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Frequency of TV viewing and prevalence of overweight and obesity among adult women in Bangladesh

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Objectives: Researches in developed countries have demonstrated association of varying degrees between TV watching and the risk of being overweight and obese. However, there is no evidence in the context of south Asian population. To this end, the present study intended to investigate if watching TV increases the risk of being overweight and obese among women in Bangladesh.

Setting: Rural and urban areas in Bangladesh.

Participants: Participant were 16,624 non-pregnant women ageing between 15 and 49 years.

Results: Prevalence of overweight and obesity in the sample population were respective 4.5% (95%CI=4.18- 4.82) and 20% (95%CI=19.39- 20.61). In the multivariable analysis, compared with women who did not watch TV at all, urban women who watched TV less than once a week had respectively 17% (95%CI=0.728-1.891) and 21% (95%CI=0.763-1.919) higher odds (adjusted) of being overweight; and who watched at least once a week had 26% (95%CI=0.801-1.985) and 67% (95%CI=0.899-1.761) higher odds of being obese. The odds being overweight and obese among rural women were 35% (95%CI=0.810-2.257) and 68% (95%CI=1.029-2.751) higher for those who watched TV at least once a week, and 26% (95%CI=0.899-1.761) and 63% (95%CI=1.179-2.241) among those who watched less than once a week.

Conclusion: Prevalence of overweight and obesity has risen considerably among women ageing between 15 and 49 years since the previous estimates based on DHS data. Frequent TV watching was associated with higher risk of being overweight and obese among adult women in Bangladesh. Further studies are required to advance understanding of the association by adopting more precise measure of TV watching hours and relevant dietary behaviours.

Key words: Bangladesh; Overweight; Obesity; TV watching; Women.

Strengths and limitations

- To our knowledge, this is the first study to investigate the association between TV viewing and being overweight/obese among adult women in a South Asian country.
- Sample size was considerably large and representative of the general population.
- TV viewing *frequency per week* was used instead of precise *duration per day* which could have produced a more precise picture of the association.
- Data were cross-sectional which precludes making any causal inference.

Introduction

Overweight and obesity represents a major risk factor for non-communicable chronic diseases (NCDs). It also plays a central role in developing metabolic syndrome (MetS) which is an escalating public health concern worldwide. Metabolic syndrome refers to a group of risk factors that predispose individuals to the development of NCDs such as type-2 diabetes (T2DM) and cardiovascular disease (CVD) [1]. The operational definition of metabolic syndrome by World Health Organisation (WHO) included impaired glucose tolerance (IGT), impaired fasting glucose (IFG) or diabetes mellitus and/or insulin resistance, hypertension (defined as a blood pressure ≥160/90 mm Hg), central obesity (defined either as body mass index > 30 kg/m2) [2]. Body mass index (BMI) serves as frequently used measure to evaluate the impact of overweight/obesity on non-communicable chronic diseases and metabolic risk factors among both in children and adults. The metabolic syndrome (MetS) is a major and escalating public-health and clinical challenge worldwide in the wake of rising prevalence of overweight and obesity, urbanization, surplus energy intake, sedentary life habits [3]. In 2010, worldwide about 3·4 million deaths, 3·9% of years of life lost, and 3·8% of disability-adjusted life-years (DALYs) were attributable to overweight/obesity alone [4].

In Bangladesh, where the epidemiological trend is usually characterized by high rates of infectious diseases along with childhood an adult undernutrition, overweight and obesity are fast becoming a significant public health concern [5]. Prevalence of overweight and obesity has increased from about two folds during the period 2004-2011: overweight 7.5% in 2004 Vs 13.5 in 2011, and obesity 1.4% in 2004 Vs 2.9 in 2011 [6]. This rising prevalence is usually attributed to the recent economic progress which has been accompanied by certain demographic and nutritional transition, urbanization, dietary and lifestyle changes [5,7]. Literature review of the epidemiological studies surrounding the determinants of overweight/obesity suggests a growing attention on the impact of lifestyle related obesogenic behaviours [8-10]. Factors that appear most

commonly include changing dietary choices, sedentary behaviour, TV watching, playing computer games, level of physical activity [5, 8-10].

Growing consensus suggest a strong correlation between sedentary lifestyle and inadequate physical activity (PA) and the risk of developing NCDs [7,9,10,11]. Studies from the developing countries showed that a large proportion of children and adolescents do not meet recommended level of PA, as lifestyle involving higher PA have been displaced by more sedentary alternatives (satellite TV, computer games, telecommunication technology) and thus contributing to reduced PA and energy expenditure [12]. TV watching has been claimed to be not simply a lack of PA, but involves a set of behaviours where sitting/lying is the dominant mode of posture with low energy expenditure, and getting used to such postural behaviour can replicate even at school and workplace [13]. Higher sitting time has been shown to associated with increased risk of developing overweight and obesity, cancer, and diabetes [14,15] and has been identified as a global public health issue [16]. In addition to reduced level of PA and low energy expenditure, TV watching also increases the consumption of obesogenic foods [17]. Cross-sectional studies on American and Latino children reported that TV watching during family meals is associated with reduced consumption of fruit and vegetables and higher consumption of soda, chips, sausages [17,18]. However, the levels and type of food intake can depend on the genre of program being watched (or alternately, boring) and level of engagement [19].

Arguably, the frequency and duration of TV watching can vary substantially from person to person depending on the availability of alternative sources of recreation, availability of resources of PA, and social factors that can impact the freedom of movement (e.g. age, gender, dietary habit, sociocultural factors, neighborhood safety, level of socialization). Therefore, the association between TV viewing and being overweight/obesity is not generalizable and needs to be studied and interpreted by taking the local contexts into consideration. Current evidences on this topic are mostly from developing countries with very limited research on South Asian countries. Major barriers to conducting studies in this line are lack of recognition of the problem and want of countrywide data. The present study aims to address the research gap be utilizing data from BDHS 2014 survey which provides quality data on various health indicators for women and children in the country. BDHS does not include any separate section on hours of TV watching, hence number of days per week, instead of hours/minutes was used as a proxy measure of duration of TV watching.

Methods:

About the study setting

Bangladesh is the third largest country in the South Asian region and also has the third largest economy in terms of GDP. It is the most densely populated country in the world with a population density of 1,070 persons/km^2 (2014 estimate). The life expectancy at birth among women is 72 years versus 69 years among men. Though the economy has been experiencing unprecedented progress in last few decades, the country still performs very low in terms of Human develop Index (HDI value for 2014 is 0.570), ranking 142nd out of 188 countries (5th in South Asia). World Bank classifies Bangladesh as a lower middle-income country with a gross national income (GNI) per capita of US$1,314 in FY 2014-2015 [21].

Survey and data collection

The 2014 Bangladesh Demographic and Health Survey was the sixth survey of this kind to take place in the country. The main objectives of the survey were to provide quality data on a range of health, demographic, and socioeconomic indicators and assist in evidence-based policy making. The survey was conducted under the authority of the National Institute of Population Research and Training (NIPORT) of the Ministry of Health and Family Welfare and was implemented by Mitra and Associates with technical assistance from ICF International of Rockville, Maryland, USA, and financial support from the U.S. Agency for International Development (USAID). Data collection lasted from June 28, 2014 to November 9 of the same year. The 2014 BDHS used three types of questionnaires: Household, Woman's Questionnaire, and Community Questionnaire. Data for the present study was extracted from the Woman's Questionnaire which included themes such as basic sociodemographic, anthropometric, reproductive, fertility, and immunization, HIV knowledge [20]. More details of the survey is available in the final report published by the National Institute of Population Research and Training (NIPORT) [21].

Study variables

The outcome variables for this study were overweight and obesity body measured by mass index (BMI), which was defined as weight in kg over height in m^2. BDHS carries out anthropometrics measurements such as height and weight for ever-married women ageing 15-49 years as an indicator of women's nutritional status. As per WHO recommendations, women were categorized as neither overweight nor obese when BMI was <25 kg/m^2, overweight if BMI was 25 kg/m^2 to

29.9 kg/m^2 and obese if BMI was >30 kg/m^2. Exclusion criteria were being currently pregnant and for whom information on height and/or weight was not available.

The explanatory variable of main interest was 'frequency of TV watching'. As the exact durations (hours or minutes/day) were not available, the frequencies per week were used as a proxy measure which included: 1) Not watching TV at all, 2) watching less than once a week, and 3) watching at least once a week.

Based on insights from literature review, the following covariates were deemed relevant to the topic and for inclusion in the study - Age: 15-24/25-34/>35 years; Division: Barisal/Chittagong/Dhaka/Khulna/Rajshahi/Rangpur/Sylhet; Educational attainment*: Nil/ Primary/ Secondary/ Higher; Husbands Educational attainment: Nil/ Primary/ Secondary/ Higher; Currently employed: Yes/No; Wealth index**: Poorest/ Poorer/ Middle/ Richer/ Richest; Parity: 1/2/3/3+.

*Educational attainment was categorized as per the highest level/class attended, regardless of the completion status of that level/class. Nil refers to no experience of formal education, primary as completing grade 5, and secondary as completing grade 10, higher as those who had pre N university/university level education.

**Measurement of wealth index is constructed using household asset data that employs principal components analysis. Wealth index is used as an indicator of household-level wealth in many DHS and other country-level surveys to measure inequalities, and is consistent with expenditure and income measures [17].

Data analysis

Data were analysed using STATA® version 12 and SPSS® version 20. Datasets were checked for missing values and outliers. Weighted baseline sociodemographic information were presented by descriptive statistics. x^2-tests were performed to examine the group differences (between overweight and obesity) for all the explanatory variables. The variables that showed significance at p<=0.25 were selected for final regression analysis. All variables were checked for multicollinearity and no significant multicollinearity was observed between any variables. The association between BMI and frequency of TV watching was measured by means of multinomial logistic regression. Results of the regression analysis were presented as crude and adjusted odds Ratios with corresponding 95% confidence intervals. All tests were two-tailed and was considered significant at the level of 5%.

