the risk factors of chronic diseases, overweight people had a higher prevalence of multimorbidity than the respondents having normal BMI. Among current tobacco smokers, or smokeless tobacco smokers or people who take extra salt with food, 8.08 % were multimorbid.

People who ate more meat or fish per days of a week had a higher prevalence of multimorbidity. In terms of physical activity, less physically active people had higher prevalence and in terms of average sleeping hours, people who slept less in average (less than 8 hours) had higher prevalence of multimorbidity.

Association of Determinants with Outcome Variable (Crude and Adjusted)

The association of multimorbidity with known risk factors and demographic variables individually by measuring crude incident risk ratio and adjusted incident rate ratio is shown in table 4 and 5. In the study population, increasing age was significantly associated with risk of developing multimorbidity. People above 60 years age were at 5.26 times at risk of multimorbidity than people of lesser age. Females were 1.15times more likely to have multimorbidity than men. People of richest quintile and higher educational status were significantly at more risk of multimorbidity than poorer and less educated respondents.

In terms of risk factors, people with higher BMI were 2.22 times more likely to develop multimorbidity than people with normal BMI, which is significant. People, who did average to high physical activity per week, had less risk of developing multimorbidity than people with no physical activity. People who ate more fish and meat per week were 1.52 times more at risk of developing multimorbidity than who ate less. Adequate and more sleeping time was found to be significantly associated with less risk of developing multimorbidity.

Then after adjusting for all covariates, higher age, and higher educational and economic statuses were found to be significantly associated with risk of developing multimorbidity. In terms of risk factors, only higher BMI was significantly associated with high risk of developing multiple diseases. Overweight and obese people had 88% more at risk of developing multimorbidity than people of normal weight.

Discussion

Multimorbidity is a less explored area in healthcare research. Individual diseases have always been the prime concern both clinically and epidemiologically. With increasing burden of chronic diseases all over the globe, co morbid conditions are also gaining attention for action. Diseases often cluster together sharing common risk factors and antecedents. Multimorbidity is important, as the cumulative effect of diseases might be more substantial than the effect of any one disease. Moreover, it might complicate the care of people with multiple co morbid conditions [1,8].

Multiple co morbidities are common especially in older adults [11] Reported prevalence varies, depending on sampling frame and measurement of multimorbidities [7].

In our study the prevalence is 8.45 %. It is important to keep in mind; we have considered only 6 chronic diseases in this study, multimorbidity can include a vast range of clinical conditions. Among them only hypertension is measured and other five diseases are self-reported, so chances of underreporting is there. Our study population age was 35 and above, selecting a higher old group could give a higher prevalence as multimorbidity is common for older adults. A combination of population based and hospital based data would be more representative and

might give higher prevalence. Among the diagnosed multimorbid patients, less than half of were regular medication which denotes requirement of better medical care for these people.

Most of the studies identify low socio economic status and less education is associated with multimorbidity. But in our study we got the opposite results, which were significant as well. This can be explained by the socio economic status of our country. Since we are a lower middle income country, people with higher wealth quartile have access to better food and education. As we already know lifestyle factors are closely associated with chronic diseases and multimorbidity risk, we can say richer and educated people have more access to food and live a sedentary life style; this can lead them to develop the risk factors and ultimately multimorbidity [10]. Identifying higher age as a significant determinant of multimorbidity, is consistent with literature. Female population having higher risk is also consistent with other studies. In terms of married, currently single population which included never married, divorced and widowed population had higher risk of developing multimorbidity.

Risk factors of multimorbidity are identified as individual risk factors of chronic diseases. Like many studies, higher BMI was significantly associated with the risk of developing co morbidity.

Many epidemiologic studies report inconsistent findings on the association of fruit and vegetable intake with the risk of cardiovascular disease and other NCDs [3]. In our study, higher intake of fish and meat was found to be significantly associated with risk of developing multimorbidity. Increased intake of fruits and vegetables came out as protective factors against developing multimorbidity, but after adjusting for covariates this result was not significant. Extra salt intake and tobacco smoking also came out as protective factors and significantly associated. This may be due any error of data collection or less number of people for the specific questions.

Increased BMI is significantly associated with developing these morbid conditions. Among other lifestyle factors, increased physical activity and higher average of daily sleeping time are protective factors against developing multimorbidity. No study was found showing association of sleep and physical activity with multimorbidity, but it is consistent with several studies done on risk factors of NCDs.

Though the study included the entire country, most of the sample was taken from rural areas (about 93%). So a huge population at urban areas has been unexplored to give an overall country statistics. The study included only 6 chronic diseases, whereas many other chronic conditions should be considered. Except for hypertension, all other diseases were self-reported which can include a lot of bias. Health care facility level data collection should have been included to get the current status.