Ethics statement

All participants gave informed consent prior to taking part in the voluntary interview. The survey was approved by the ICF International Institutional Review Board (IRB) who is responsible for reviewing the procedures and questionnaires for standard DHS surveys.

Results:

Basic characteristics of the sample population are presented in table 1. Table shows that majority of the women were of rural origin with highest participation from Dhaka division (17.4%) and lowest from Sylhet (11.3%). More than a quarter of the women were in the 15-24 years age group and more than one-third aged above 34 years. Rate of having no formal education was higher women compared to their husbands (75.7% Vs 71.3%). Majority of the women (37%) and their husbands (29.4%) had secondary school level qualification, and rate of higher education were respectively 9.4 and 14.9%. Less than one-third of the women reported having an employment at the time of time of interview, and rate of unemployment were slightly higher among urban women compared to rural women (68.8% Vs 66.8%). Regarding household wealth status, majority of the women belonged to the wealthiest group (21.7%). However, the rate of being in the wealthiest group was noticeably higher among urban women compared to their rural counterparts (44.4% Vs 9.6%). More than one-fifth of the women were primiparous and little less than one-third of the had experienced more than three childbirths. About two-fifth of the women reported not watching TV at all (39.4%) and more than half reported watching at least once a week. Rate of watching TV at least once a week was almost twice as high among urban women compared to rural women (75.1% Vs 39.6%). Prevalence of overweight and obesity in the sample population were respective 4.5% and 20%. Urban women had a higher prevalence of both overweight (27.7 Vs 15.9%) and obesity (8.1 Vs 2.6%) compared to rural women.

Table 1: Baseline characteristics of the study population, BDHS 2014.

Variables	Frequency (%)	Region	
		Urban (34.7%)	Rural (65.3%)
Age			
15-24	4433 (26.7)	25.8	27.1
25-34	5969 (35.9)	36.2	35.8
35/35+	6222 (37.4)	38.1	37.1
Division			
Barisal	1982 (11.9)	11.1	12.4

Chittagong	2639 (15.9)	16.3	15.6
Dhaka	2893 (17.4)	21.9	15.0
Khulna	2460 (14.8)	14.7	14.9
Rajshahi	2380 (14.3)	13.9	14.5
Rangpur	2389 (14.4)	11.9	15.7
Sylhet	1881 (11.3)	10.2	11.9
Educational attainment			
Nil	4039 (24.3)	19.3	26.9
Primary	4875 (29.3)	25.7	31.3
Secondary	6153 (37.0)	38.7	36.1
Higher	1557 (9.4)	16.4	5.7
Husbands Educational attainment			
Nil	4764 (28.7)	21.0	32.7
Primary	4503 (27.1)	23.0	29.2
Secondary	4884 (29.4)	31.8	28.1
Higher	2473 (14.9)	24.1	10.0
Currently employment			
No	11221 (67.5)	68.8	66.8
Yes	5403 (32.5)	31.2	33.2
Wealth index			
Poorest	2999 (18.0)	8.5	23.1
Poorer	3102 (18.7)	6.6	25.1
Middle	3382 (20.3)	13.4	24.0
Richer	3534 (21.3)	27.0	18.2
Richest	3607 (21.7)	44.4	9.6
Parity			
1	3625 (21.8)	25.4	19.9
2	4495 (27.0)	29.4	25.8
3	3238 (19.5)	18.5	20.0
3+	5266 (31.7)	26.8	34.3
Frequency of watching TV			
Not at all	6544 (39.4)	17.6	50.9
Less than once a week	1453 (8.7)	9.5	7.4
At least once a week	8627 (51.9)	75.1	39.6
BMI			
BMI≥30	748 (4.2)	8.1	2.6
25 ≥BMI < 30	3325 (20.0)	27.7	15.9

BMI<25	12551 (75.8)	64.2	81.5

Cross-tabulation

Table 2 shows the results of chi-square tests of association among the three groups according to their BMI status in relation to the explanatory variables. Result shows that the prevalence of both overweight and obesity increased with higher age and was most common in Dhaka division. Women who had secondary level education, currently unemployed, belonging to the wealthier households, and higher parities were more likely to be overweight and obese. Participants who reported watching TV at least once a week were also more likely to be overweight and obese compared to those who did not watch at all and watched less than once a week.

Table 2: Prevalence of overweight and obesity in the sample population across the explanatory variables, BDHS 2014.

Variables	BMI status			Chi-square	p-value
	BMI≥30	25 ≥BMI < 30	BMI<25		
Age				428.111	**<0.0001**
15-24	10.6	15.5	30.6		
25-34	37.2	41.2	34.4		
35/35+	52.3	43.3	35.0		
Division				176.299	**<0.0001**
Barisal	8.7	10.5	12.5		
Chittagong	18.7	18.2	15.1		
Dhaka	20.1	19.8	16.6		
Khulna	18.4	17.4	13.9		
Rajshahi	15.5	14.7	14.2		
Rangpur	10.2	11.3	15.4		
Sylhet	8.4	8.0	12.4		
Educational attainment				434.825	**0.001**
Nil	14.2	17.1	26.8		
Primary	23.9	25.4	30.7		
Secondary	44.9	42.2	35.2		
Higher	17.0	15.2	7.4		

Husbands				758.122	**<0.0001**
Educational					
attainment					
Nil	14.8	18.6	32.1		
Primary	20.1	22.7	28.7		
Secondary	34.8	33.8	27.9		
Higher	30.3	24.8	11.3		
Currently				53.861	**<0.0001**
employment					
No	77.8	69.9	66.2		
Yes	22.2	30.1	33.8		
Wealth index				36.790	**0.013**
Poorest	3.3	7.5	21.7		
Poorer	4.8	11.1	21.5		
Middle	12.0	17.4	21.6		
Richer	23.7	24.7	20.2		
Richest	56.1	39.2	15.0		
Parity				154.802	**0.004**
1	18.7	19.3	22.7		
2	31.8	33.1	25.1		
3	25.1	20.9	18.8		
3+	24.3	26.7	33.4		
Frequency of				18.898	**0.001**
watching TV					
Not at all	14.2	23.9	45.0		
Less than once a week	5.6	7.6	9.2		
At least once a week	80.2	68.5	45.8		

Association between frequency of TV watching and BMI status among the sample population were analysed by means of multivariable logistic regression with normal weight considering as the reference group. The crude and adjusted odds of being overweight and obese were shown in table 3 and table 4 respectively. Table 3 illustrates that higher frequency of TV watching was significantly associated with being overweight and obese among both urban and rural women. In the urban areas, compared with women who did not watch TV at all, those who watched less than once a week and at least once a week were respectively 41% and 84% as likely to be overweight

and respectively 2 fold and 4.7 times as likely to be obese. For rural women, the corresponding figures were respectively 54% and 57% for overweight and 2.64 and 3.6 times for obesity.

In the adjusted model, the odds of being overweight and obese among urban women were respectively 17% (95%CI=0.728-1.891) and 21% (95%CI=0.763-1.919) higher for those who watched TV less than once a week, and 26% (95%CI=0.801-1.985) and 67 % (95%CI=0.899-1.761) higher among those who watched at least once a week. The odds being overweight and obese were slightly higher among rural women: 35% (95%CI=0.810-2.257) and 68% (95%CI=1.029-2.751) higher for those who watched TV at least once a week, and 26% (95%CI=0.899-1.761) and 63% (95%CI=1.179-2.241) among those who watched less than once a week.

Table 3: Association (crude) between frequency of watching TV and overweight and obesity among Bangladeshi women. BDHS 2014.

Variable	Overweight (COR)		Obesity (COR)	
Frequency of watching TV	**Urban**	**Rural**	**Urban**	**Rural**
Not at all	1	1	1	1
Less than once a week	1.412 (0.887-2.248)	1.542 (0.933-2.549)	2.075 (1.341-3.211)	2.643 (1.639-4.264)
At least once a week	1.840 (1.215-2.788)	1.578 (1.189-2.094)	4.705 (3.184-6.954)	3.611 (2.761-4.722)

Table 4: **Association (Adjusted) between frequency of watching TV and overweight and obesity among Bangladeshi women. BDHS 2014.**

Variable	Overweight (AOR)		Obesity (AOR)	
Frequency of watching TV	**Urban**	**Rural**	**Urban**	**Rural**
Not at all	1	1	1	1
Less than once a week	1.173 (0.728-1.891)	1.258 (0.899-1.761)	1.210 (0.763-1.919)	1.625 (1.179-2.241)
At least once a week	1.261 (0.801-1.985)	1.352 (0.810-2.257)	1.665 (1.079-2.568)	1.683 (1.029-2.751)

N.B. Adjusted for the variables found significant in the bivariate tests.

Discussion

Main findings

Based on a nationally representative cross-sectional data, this study attempted to show the current prevalence of overweight and obesity among non-pregnant adult women in Bangladesh, and the association between frequency of TV viewing and being overweight and obese. Our findings indicate a net increase in the prevalence of overweight and obesity among women ageing between 15 and 49 years. In 2004 BDHS, which was the first to include anthropometric measurements for adult women, the prevalence of women with BMI$\geq$25.0 was 8.9% (7.5% overweight and 1.4% obese), which increased to 16.4% (13.5% overweight and 2.9 % obese) in 2011 and 24% in 2014 (19.4% overweight and 4.4% obese). As seen in the previous surveys, urban women had notably higher prevalence of both overweight (27.7% Vs 15.9%) and obese (8.1% Vs 2.6%) compared to their rural counterparts.

As expected, the frequency of TV watching was also higher among women in urban areas than in rural areas. This is understandable as urban residents enjoy a higher coverage of electric grids and access to more diverse TV channels. Another possible reason can be the higher rate of employment among rural women which may allow them less time for recreation. TV watching was associated with of being overweight and obese among both urban and rural women. Women

who reported watching TV less than once a week had higher odds of being overweight and obese compared to those did not watch TV at all. Those who watched at least once a week had the highest likelihood of being overweight and obese. Regardless of the frequency of watching TV, urban women had higher odds of being obese than their rural counterparts. This might be due to the type of work they are engaged with and the types of food consumed. Types of employment is rural areas are supposed to be more labor consuming and involve greater movement due to less developed transportation and technological infrastructure. Moreover, dietary environment in rural areas are also supposed to be less obesogenic than in urban areas due to lesser concentration of fast-food, restaurant and supermarket chains.

Comparison with previous studies

Prevalence of overweight and obesity is rising in not only in Bangladesh, but also in other South Asian countries with varying trend across age, sex and region. In India, the percentage of overweight and obese women ageing 15 to 49 years rose from 11% in National Family Health Survey (NFHS)-2 to 15% in NFHS-3; with highest rates in Punjab (29.9%) followed by Kerala (28.1%) and Delhi (26.4%) [22]. According to World Health Organisation (WHO) estimates, the percentage of overweight and obesity among Pakistani women was respectively 25.5% and 3.6% with higher prevalence of overweight and obesity among women than among men [23]. For Nepal, the increase in combined prevalence of overweight and obesity was about six times (1.6% in 1996 Vs 10.1% in 2006) between 1996 and 2006 [24].

Evidence regarding the association between TV viewing and overweight and obesity in South Asia is scarce, however studies from other countries shows that TV viewing is strongly associated with overweight and obesity among preschool children, adolescent and adults of both sexes [25-29] which is consistent with our findings on adult women in Bangladesh. Similar findings were observed in USA [25] japan [28] and Australia [29]. Among Iranian adolescents, TV Viewing was associated with increasing rates of overweight and obesity independent of PA and consumption of obesogenic foods 27. One review study proposed that TV viewing may act through mechanisms other than reducing the expenditure of energy and increasing the consumption of obesogenic foods [30] as the amount of obesogenic foods consumption is not always related to the length of time the adolescents spent on watching TV [31].

Research implications and general discussion

Recent research evidence suggests a rapid rise in the burden of overweight/obesity and associated NCDs which a growing concern for the underdeveloped healthcare system in Bangladesh. As the country is progressing in terms of socioeconomic development and improving living standards, more and more people are adopting modern technological conveniences and embracing widely spread western lifestyle. Rate of literacy is still low and the general population is largely unaware of the consequences of unhealthy behaviour and lifestyle related risk factors of overweight/obesity and NCDs. Given the rising prevalence of overweight and obesity in the country, it is becoming an urgent imperative for the health policy makers to develop socio-culturally appropriate guidelines and creating the opportunities for averting the onset of overweight/obesity among children and intervention among the already overweight/obese population. This is certainly a challenging task, and effective implementation of which is reliant on evidences from large scale population based studies. Though the present study is very limited in its scope, it sets out the avenue for more in-depth studies to probe into the underlying determinants of inadequate PA and TV watching and the mechanisms through which they are contributing to the increasing prevalence of overweight/obesity among adult women and in the population in general.

Strengths and limitations

This study has several important strengths and limitations to mention. To our knowledge, this is the first nationally representative study to investigate the frequency of TV viewing in relation to overweight/obesity among adult women in South Asia. The findings are expected to serve useful tools for developing proper intervention methods. However, as the survey collected data on outcome and explanatory variables at the same point of time, no causal inferences can be made. Secondly, TV viewing *frequency per week* was used instead of precise *duration per day* which could have produced more precise picture of the association provided data were available on exact number of hours of TV watching. More importantly, women reported the frequency themselves which may be subject to reporting bias and recall error. Future surveys are recommended to focus on the impact of total number of hours instead of days and also include dietary and associated behaviours to TV watching.

Abbreviations: BDHS: Bangladesh Demographic and Health Survey; DALYs: Disability-adjusted life-years; GDP: Gross domestic product; MetS: Metabolic syndrome; NCDs: Non-communicable chronic diseases; WHO: World health organisation.

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Frequency of TV viewing and prevalence of overweight and obesity among adult women in Bangladesh: A cross-sectional study

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Frequency of TV viewing and prevalence of overweight and obesity among adult women in Bangladesh: A cross-sectional study

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Objectives: Researches in developed countries have demonstrated association of varying degrees between TV watching and the risk of being overweight and obese. However, there is no evidence in the context of south Asian population. To this end, the present study intended to investigate if watching TV increases the risk of being overweight and obese among women in Bangladesh.

Setting: Rural and urban areas in Bangladesh.

Participants: Participant were 16,624 non-pregnant women ageing between 15 and 49 years.

Methods: The study is based on cross-sectional data from Bangladesh Demographic and Health Survey (BDHS) conducted in 2014. Main outcome variables were overweight and obesity measured by body mass index. Data were analysed by using descriptive statistics, cross-tabulation and multivariable logistic regression models.

Results: Prevalence of overweight and obesity in the sample population were respective 4.5% (95%CI=4.18- 4.82) and 20% (95%CI=19.39- 20.61). In the multivariable analysis, compared with women who did not watch TV at all, urban women who watched TV less than once a week had 17% (AOR=1.173; 95%CI=0.728-1.891) higher odds of being overweight and 21% (AOR=1.21; 95%CI=0.763-1.919) higher odds of being obese. Urban women who watched TV at least once a week had 26% (AOR= 1.261; 95%CI=0.801-1.985) higher odds of being overweight and 67% (AOR= 1.665; 95%CI=0.899-1.761) higher odds of being obese. The odds of being overweight and obese among rural women were 35% (AOR=1.352; 95%CI=0.810-2.257) and 68% (AOR=1.683; 95%CI=1.029-2.751) higher for those who watched TV at least once a week, and 26% (AOR= 1.258; 95%CI=0.899-1.761) and 63% (AOR=1.625; 95%CI=1.179-2.241) among those who watched less than once a week.

Conclusion: Prevalence of overweight and obesity has risen considerably among women ageing between 15 and 49 years since the previous estimates based on DHS data. Frequent TV watching was associated with higher risk of being obese among adult women in rural areas.

Key words: Bangladesh; Overweight; Obesity; TV watching; Women.

Strengths and limitations

- To our knowledge, this is the first study to investigate the association between TV viewing and being overweight/obese among adult women in a South Asian country.
- Sample size was considerably large and representative of the general population.

- TV viewing *frequency per week* was used instead of precise *duration per day* which could have produced a more precise picture of the association.
- Data were cross-sectional which precludes making any causal inference.

Introduction

Overweight/obesity represent a major risk factor for non-communicable chronic diseases (NCDs), and is considered as major public health hazards in both developing and developed countries [1,2]. In 2010, worldwide about 3·4 million deaths, 3·9% of years of life lost, and 3·8% of disability-adjusted life-years (DALYs) were attributable to overweight/obesity alone [3]. In Bangladesh, where the epidemiological trend is usually characterized by high rates of infectious diseases [4] along with childhood an adult undernutrition, overweight and obesity are fast becoming a significant public health concern [5]. Prevalence of overweight and obesity has increased from about two folds during the period 2004-2011: overweight 7.5% in 2004 Vs 13.5 in 2011, and obesity 1.4% in 2004 Vs 2.9 in 2011 [6]. This rising prevalence is usually attributed to the recent economic progress which has been accompanied by certain demographic and nutritional transition, urbanization, dietary and lifestyle changes [5,7]. Literature review of the epidemiological studies surrounding the determinants of overweight/obesity suggests a growing attention on the impact of lifestyle related obesogenic behaviours [8-10]. Factors that appear most commonly include changing dietary choices, sedentary behaviour, TV watching, playing computer games, and level of physical activity [5, 8-10].

Growing consensus suggest a strong correlation between sedentary lifestyle and inadequate physical activity (PA) and the risk of developing NCDs [7,9,10,11]. Studies from the developing countries showed that a large proportion of children and adolescents do not meet recommended level of PA, as lifestyle involving higher PA have been displaced by more sedentary alternatives (satellite TV, computer games, telecommunication technology) and thus contributing to reduced PA and energy expenditure [12]. TV watching has been claimed to be not simply a lack of PA, but involves a set of behaviours where sitting/lying is the dominant mode of posture with low energy expenditure, and getting used to such postural behaviour can replicate even at school and workplace [13]. Higher sitting time has been shown to associated with increased risk of developing overweight and obesity, cancer, and diabetes [14,15] and has been identified as a global public health issue [16]. In addition to reduced level of PA and low energy expenditure, TV watching also increases the consumption of obesogenic foods [17]. Cross-sectional studies on American and

Latino children reported that TV watching during family meals is associated with reduced consumption of fruit and vegetables and higher consumption of soda, chips, sausages [17,18]. However, the levels and type of food intake can depend on the genre of program being watched (or alternately, boring) and level of engagement [19].

Arguably, the frequency and duration of TV watching can vary substantially from person to person depending on the availability of alternative sources of recreation, availability of resources of PA, and social factors that can impact the freedom of movement (e.g. age, gender, dietary habit, sociocultural factors, neighborhood safety, level of socialization). Therefore, the association between TV viewing and being overweight/obesity is not generalizable and needs to be studied and interpreted by taking the local contexts into consideration. Current evidences on this topic are mostly from developing countries with very limited research on South Asian countries. Major barriers to conducting studies in this line are lack of recognition of the problem and want of countrywide data. The present study aims to address the research gap be utilizing data from BDHS 2014 survey which provides quality data on various health indicators for women and children in the country. BDHS does not include any separate section on hours of TV watching, hence number of days per week, instead of hours/minutes was used as a proxy measure of duration of TV watching.

Methods:

About the study setting

Bangladesh is the third largest country in the South Asian region and also has the third largest economy in terms of Gross Domestic Product (GDP). It is the most densely populated country in the world with a population density of 1,070 persons/km^2 (2014 estimate). The life expectancy at birth among women is 72 years versus 69 years among men. Though the economy has been experiencing unprecedented progress in last few decades, the country still performs very low in terms of Human develop Index (HDI value for 2014 is 0.570), ranking 142nd out of 188 countries (5th in South Asia). World Bank classifies Bangladesh as a lower middle-income country with a gross national income (GNI) per capita of US$1,314 in FY 2014-2015 [20].