Recommendation

Evidence on global burden of multimorbidity is not available. There is no satisfactory documentation of its status in developing and under developed countries. The increasing burden of chronic diseases also increases the burden of multimorbidity in aging population. A detailed exploration of current status is an urgent need for future health care policy development. A detailed and approved list of diseases which are counted as multimorbidity and a guideline definition of the condition must be developed [8].

Currently one of the major challenges facing clinical guidelines is multimorbidity. Current guidelines are not designed to consider the cumulative impact of treatment recommendations on people with several conditions, nor to address the issue of polypharmacy. This is despite the fact that multimorbidity is a common phenomenon. So an international clinical guideline should be developed. At the same time, research is needed on identifying needs of primary and secondary health care facilities for the treatment of patients with multimorbidity. National and International level large scale studies are needed to combat this future global health burden.

As for Bangladesh, which need a detailed national level survey including the rural and urban population in a larger scale. An approved range of diseases conditions to be explored is needed and health care facility and population level survey should be conducted to document the actual status.

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Annex:

Table 1: Prevalence of Chronic Diseases

Variable	**Prevalence** (N = 12338)		**Currently on Medication**			
			No		**Yes**	
	n	**(%)**	**n**	**(%)**	**n**	**(%)**
Hypertension	3754	30.14				
Diabetes	1310	10.62				
Cardiovascular Diseases	391	3.17	144	36.83	247	63.17
Cancer	15	0.12	5	33.33	10	66.67
Stroke	219	1.78	78	35.62	141	64.38
COPD	116	0.94	31	26.72	85	73.28
Having only one physical condition	3534	28.64	2661	75.30	873	24.70
Multimorbidity (Having two or more physical conditions together)	1031	8.36	663	64.31	368	35.69

Table 2: Prevalence of Multimorbidity as Disease Clusters

Variable	**Prevalence (N = 12338)**	
	n	**(%)**
Hypertension, Diabetes, Heart Diseases	76	0.62
Hypertension, Diabetes, Stroke	45	0.36
Hypertension, Diabetes, Cancer	1	0.01
Hypertension, Diabetes, COPD	14	0.11
Hypertension, Heart Diseases, Stroke	40	0.32
Diabetes, Heart Diseases, Stroke	21	0.17
Hypertension, Diabetes,Heart Diseases, Stroke	18	0.15

	Hypertension	Diabetes	CVD	Cancer	Stroke	COPD
Hypertension						
Diabetes	701 (5.68%)					
CVD	235 (1.90%)	100 (0.81%)				
Cancer	5 (0.04%)	1 (0.01%)	2 (0.02%)			
Stroke	156 (1.26%)	54 (0.44%)	54 (0.44%)	1 (0.01%)		
COPD	45 (0.36%)	19 (0.15%)	28 (0.23%)	1 (0.01%)	7 (0.06%)	

Table 3: Relationship of Multimorbidity with Demographic Variables

Variable	Category	Multi-morbidity		p-value
		No n= 11307(91.64%)	Yes n = 1031 (8.36%)	
Age (mean, SD)		51.09 (12.80)	58.54 (13.00)	0.000*
Age (n, %)	35-40	3424 (97.16)	100 (2.84)	0.000*
	41-50	2842 (92.30)	237(7.70)	
	51-60	2728 (90.45)	288 (9.55)	
	> 60	2313 (85.07)	406 (14.93)	
Sex (n, %)	Male	5531 (92.26)	464 (7.74)	0.021*
	Female	5776 (91.06)	567 (8.94)	
Marital status (n, %)	Married	9385 (92.24)	789 (7.76)	0.000*
	Unmarried	68 (93.15)	5 (6.85)	
	Currently Single	1854 (88.67)	237 (11.33)	
Wealth quintile (n, %)	Poorest	2354 (95.34)	115 (4.66)	0.000*
	Second	2358 (94.36)	141 (5.64)	
	Middle	2346 (93.06)	175 (6.94)	
	Fourth	2209 (90.05)	244 (9.95)	
	Richest	2040 (85.14)	356 (14.86)	
Educational status (n, %)	No education	6992 (92.82)	541 (7.18)	0.000*
	Primary Education	2397(91.00)	237 (9.00)	
	Secondary and higher	1918 (88.35)	253 (11.65)	
BMI(mean, SD)		21.67 (3.55)	23.49 (4.31)	0.000*
BMI (n, %)	18.5-25 kg/m^2	7137 (92.87)	548 (7.13)	0.000*
	< 18.5 kg/m^2	2083 (94.98)	110 (5.02)	
	≥ 25 kg/m^2	1863 (84.08)	350 (15.82)	
Unhealthy Lifestyle Habit (Tobacco, Smokeless Tobacco, Extra Salt Intake) (n, %)	Yes	10653 (91.92)	936 (8.08)	0.000*
	No	654 (87.32)	95 (12.68)	
Average days of fish/meat intake(weekly)	Less than 4 times per week (n, %)	2979 (93.97)	191 (6.03)	0.000*
	4 or more times per week (n, %)	8328 (90.84)	840 (9.16)	
Average days of fruit intake(weekly)	Less than 4 times per week (n, %)	10536 (92.19)	892 (7.81)	0.000*
	4 or more times per week (n, %)	771 (84.73)	139 (15.27)	
Physical activity	Not active(<1 hour)	3154 (90.89)	316 (9.11)	0.001*