Survey and data collection

The 2014 Bangladesh Demographic and Health Survey was the sixth survey of this kind to take place in the country. The main objectives of the survey were to provide quality data on a range of

health, demographic, and socioeconomic indicators and assist in evidence-based policy making. The survey was conducted under the authority of the National Institute of Population Research and Training (NIPORT) of the Ministry of Health and Family Welfare and was implemented by Mitra and Associates with technical assistance from ICF International of Rockville, Maryland, USA, and financial support from the U.S. Agency for International Development (USAID). Data collection lasted from June 28, 2014 to November 9 of the same year.

Bangladesh has seven administrative regions which are divided into sixty-four districts. Sample population covered the residents in noninstitutional dwellings in both urban and rural areas from all sixty-four districts. The primary sampling units (PSU) for the survey were enumeration areas (EAs) used in the Population and Housing Census in the country in 2011 that was provided by the Bangladesh Bureau of Statistics (BBS). Each EA is a collection of an average of about 120 households. At first, 600 EAs were selected for the survey with 207 EAs in urban areas and 393 in rural areas. In the second stage, on average 30 households were selected from each EA, which summed to about 18,000 households. The 2014 BDHS used three types of questionnaires: Household, Woman's Questionnaire, and Community Questionnaire. The main purpose of the Household Questionnaire was to identify women eligible for the individual interview. A total of 18,245 ever-married women ageing between 15 to 49 years were identified in these households from which 17,863 were finally interviewed, producing a response rate of 98 percent. Data for the present study was extracted from the Woman's Questionnaire which included themes such as basic sociodemographic, anthropometric, reproductive, fertility, immunization, and HIV knowledge [4,21]. More details of the survey is available in the final report published by the National Institute of Population Research and Training (NIPORT) [21].

Study variables

The outcome variables for this study were overweight and obesity measured by mass index (BMI), which was defined as weight in kg over height in m^2. BDHS carries out anthropometrics measurements such as height and weight for ever-married women ageing 15-49 years as an indicator of women's nutritional status. As per WHO recommendations, women were categorized as neither overweight nor obese when BMI was <25 kg/m^2, overweight if BMI was 25 kg/m^2 to 29.9 kg/m^2 and obese if BMI was >30 kg/m^2. Exclusion criteria were being currently pregnant and for whom information on height and/or weight was not available.

The explanatory variable of main interest was 'frequency of TV watching'. As the exact durations (hours or minutes/day) were not available, the frequencies per week were used as a proxy

measure which included: 1) Not watching TV at all, 2) watching less than once a week, and 3) watching at least once a week.

Based on insights from literature review, the following covariates were deemed relevant to the topic and for inclusion in the study - Age: 15-24/25-34/>35 years; Division: Barisal/Chittagong/Dhaka/Khulna/Rajshahi/Rangpur/Sylhet; Educational attainment*: Nil/ Primary/ Secondary/ Higher; Husbands Educational attainment: Nil/ Primary/ Secondary/ Higher; Currently employed: Yes/No; Wealth index**: Poorest/ Poorer/ Middle/ Richer/ Richest; Parity: 1/2/3/3+.

*Educational attainment was categorized as per the highest level/class attended, regardless of the completion status of that level/class. Nil refers to no experience of formal education, primary as completing grade 5, and secondary as completing grade 10, higher as those who had pre-university/university level education.

** DHS surveys provide information on wealth status instead of any direct information on income. Household Wealth Index is a used as a proxy measure for household living status which takes into consideration household possessions e.g. TV, Radio, bicycle, and housing quality e.g. type of floor, wall, and roof. Calculation of the wealth index consists of assigning a factor score for a set of possessions which is generated through principal component analysis (PCA). The scores are then summed and standardized for each household which places them in a continuous scale based on relative wealth scores. Finally, the scores are categorized into quintiles where each households fall into a category, with the lowest scores representing the poorest and highest representing the richest households [17].

Data analysis

Data were analysed using STATA® version 12 and SPSS® version 20. Datasets were checked for missing values and outliers. Weighted baseline sociodemographic information were presented by descriptive statistics. x^2-tests were performed to examine the group differences (between overweight and obesity) for all the explanatory variables. The variables that showed significance at $p<=0.25$ were selected for final regression analysis. All variables were checked for multicollinearity and no significant multicollinearity was observed between any variables. The association between BMI and frequency of TV watching was measured by means of multinomial logistic regression. Results of the regression analysis were presented as crude and adjusted odds Ratios with corresponding 95% confidence intervals. All tests were two-tailed and was considered significant at the level of 5%.

Ethics statement

All participants gave informed consent prior to taking part in the voluntary interview. The survey was approved by the ICF International Institutional Review Board (IRB) who is responsible for reviewing the procedures and questionnaires for standard DHS surveys.

Results:

Basic characteristics of the sample population are presented in table 1. Table shows that majority of the women were of rural origin with highest participation from Dhaka division (17.4%) and lowest from Sylhet (11.3%). More than a quarter of the women were in the 15-24 years age group and more than one-third aged above 34 years, and about two-third (65.3%) were of rural origin. The rate of having no formal education was higher among women compared to their husbands (75.7% Vs 71.3%). Majority of the women (37%) and their husbands (29.4%) had secondary school level qualification. However, the rate of completion of higher education were lower among women (9.4%) compared to their husbands (14.9%). Less than one-third of the women reported having an employment at the time of interview, and rate of unemployment were slightly higher among urban women compared to rural women (68.8% Vs 66.8%). Regarding household wealth status, majority of the women belonged to the wealthiest group (21.7%). However, the rate of being in the wealthiest group was noticeably higher among urban women compared to their rural counterparts (44.4% Vs 9.6%). More than one-fifth of the women were primiparous and little less than one-third of the women had experienced more than three childbirths. About two-fifth of the women reported not watching TV at all (39.4%) and more than half reported watching at least once a week. Rate of watching TV at least once a week was almost twice as high among urban women compared to rural women (75.1% Vs 39.6%). Prevalence of overweight and obesity in the sample population were respective 4.5% and 20%. Urban women had a higher prevalence of both overweight (27.7 Vs 15.9%) and obesity (8.1 Vs 2.6%) compared to rural women.

Table 1: Baseline characteristics of the study population, BDHS 2014.

Variables	Frequency (%)
Age	
15-24	4433 (26.7)
25-34	5969 (35.9)
35/35+	6222 (37.4)
Division	

Barisal	1982 (11.9)
Chittagong	2639 (15.9)
Dhaka	2893 (17.4)
Khulna	2460 (14.8)
Rajshahi	2380 (14.3)
Rangpur	2389 (14.4)
Sylhet	1881 (11.3)
Residency	
Urban	5764 (34.7)
Rural	10860 (65.3)
Educational attainment	
Nil	4039 (24.3)
Primary	4875 (29.3)
Secondary	6153 (37.0)
Higher	1557 (9.4)
Husbands Educational attainment	
Nil	4764 (28.7)
Primary	4503 (27.1)
Secondary	4884 (29.4)
Higher	2473 (14.9)
Currently employment	
No	11221 (67.5)
Yes	5403 (32.5)
Wealth index	
Poorest	2999 (18.0)
Poorer	3102 (18.7)
Middle	3382 (20.3)
Richer	3534 (21.3)
Richest	3607 (21.7)
Parity	
1	3625 (21.8)
2	4495 (27.0)
3	3238 (19.5)
3+	5266 (31.7)
Frequency of watching TV	
Not at all	6544 (39.4)
Less than once a week	1453 (8.7)

At least once a week	8627 (51.9)
BMI	
BMI≥30	748 (4.2)
25 ≥BMI < 30	3325 (20.0)
BMI<25	12551 (75.8)

Cross-tabulation

Table 2 shows the results of chi-square tests of association among the three groups according to their BMI status in relation to the explanatory variables. Result shows that the prevalence of both overweight and obesity increased with higher age and was most common in Dhaka division. Women who had secondary level education, currently unemployed, belonging to the wealthier households, and had two children were more likely to be overweight and obese. Participants who reported watching TV at least once a week were also more likely to be overweight and obese compared to those who did not watch at all and watched less than once a week.

Table 2: Prevalence of overweight and obesity in the sample population across the explanatory variables, BDHS 2014.

Variables	BMI status (%)			Chi-square	p-value
	BMI≥30	**25 ≥BMI < 30**	**BMI<25**		
Age				428.111	**<0.0001**
15-24	10.6	15.5	30.6		
25-34	37.2	41.2	34.4		
35/35+	52.3	43.3	35.0		
Division				176.299	**<0.0001**
Barisal	8.7	10.5	12.5		
Chittagong	18.7	18.2	15.1		
Dhaka	20.1	19.8	16.6		
Khulna	18.4	17.4	13.9		
Rajshahi	15.5	14.7	14.2		
Rangpur	10.2	11.3	15.4		
Sylhet	8.4	8.0	12.4		

Residency				664,562	**<0.0001**
Urban	62.3	48.1	29.5		
Rural	37.7	51.9	70.5		
Educational attainment				434.825	**0.001**
Nil	14.2	17.1	26.8		
Primary	23.9	25.4	30.7		
Secondary	44.9	42.2	35.2		
Higher	17.0	15.2	7.4		
Husbands Educational attainment				758.122	**<0.0001**
Nil	14.8	18.6	32.1		
Primary	20.1	22.7	28.7		
Secondary	34.8	33.8	27.9		
Higher	30.3	24.8	11.3		
Currently employment				53.861	**<0.0001**
No	77.8	69.9	66.2		
Yes	22.2	30.1	33.8		
Wealth index				36.790	**0.013**
Poorest	3.3	7.5	21.7		
Poorer	4.8	11.1	21.5		
Middle	12.0	17.4	21.6		
Richer	23.7	24.7	20.2		
Richest	56.1	39.2	15.0		
Parity				154.802	**0.004**
1	18.7	19.3	22.7		
2	31.8	33.1	25.1		
3	25.1	20.9	18.8		
3+	24.3	26.7	33.4		
Frequency of watching TV				18.898	**0.001**
Not at all	14.2	23.9	45.0		
Less than once a week	5.6	7.6	9.2		
At least once a week	80.2	68.5	45.8		

Association between frequency of TV watching and BMI status among the sample population were analysed by means of multivariable logistic regression with normal weight considering as the reference group. The crude and adjusted odds of being overweight and obese were shown in

table 3 and table 4 respectively. In the urban areas, compared with women who did not watch TV at all, those who watched less than once a week and at least once a week were respectively 41% and 84% as likely to be overweight and respectively 2 fold and 4.7 times as likely to be obese. For rural women, the corresponding figures were respectively 54% and 57% for overweight and 2.64 and 3.6 times for obesity.

In the adjusted model, however, TV viewing was significantly associated with obesity among rural women, and among urban women who watched TV at least once a week only. Table 4 shows that the odds of being overweight and obese among urban women were respectively 17% (AOR= 1.173; 95%CI=0.728-1.891) and 21% (AOR=1.210 ; 95%CI=0.763-1.919) higher for those who watched TV less than once a week, and 26% (AOR=1.261; 95%CI=0.801-1.985) and 67 % (AOR=1.665; 95%CI=0.899-1.761) higher among those who watched at least once a week. The odds being overweight and obese were slightly higher among rural women: 35% (AOR= 1.352; 95%CI=0.810-2.257) and 68% (AOR= 1.683; 95%CI=1.029-2.751) higher for those who watched TV at least once a week, and 26% (AOR= 1.258; 95%CI=0.899-1.761) and 63% (AOR= 1.625; 95%CI=1.179-2.241) among those who watched less than once a week.

Table 3: Association (crude) between frequency of watching TV and overweight and obesity among Bangladeshi women. BDHS 2014.

Variable	Overweight (COR)		Obesity (COR)	
Frequency of watching TV	**Urban**	**Rural**	**Urban**	**Rural**
Not at all	1	1	1	1
Less than once a week	1.412 (0.887-2.248)	1.542 (0.933-2.549)	2.075 (1.341-3.211)	2.643 (1.639-4.264)
At least once a week	1.840 (1.215-2.788)	1.578 (1.189-2.094)	4.705 (3.184-6.954)	3.611 (2.761-4.722)

N.B. COR= Crude Odds ratio.

Table 4: **Association (Adjusted) between frequency of watching TV and overweight and obesity among Bangladeshi women. BDHS 2014.**

Variable	Overweight (AOR)	Obesity (AOR)

Frequency of watching TV	Urban	Rural	Urban	Rural
Not at all	1	1	1	1
Less than once a week	1.173 (0.728-1.891)	1.258 (0.899-1.761)	1.210 (0.763-1.919)	1.625 (1.179-2.241)
At least once a week	1.261 (0.801-1.985)	1.352 (0.810-2.257)	1.665 (1.079-2.568)	1.683 (1.029-2.751)

N.B. AOR= Adjusted Odds ratio. Adjusted for Age, Division, Educational attainment, Husbands Educational attainment, employment status, Wealth index, and Parity.

Model goodness-of-fit: Several goodness-of-fit statistics are used to check for internal validity of regression models. However, for this study McFadden R^2 value was used as it is one of the most commonly reported one. The McFadden R^2 was 0.197 in the adjusted model, and indicated a satisfactory model fitness.

Discussion

Main findings

Based on a nationally representative cross-sectional data, this study attempted to show the current prevalence of overweight and obesity among non-pregnant adult women in Bangladesh, and the association between frequency of TV viewing and being overweight and obese. Our findings indicate a net increase in the prevalence of overweight and obesity among women ageing between 15 and 49 years. In 2004 BDHS, which was the first to include anthropometric measurements for adult women, the prevalence of women with BMI≥25.0 was 8.9% (7.5% overweight and 1.4% obese), which increased to 16.4% (13.5% overweight and 2.9 % obese) in 2011 and 24% in 2014 (19.4% overweight and 4.4% obese). As seen in the previous surveys, urban women had notably higher prevalence of both overweight (27.7% Vs 15.9%) and obese (8.1% Vs 2.6%) compared to their rural counterparts.

As expected, the frequency of TV watching was also higher among women in urban areas than in rural areas. This is understandable as urban residents enjoy a higher coverage of electric grids and access to more diverse TV channels. Another possible reason can be the higher rate of

employment among rural women which may allow them less time for recreation. TV watching was significantly associated with obesity among rural women. Women who reported watching TV less than once a week had higher odds of being overweight and obese compared to those did not watch TV at all. Those who watched at least once a week had the highest likelihood of being overweight and obese. Regardless of the frequency of watching TV, urban women had higher odds of being obese than their rural counterparts. This might be due to the type of work they are engaged with and the types of food consumed. Types of employment is rural areas are supposed to be more labor consuming and involve greater movement due to less developed transportation and technological infrastructure. Moreover, dietary environment in rural areas are also supposed to be less obesogenic than in urban areas due to lesser concentration of fast-food, restaurant and supermarket chains.

Comparison with previous studies

Prevalence of overweight and obesity is rising in not only in Bangladesh, but also in other South Asian countries with varying trend across age, sex and region. In India, the percentage of overweight and obese women ageing 15 to 49 years rose from 11% in National Family Health Survey (NFHS)-2 to 15% in NFHS-3; with highest rates in Punjab (29.9%) followed by Kerala (28.1%) and Delhi (26.4%) [22]. According to World Health Organisation (WHO) estimates, the percentage of overweight and obesity among Pakistani women was respectively 25.5% and 3.6% with higher prevalence of overweight and obesity among women than among men [23]. For Nepal, the increase in combined prevalence of overweight and obesity was about six times (1.6% in 1996 Vs 10.1% in 2006) between 1996 and 2006 [24].

Evidence regarding the association between TV viewing and overweight and obesity in South Asia is scarce, however studies from other countries shows that TV viewing is strongly associated with overweight and obesity among preschool children, adolescent and adults of both sexes [25-29] which is consistent with our findings on adult women in Bangladesh. Similar findings were observed in USA [25] japan [28] and Australia [29]. Among Iranian adolescents, TV Viewing was associated with increasing rates of overweight and obesity independent of PA and consumption of obesogenic foods [27]. One review study proposed that TV viewing may act through mechanisms other than reducing the expenditure of energy and increasing the consumption of obesogenic foods [30] as the amount of obesogenic foods consumption is not always related to the length of time the adolescents spent on watching TV [31].

Research implications and general discussion

Recent research evidence suggests a rapid rise in the burden of overweight/obesity and associated NCDs which a growing concern for the underdeveloped healthcare system in Bangladesh. As the country is progressing in terms of socioeconomic development and improving living standards, more and more people are adopting modern technological conveniences and embracing widely spread western lifestyle. Rate of literacy is still low and the general population is largely unaware of the consequences of unhealthy behaviour and lifestyle related risk factors of overweight/obesity and NCDs. Given the rising prevalence of overweight and obesity in the country, it is becoming an urgent imperative for the health policy makers to develop socio-culturally appropriate guidelines and creating the opportunities for averting the onset of overweight/obesity among children and intervention among the already overweight/obese population. This is certainly a challenging task, and effective implementation of which is reliant on evidences from large scale population based studies. Though the present study is very limited in its scope, it sets out the avenue for more in-depth studies to probe into the underlying determinants of inadequate PA and TV watching and the mechanisms through which they are contributing to the increasing prevalence of overweight/obesity among adult women and in the population in general.

Strengths and limitations

This study has several important strengths and limitations to mention. To our knowledge, this is the first nationally representative study to investigate the frequency of TV viewing in relation to overweight/obesity among Bangladeshi women, so the findings are generalizable for adult women ageing below 50 years in Bangladesh. The findings are expected to serve useful tools for developing proper intervention methods. However, as the survey collected data on outcome and explanatory variables at the same point of time, no causal inferences can be made. Secondly, TV viewing *frequency per week* was used instead of precise *duration per day* which could have produced more precise picture of the association provided data were available on exact number of hours of TV watching. More importantly, women reported the frequency themselves which may be subject to reporting bias and recall error. Future surveys are recommended to focus on the impact of total number of hours instead of days and also include dietary and associated behaviours to TV watching.

Abbreviations: BDHS: Bangladesh Demographic and Health Survey; DALYs: Disability-adjusted life-years; GDP: Gross domestic product; NCDs: Non-communicable chronic diseases; WHO: World health organisation.

Data sharing statement: Dataset used for this study was obtained from DHS website. DHS holds the sole authority to distribute the data through the public domain which is available at: http://dhsprogram.com/data/available-datasets.cfm

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Frequency of TV viewing and prevalence of overweight and obesity among adult women in Bangladesh: A cross-sectional study

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Frequency of TV viewing and prevalence of overweight and obesity among adult women in Bangladesh: A cross-sectional study

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Objectives: Researches in developed countries have demonstrated association of varying degrees between TV watching and the risk of being overweight and obese. However, there is no evidence in the context of south Asian population. To this end, the present study intended to investigate if watching TV increases the risk of being overweight and obese among women in Bangladesh.

Setting: Rural and urban areas in Bangladesh.

Participants: Participant were 16,624 non-pregnant women ageing between 15 and 49 years.

Methods: The study is based on cross-sectional data from Bangladesh Demographic and Health Survey (BDHS) conducted in 2014. Main outcome variables were overweight and obesity measured by body mass index. Data were analysed by using descriptive statistics, cross-tabulation and multivariable logistic regression models.