	Less active (1 to less than 3 hours)	7919 (91.78)	709 (8.22)	
	Moderatelyto highly active (≥ 3 hours)	234 (97.50)	6 (2.50)	
Sleeping time in last 24 hours	< 8 hours	3178 (90.34)	340 (9.66)	0.001*
	≥ 8 hours	8129 (92.17)	691 (7.83)	

*Chi-square test** Student *t*-test

Table 4: Association of Determinants with Outcome Variable (Crude)

Variable	Category	CIRR	Robust SE	p-value	95% CI
Age	35-40	1.00			
	41-50	2.71	0.32	0.000	2.16-3.41
	51-60	3.37	0.38	0.000	2.69-4.20
	> 60	5.26	0.57	0.000	4.25-6.51
Sex	Male				
	Female	1.15	0.07	0.016	1.03-1.30
Wealth quintile	Poorest				
	Second	1.21	0.15	0.117	0.95-1.54
	Middle	1.49	0.17	0.001	1.19-1.87
	Fourth	2.14	0.23	0.000	1.72-2.65
	Richest	3.19	0.33	0.000	2.60-3.91
Educational status	No education				
	Primary Education	1.25	0.09	0.002	1.08-1.45
	Secondary and higher	1.62	0.12	0.000	1.41-1.87
BMI	18.5-25				
	< 18.5	0.70	0.07	0.001	0.58-0.86
	≥ 25	2.22	0.14	0.000	1.96-2.51
Unhealthy Lifestyle Habit	No				
	Yes	0.64	0.06	0.000	0.52-0.78
Average days of fish/meat intake(weekly)	< 4 times				
	≥ 4 times	1.52	0.12	0.000	1.31-1.77
Average days of fruit intake(weekly)	< 4 times				
	≥ 4 times	1.96	0.17	0.000	1.66-2.31
Sleeping time in last 24 hours	< 8 hours				
	≥ 8 hours	0.81	0.05	0.001	0.72-0.92
Physical activity	Not active				
	Less active	0.90	0.06	0.112	0.80-1.02
	Moderately to highly active	0.27	0.11	0.001	0.12-0.61

*CIRR=Crude Incidence Rate Ratio

Table 5: Association of Determinants with Outcome Variable (Adjusted)

Variable	Category	AIRR	Robust SE	p-value	95% CI
Constant		0.016	0.003	0.000	0.011-0.023
Age	35-40	1.00			
	41-50	3.02	0.35	0.000	2.40-3.80
	51-60	4.16	0.48	0.000	3.31-5.22
	> 60	6.75	0.75	0.000	5.43-8.40
Sex	Male	1.00			
	Female	1.20	0.08	0.003	1.06-1.36
Wealth quintile	Poorest	1.00			
	Second	1.08	0.13	0.522	0.85-1.38
	Middle	1.19	0.14	0.136	0.95-1.50
	Fourth	1.43	0.16	0.002	1.15-1.79
	Richest	1.89	0.21	0.000	1.51-2.36
Educational status	No education	1.00			
	Primary Education	1.40	0.11	0.000	1.21-1.63
	Secondary and higher	1.72	0.14	0.000	1.46-2.02
BMI	18.5-25	1.00			
	< 18.5	0.68	0.07	0.000	0.56-0.82
	≥ 25	1.88	0.12	0.000	1.65-2.13
Unhealthy Lifestyle Habit	No	1.00			
	Yes	0.78	0.08	0.013	0.64-0.95
Average days of fish/meat intake(weekly)	< 4 times	1.00			
	≥ 4 times	1.00	0.08	0.990	0.85-1.17
Average days of fruit intake(weekly)	< 4 times	1.00			
	≥ 4 times	1.21	0.11	0.025	1.02-1.44
Sleeping time in last 24 hours	< 8 hours	1.00			
	≥ 8 hours	0.85	0.05	0.009	0.75-0.96
Physical activity	Not active	1.00			
	Less active	1.07	0.07	0.293	0.94-1.21
	Moderately to highly active	0.55	0.22	0.132	0.26-1.19

ARR = Adjusted Incidence Rate Ratio

Abbreviations:

BRAC = Building Resources Across Communities

BMRC = Bangladesh Medical Research Council

BMI = Body Mass Index

CVD = Cardio Vascular Disease

COPD = Chronic Obstructive Pulmonary Disease

GLM = Generalized Linear Model

HNPP = Health Population and Nutrition Program

ICT = Information Communication Technology

NCD = Non Communicable Disease

ODK

PC = Personal Computer

WHO = World Health Organization