Results: Prevalence of overweight and obesity in the sample population were respectively 4.5% (95%CI=4.18- 4.82) and 20% (95%CI=19.39- 20.61). In the multivariable analysis, no statistically significant association was found between TV watching and being overweight. However, the odds of being obese among rural women were 63% higher (AOR=1.625; 95%CI=1.179-2.241) among those who watched less than once a week, and 68% (AOR=1.683; 95%CI=1.029-2.751) higher among women who watched TV at least once a week compared to those who did not watch TV at all. Urban women who watched TV at least once a week were 67% as likely to be obese [AOR=1.665; 95%=1.079-2.568] compared to those who did not watch at all.

Conclusion: Prevalence of overweight and obesity has risen considerably among women ageing between 15 and 49 years since the previous estimates based on DHS data. Frequent TV watching was associated with higher risk of being obese among adult women in rural areas.

Key words: Bangladesh; Overweight; Obesity; TV watching; Women.

Strengths and limitations

- This is the first study to investigate the association between TV viewing and being overweight/obese among adult women in a South Asian country.
- Sample size was considerably large and representative of the general population.
- TV viewing *frequency per week* was used instead of precise *duration per day* which could have produced a more precise picture of the association.

- Data were cross-sectional which precludes making any causal inference.

Introduction

Overweight/obesity represent a major risk factor for non-communicable chronic diseases (NCDs), and is considered as major public health hazards in both developing and developed countries [1,2]. In 2010, worldwide about 3.4 million deaths, 3.9% of years of life lost, and 3.8% of disability-adjusted life-years (DALYs) were attributable to overweight/obesity alone [3]. In Bangladesh, where the epidemiological trend is usually characterized by high rates of infectious diseases [4] along with childhood an adult undernutrition, overweight and obesity are fast becoming a significant public health concern [5]. Prevalence of overweight and obesity has increased from about two folds during the period 2004-2011: overweight 7.5% in 2004 Vs 13.5 in 2011, and obesity 1.4% in 2004 Vs 2.9 in 2011 [6]. This rising prevalence is usually attributed to the recent economic progress which has been accompanied by certain demographic and nutritional transition, urbanization, dietary and lifestyle changes [5,7]. Literature review of the epidemiological studies surrounding the determinants of overweight/obesity suggests a growing attention on the impact of lifestyle related obesogenic behaviours [8-10]. Factors that appear most commonly include changing dietary choices, sedentary behaviour, TV watching, playing computer games, and level of physical activity [5, 8-10].

Growing consensus suggest a strong correlation between sedentary lifestyle and inadequate physical activity (PA) and the risk of developing NCDs [7,9,10,11]. Studies from the developing countries showed that a large proportion of children and adolescents do not meet recommended level of PA, as lifestyle involving higher PA have been displaced by more sedentary alternatives (satellite TV, computer games, telecommunication technology) and thus contributing to reduced PA and energy expenditure [12]. TV watching has been claimed to be not simply a lack of PA, but involves a set of behaviours where sitting/lying is the dominant mode of posture with low energy expenditure, and getting used to such postural behaviour can replicate even at school and workplace [13]. Higher sitting time has been shown to associated with increased risk of developing overweight and obesity, cancer, and diabetes [14,15] and has been identified as a global public health issue [16]. In addition to reduced level of PA and low energy expenditure, TV watching also increases the consumption of obesogenic foods [17]. Cross-sectional studies on American and Latino children reported that TV watching during family meals is associated with reduced consumption of fruit and vegetables and higher consumption of soda, chips, sausages [17,18].

However, the levels and type of food intake can depend on the genre of program being watched (or alternately, boring) and level of engagement [19].

Arguably, the frequency and duration of TV watching can vary substantially from person to person depending on the availability of alternative sources of recreation, availability of resources of PA, and social factors that can impact the freedom of movement (e.g. age, gender, dietary habit, sociocultural factors, neighborhood safety, level of socialization). Therefore, the association between TV viewing and being overweight/obesity is not generalizable and needs to be studied and interpreted by taking the local contexts into consideration. Current evidences on this topic are mostly from developing countries with very limited research on South Asian countries. Major barriers to conducting studies in this line are lack of recognition of the problem and want of countrywide data. The present study aims to address the research gap be utilizing data from BDHS 2014 survey which provides quality data on various health indicators for women and children in the country. BDHS does not include any separate section on hours of TV watching, hence number of days per week, instead of hours/minutes was used as a proxy measure of duration of TV watching.

Methods:

About the study setting

Bangladesh is the third largest country in the South Asian region and also has the third largest economy in terms of Gross Domestic Product (GDP). It is the most densely populated country in the world with a population density of 1,070 persons/km^2 (2014 estimate). The life expectancy at birth among women is 72 years versus 69 years among men. Though the economy has been experiencing unprecedented progress in last few decades, the country still performs very low in terms of Human develop Index (HDI value for 2014 is 0.570), ranking 142nd out of 188 countries (5th in South Asia). World Bank classifies Bangladesh as a lower middle-income country with a gross national income (GNI) per capita of US$1,314 in FY 2014-2015 [20].

Survey and data collection

The 2014 Bangladesh Demographic and Health Survey was the sixth survey of this kind to take place in the country. The main objectives of the survey were to provide quality data on a range of health, demographic, and socioeconomic indicators and assist in evidence-based policy making. The survey was conducted under the authority of the National Institute of Population Research

and Training (NIPORT) of the Ministry of Health and Family Welfare and was implemented by Mitra and Associates with technical assistance from ICF International of Rockville, Maryland, USA, and financial support from the U.S. Agency for International Development (USAID). Data collection lasted from June 28, 2014 to November 9 of the same year.

Bangladesh has seven administrative regions which are divided into sixty-four districts. Sample population covered the residents in noninstitutional dwellings in both urban and rural areas from all sixty-four districts. The primary sampling units (PSU) for the survey were enumeration areas (EAs) used in the Population and Housing Census in the country in 2011 that was provided by the Bangladesh Bureau of Statistics (BBS). Each EA is a collection of an average of about 120 households. At first, 600 EAs were selected for the survey with 207 EAs in urban areas and 393 in rural areas. In the second stage, on average 30 households were selected from each EA, which summed to about 18,000 households. The 2014 BDHS used three types of questionnaires: Household, Woman's Questionnaire, and Community Questionnaire. The main purpose of the Household Questionnaire was to identify women eligible for the individual interview. A total of 18,245 ever-married women ageing between 15 to 49 years were identified in these households from which 17,863 were finally interviewed, producing a response rate of 98 percent. Data for the present study was extracted from the Woman's Questionnaire which included themes such as basic sociodemographic, anthropometric, reproductive, fertility, immunization, and HIV knowledge [4,21]. More details of the survey is available in the final report published by the National Institute of Population Research and Training (NIPORT) [21].

Study variables

The outcome variables for this study were overweight and obesity measured by mass index (BMI), which was defined as weight in kg over height in m^2. BDHS carries out anthropometrics measurements such as height and weight for ever-married women ageing 15-49 years as an indicator of women's nutritional status. As per WHO recommendations, women were categorized as neither overweight nor obese when BMI was <25 kg/m^2, overweight if BMI was 25 kg/m^2 to 29.9 kg/m^2 and obese if BMI was >30 kg/m^2. Exclusion criteria were being currently pregnant and for whom information on height and/or weight was not available.

The explanatory variable of main interest was 'frequency of TV watching'. As the exact durations (hours or minutes/day) were not available, the frequencies per week were used as a proxy measure which included: 1) Not watching TV at all, 2) watching less than once a week, and 3) watching at least once a week.

Based on insights from literature review, the following covariates were deemed relevant to the topic and for inclusion in the study - Age: 15-24/25-34/>35 years; Division: Barisal/Chittagong/Dhaka/Khulna/Rajshahi/Rangpur/Sylhet; Educational attainment*: Nil/ Primary/ Secondary/ Higher; Husbands Educational attainment: Nil/ Primary/ Secondary/ Higher; Currently employed: Yes/No; Wealth index**: Poorest/ Poorer/ Middle/ Richer/ Richest; Parity: 1/2/3/3+.

*Educational attainment was categorized as per the highest level/class attended, regardless of the completion status of that level/class. Nil refers to no experience of formal education, primary as completing grade 5, and secondary as completing grade 10, higher as those who had pre-university/university level education.

** DHS surveys provide information on wealth status instead of any direct information on income. Household Wealth Index is a used as a proxy measure for household living status which takes into consideration household possessions e.g. TV, Radio, bicycle, and housing quality e.g. type of floor, wall, and roof. Calculation of the wealth index consists of assigning a factor score for a set of possessions which is generated through principal component analysis (PCA). The scores are then summed and standardized for each household which places them in a continuous scale based on relative wealth scores. Finally, the scores are categorized into quintiles where each households fall into a category, with the lowest scores representing the poorest and highest representing the richest households [17].

Data analysis

Data were analysed using STATA® version 12 and SPSS® version 20. Datasets were checked for missing values and outliers. Weighted baseline sociodemographic information were presented by descriptive statistics. x^2-tests were performed to examine the group differences (between overweight and obesity) for all the explanatory variables. The variables that showed significance at $p <= 0.25$ were selected for final regression analysis. All variables were checked for multicollinearity and no significant multicollinearity was observed between any variables. The association between BMI and frequency of TV watching was measured by means of multinomial logistic regression. Results of the regression analysis were presented as crude and adjusted odds Ratios with corresponding 95% confidence intervals. All tests were two-tailed and was considered significant at the level of 5%.

Ethics statement

All participants gave informed consent prior to taking part in the voluntary interview. The survey was approved by the ICF International Institutional Review Board (IRB) who is responsible for reviewing the procedures and questionnaires for standard DHS surveys.

Results:

Basic characteristics of the sample population are presented in table 1. Table shows that majority of the women were of rural origin with highest participation from Dhaka division (17.4%) and lowest from Sylhet (11.3%). More than a quarter of the women were in the 15-24 years age group and more than one-third aged above 34 years, and about two-third (65.3%) were of rural origin. The rate of having no formal education was higher among women compared to their husbands (75.7% Vs 71.3%). Majority of the women (37%) and their husbands (29.4%) had secondary school level qualification. However, the rate of completion of higher education were lower among women (9.4%) compared to their husbands (14.9%). Less than one-third of the women reported having an employment at the time of interview, and rate of unemployment were slightly higher among urban women compared to rural women (68.8% Vs 66.8%). Regarding household wealth status, majority of the women belonged to the wealthiest group (21.7%). However, the rate of being in the wealthiest group was noticeably higher among urban women compared to their rural counterparts (44.4% Vs 9.6%). More than one-fifth of the women were primiparous and little less than one-third of the women had experienced more than three childbirths. About two-fifth of the women reported not watching TV at all (39.4%) and more than half reported watching at least once a week. Rate of watching TV at least once a week was almost twice as high among urban women compared to rural women (75.1% Vs 39.6%). Prevalence of overweight and obesity in the sample population were respective 4.5% and 20%. Urban women had a higher prevalence of both overweight (27.7 Vs 15.9%) and obesity (8.1 Vs 2.6%) compared to rural women.

Table 1: Baseline characteristics of the study population, BDHS 2014.

Variables	Frequency (%)
Age	
15-24	4433 (26.7)
25-34	5969 (35.9)
35/35+	6222 (37.4)
Division	
Barisal	1982 (11.9)
Chittagong	2639 (15.9)

Dhaka	2893 (17.4)
Khulna	2460 (14.8)
Rajshahi	2380 (14.3)
Rangpur	2389 (14.4)
Sylhet	1881 (11.3)
Residency	
Urban	5764 (34.7)
Rural	10860 (65.3)
Educational attainment	
Nil	4039 (24.3)
Primary	4875 (29.3)
Secondary	6153 (37.0)
Higher	1557 (9.4)
Husbands Educational attainment	
Nil	4764 (28.7)
Primary	4503 (27.1)
Secondary	4884 (29.4)
Higher	2473 (14.9)
Currently employment	
No	11221 (67.5)
Yes	5403 (32.5)
Wealth index	
Poorest	2999 (18.0)
Poorer	3102 (18.7)
Middle	3382 (20.3)
Richer	3534 (21.3)
Richest	3607 (21.7)
Parity	
1	3625 (21.8)
2	4495 (27.0)
3	3238 (19.5)
3+	5266 (31.7)
Frequency of watching TV	
Not at all	6544 (39.4)
Less than once a week	1453 (8.7)
At least once a week	8627 (51.9)
BMI	

BMI≥30	748 (4.2)
25 ≥BMI < 30	3325 (20.0)
BMI<25	12551 (75.8)

Cross-tabulation

Table 2 shows the results of chi-square tests of association among the three groups according to their BMI status in relation to the explanatory variables. Result shows that the prevalence of both overweight and obesity increased with higher age and was most common in Dhaka division. Women who had secondary level education, currently unemployed, belonging to the wealthier households, and had two children were more likely to be overweight and obese. Participants who reported watching TV at least once a week were also more likely to be overweight and obese compared to those who did not watch at all and watched less than once a week.

Table 2: Prevalence of overweight and obesity in the sample population across the explanatory variables, BDHS 2014.

Variables	BMI status (%)			Chi-square	p-value
	BMI≥30	25 ≥BMI < 30	BMI<25		
Age				428.111	**<0.0001**
15-24	10.6	15.5	30.6		
25-34	37.2	41.2	34.4		
35/35+	52.3	43.3	35.0		
Division				176.299	**<0.0001**
Barisal	8.7	10.5	12.5		
Chittagong	18.7	18.2	15.1		
Dhaka	20.1	19.8	16.6		
Khulna	18.4	17.4	13.9		
Rajshahi	15.5	14.7	14.2		
Rangpur	10.2	11.3	15.4		
Sylhet	8.4	8.0	12.4		
Residency					
Urban	62.3	48.1	29.5	664,562	**<0.0001**

Rural	37.7	51.9	70.5		
Educational attainment				434.825	**0.001**
Nil	14.2	17.1	26.8		
Primary	23.9	25.4	30.7		
Secondary	44.9	42.2	35.2		
Higher	17.0	15.2	7.4		
Husbands Educational attainment				758.122	**<0.0001**
Nil	14.8	18.6	32.1		
Primary	20.1	22.7	28.7		
Secondary	34.8	33.8	27.9		
Higher	30.3	24.8	11.3		
Currently employment				53.861	**<0.0001**
No	77.8	69.9	66.2		
Yes	22.2	30.1	33.8		
Wealth index				36.790	**0.013**
Poorest	3.3	7.5	21.7		
Poorer	4.8	11.1	21.5		
Middle	12.0	17.4	21.6		
Richer	23.7	24.7	20.2		
Richest	56.1	39.2	15.0		
Parity				154.802	**0.004**
1	18.7	19.3	22.7		
2	31.8	33.1	25.1		
3	25.1	20.9	18.8		
3+	24.3	26.7	33.4		
Frequency of watching TV				18.898	**0.001**
Not at all	14.2	23.9	45.0		
Less than once a week	5.6	7.6	9.2		
At least once a week	80.2	68.5	45.8		

Association between frequency of TV watching and BMI status among the sample population were analysed by means of multivariable logistic regression with normal weight considering as the reference group. The crude and adjusted odds of being overweight and obese were shown in table 3 and table 4 respectively. Compared with women who did not watch TV at all, those who

watched at least once a week were 84% [AOR=1.840; 95%CI=1.215-2.788] and 58% [AOR=1.578; 95%CI=1.189-2.094] as likely to be overweight in urban and rural areas respectively. Urban women who watched TV less than once and at least once per week, were 2 [AOR=2.075; 95%CI=1.341-3.211)] and 4.7 [AOR=4.705; 95%CI=3.184-6.954] times as likely to be obese compared to those who did not watch TV at all. The corresponding figures for rural women were respectively 2.64 [AOR=2.643; 95%CI=1.639-4.264] and 3.6 [AOR=3.611; 95%CI=2.761-4.722] times.

In the adjusted model, however, no statistically significant association was found between TV viewing and being overweight. Urban women who watched TV at least once a week were 67% as likely to be obese [AOR=1.665; 95%=1.079-2.568] compared to those who did not watch at all. In the rural areas, women who watched TV less than once and at least once per week, had respectively 63% (AOR= 1.625; 95%CI=1.179-2.241) and 68% (AOR= 1.683; 95%CI=1.029-2.751) higher odds of being obese compared to those who did not watch TV at all.

Table 3: Association (crude) between frequency of watching TV and overweight and obesity among Bangladeshi women. BDHS 2014.

Variable	Overweight (COR)		Obesity (COR)	
Frequency of watching TV	**Urban**	**Rural**	**Urban**	**Rural**
Not at all	1	1	1	1
Less than once a week	1.412 (0.887-2.248)	1.542 (0.933-2.549)	2.075 (1.341-3.211)	2.643 (1.639-4.264)
At least once a week	1.840 (1.215-2.788)	1.578 (1.189-2.094)	4.705 (3.184-6.954)	3.611 (2.761-4.722)

N.B. COR= Crude Odds ratio.

Table 4: **Association (Adjusted) between frequency of watching TV and overweight and obesity among Bangladeshi women. BDHS 2014.**

Variable	Overweight (AOR)		Obesity (AOR)	
Frequency of watching TV	**Urban**	**Rural**	**Urban**	**Rural**
Not at all	1	1	1	1
Less than once a week	1.173 (0.728-1.891)	1.258 (0.899-1.761)	1.210 (0.763-1.919)	1.625 (1.179-2.241)
At least once a week	1.261 (0.801-1.985)	1.352 (0.810-2.257)	1.665 (1.079-2.568)	1.683 (1.029-2.751)

N.B. AOR= Adjusted Odds ratio. Adjusted for Age, Division, Educational attainment, Husbands Educational attainment, employment status, Wealth index, and Parity.

Model goodness-of-fit: Several goodness-of-fit statistics are used to check for internal validity of regression models. However, for this study McFadden R^2 value was used as it is one of the most commonly reported one. The McFadden R^2 was 0.197 in the adjusted model, and indicated a satisfactory model fitness.

Discussion

Main findings

Based on a nationally representative cross-sectional data, this study attempted to show the current prevalence of overweight and obesity among non-pregnant adult women in Bangladesh, and the association between frequency of TV viewing and being overweight and obese. Our findings indicate a net increase in the prevalence of overweight and obesity among women ageing between 15 and 49 years. In 2004 BDHS, which was the first to include anthropometric measurements for adult women, the prevalence of women with BMI≥25.0 was 8.9% (7.5% overweight and 1.4% obese), which increased to 16.4% (13.5% overweight and 2.9 % obese) in 2011 and 24% in 2014 (19.4% overweight and 4.4% obese). As seen in the previous surveys, urban women had notably higher prevalence of both overweight (27.7% Vs 15.9%) and obese (8.1% Vs 2.6%) compared to their rural counterparts.

As expected, the frequency of TV watching was also higher among women in urban areas than in rural areas. This is understandable as urban residents enjoy a higher coverage of electric grids and access to more diverse TV channels. Another possible reason can be the higher rate of employment among rural women which may allow them less time for recreation. TV watching was significantly associated with obesity among rural women. Women who reported watching TV less than once a week had higher odds of being obese compared to those did not watch TV at all. Those who watched at least once a week had the highest likelihood of being overweight and obese. Regardless of the frequency of watching TV, urban women had higher odds of being obese than their rural counterparts. This might be due to the type of work they are engaged with and the types of food consumed. Types of employment is rural areas are supposed to be more labor consuming and involve greater movement due to less developed transportation and technological infrastructure. Moreover, dietary environment in rural areas are also supposed to be less obesogenic than in urban areas due to lesser concentration of fast-food, restaurant and supermarket chains.

Comparison with previous studies

Prevalence of overweight and obesity is rising in not only in Bangladesh, but also in other South Asian countries with varying trend across age, sex and region. In India, the percentage of overweight and obese women ageing 15 to 49 years rose from 11% in National Family Health Survey (NFHS)-2 to 15% in NFHS-3; with highest rates in Punjab (29.9%) followed by Kerala (28.1%) and Delhi (26.4%) [22]. According to World Health Organisation (WHO) estimates, the percentage of overweight and obesity among Pakistani women was respectively 25.5% and 3.6% with higher prevalence of overweight and obesity among women than among men [23]. For Nepal, the increase in combined prevalence of overweight and obesity was about six times (1.6% in 1996 Vs 10.1% in 2006) between 1996 and 2006 [24].

Evidence regarding the association between TV viewing and overweight and obesity in South Asia is scarce, however studies from other countries shows that TV viewing is strongly associated with overweight and obesity among preschool children, adolescent and adults of both sexes [25-29] which is consistent with our findings on adult women in Bangladesh. Similar findings were observed in USA [25] japan [28] and Australia [29]. Among Iranian adolescents, TV Viewing was associated with increasing rates of overweight and obesity independent of PA and consumption of obesogenic foods [27]. One review study proposed that TV viewing may act through mechanisms other than reducing the expenditure of energy and increasing the consumption of obesogenic

foods [30] as the amount of obesogenic foods consumption is not always related to the length of time the adolescents spent on watching TV [31].

Research implications and general discussion

Recent research evidence suggests a rapid rise in the burden of overweight/obesity and associated NCDs which a growing concern for the underdeveloped healthcare system in Bangladesh. As the country is progressing in terms of socioeconomic development and improving living standards, more and more people are adopting modern technological conveniences and embracing widely spread western lifestyle. Rate of literacy is still low and the general population is largely unaware of the consequences of unhealthy behaviour and lifestyle related risk factors of overweight/obesity and NCDs. Given the rising prevalence of overweight and obesity in the country, it is becoming an urgent imperative for the health policy makers to develop socio-culturally appropriate guidelines and creating the opportunities for averting the onset of overweight/obesity among children and intervention among the already overweight/obese population. This is certainly a challenging task, and effective implementation of which is reliant on evidences from large scale population based studies. Though the present study is very limited in its scope, it sets out the avenue for more in-depth studies to probe into the underlying determinants of inadequate PA and TV watching and the mechanisms through which they are contributing to the increasing prevalence of overweight/obesity among adult women and in the population in general.

Strengths and limitations

This study has several important strengths and limitations to mention. To our knowledge, this is the first nationally representative study to investigate the frequency of TV viewing in relation to overweight/obesity among Bangladeshi women, so the findings are generalizable for adult women ageing below 50 years in Bangladesh. The findings are expected to serve useful tools for developing proper intervention methods. However, as the survey collected data on outcome and explanatory variables at the same point of time, no causal inferences can be made. Secondly, TV viewing *frequency per week* was used instead of precise *duration per day* which could have produced more precise picture of the association provided data were available on exact number of hours of TV watching. More importantly, women reported the frequency themselves which may be subject to reporting bias and recall error. Future surveys are recommended to focus on the

impact of total number of hours instead of days and also include dietary and associated behaviours to TV watching.

Abbreviations: BDHS: Bangladesh Demographic and Health Survey; DALYs: Disability-adjusted life-years; GDP: Gross domestic product; NCDs: Non-communicable chronic diseases; WHO: World health organisation.

Data sharing statement: Dataset used for this study was obtained from DHS website. DHS holds the sole authority to distribute the data through the public domain which is available at: http://dhsprogram.com/data/available-datasets.cfm

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Item 8- NA.

Item 9- NA.

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Item 11- NA

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Frequency of TV viewing and prevalence of overweight and obesity among adult women in Bangladesh: A cross-sectional study

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Frequency of TV viewing and prevalence of overweight and obesity among adult women in Bangladesh: A cross-sectional study

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Objectives: Researches in developed countries have demonstrated association of varying degrees between TV watching and the risk of being overweight and obese. However, there is no evidence in the context of south Asian population. To this end, the present study intended to investigate if watching TV increases the risk of being overweight and obese among women in Bangladesh.

Setting: Rural and urban areas in Bangladesh.

Participants: Participant were 16,624 non-pregnant women ageing between 15 and 49 years.

Methods: The study is based on cross-sectional data from Bangladesh Demographic and Health Survey (BDHS) conducted in 2014. Main outcome variables were overweight and obesity measured by body mass index. Data were analysed by using descriptive statistics, cross-tabulation and multivariable logistic regression models.

Results: Prevalence of overweight and obesity in the sample population were respectively 4.5% (95%CI=4.18- 4.82) and 20% (95%CI=19.39- 20.61). In the multivariable analysis, no statistically significant association was found between TV watching and being overweight. However, the odds of being obese among rural women were 63% higher (AOR=1.625; 95%CI=1.179-2.241) among those who watched less than once a week, and 68% (AOR=1.683; 95%CI=1.029-2.751) higher among women who watched TV at least once a week compared to those who did not watch TV at all. Urban women who watched TV at least once a week were 67% as likely to be obese [AOR=1.665; 95%=1.079-2.568] compared to those who did not watch at all.

Conclusion: Prevalence of overweight and obesity has risen considerably among women ageing between 15 and 49 years since the previous estimates based on DHS data. Frequent TV watching was associated with higher risk of being obese among adult women in rural areas.

Key words: Bangladesh; Overweight; Obesity; TV watching; Women.

Strengths and limitations

- This is the first study to investigate the association between TV viewing and being overweight/obese among adult women in a South Asian country.
- Sample size was considerably large and representative of the general population.
- TV viewing *frequency per week* was used instead of precise *duration per day* which could have produced a more precise picture of the association.

- Data were cross-sectional which precludes making any causal inference.

Introduction

Overweight/obesity represent a major risk factor for non-communicable chronic diseases (NCDs), and is considered as major public health hazards in both developing and developed countries [1,2]. In 2010, worldwide about 3.4 million deaths, 3.9% of years of life lost, and 3.8% of disability-adjusted life-years (DALYs) were attributable to overweight/obesity alone [3]. In Bangladesh, where the epidemiological trend is usually characterized by high rates of infectious diseases [4] along with childhood an adult undernutrition, overweight and obesity are fast becoming a significant public health concern [5]. Prevalence of overweight and obesity has increased from about two folds during the period 2004-2011: overweight 7.5% in 2004 Vs 13.5 in 2011, and obesity 1.4% in 2004 Vs 2.9 in 2011 [6]. This rising prevalence is usually attributed to the recent economic progress which has been accompanied by certain demographic and nutritional transition, urbanization, dietary and lifestyle changes [5,7]. Literature review of the epidemiological studies surrounding the determinants of overweight/obesity suggests a growing attention on the impact of lifestyle related obesogenic behaviours [8-10]. Factors that appear most commonly include changing dietary choices, sedentary behaviour, TV watching, playing computer games, and level of physical activity [5, 8-10].

Growing consensus suggest a strong correlation between sedentary lifestyle and inadequate physical activity (PA) and the risk of developing NCDs [7,9,10,11]. Studies from the developing countries showed that a large proportion of children and adolescents do not meet recommended level of PA, as lifestyle involving higher PA have been displaced by more sedentary alternatives (satellite TV, computer games, telecommunication technology) and thus contributing to reduced PA and energy expenditure [12]. TV watching has been claimed to be not simply a lack of PA, but involves a set of behaviours where sitting/lying is the dominant mode of posture with low energy expenditure, and getting used to such postural behaviour can replicate even at school and workplace [13]. Higher sitting time has been shown to associated with increased risk of developing overweight and obesity, cancer, and diabetes [14,15] and has been identified as a global public health issue [16]. In addition to reduced level of PA and low energy expenditure, TV watching also increases the consumption of obesogenic foods [17]. Cross-sectional studies on American and Latino children reported that TV watching during family meals is associated with reduced consumption of fruit and vegetables and higher consumption of soda, chips, sausages [17,18].

However, the levels and type of food intake can depend on the genre of program being watched (or alternately, boring) and level of engagement [19].

Arguably, the frequency and duration of TV watching can vary substantially from person to person depending on the availability of alternative sources of recreation, availability of resources of PA, and social factors that can impact the freedom of movement (e.g. age, gender, dietary habit, sociocultural factors, neighborhood safety, level of socialization). Therefore, the association between TV viewing and being overweight/obesity is not generalizable and needs to be studied and interpreted by taking the local contexts into consideration. Current evidences on this topic are mostly from developing countries with very limited research on South Asian countries. Major barriers to conducting studies in this line are lack of recognition of the problem and want of countrywide data. The present study aims to address the research gap be utilizing data from BDHS 2014 survey which provides quality data on various health indicators for women and children in the country. BDHS does not include any separate section on hours of TV watching, hence number of days per week, instead of hours/minutes was used as a proxy measure of duration of TV watching.

Methods:

About the study setting

Bangladesh is the third largest country in the South Asian region and also has the third largest economy in terms of Gross Domestic Product (GDP). It is the most densely populated country in the world with a population density of 1,070 persons/km^2 (2014 estimate). The life expectancy at birth among women is 72 years versus 69 years among men. Though the economy has been experiencing unprecedented progress in last few decades, the country still performs very low in terms of Human develop Index (HDI value for 2014 is 0.570), ranking 142nd out of 188 countries (5th in South Asia). World Bank classifies Bangladesh as a lower middle-income country with a gross national income (GNI) per capita of US$1,314 in FY 2014-2015 [20].

Survey and data collection

The 2014 Bangladesh Demographic and Health Survey was the sixth survey of this kind to take place in the country. The main objectives of the survey were to provide quality data on a range of health, demographic, and socioeconomic indicators and assist in evidence-based policy making. The survey was conducted under the authority of the National Institute of Population Research

and Training (NIPORT) of the Ministry of Health and Family Welfare and was implemented by Mitra and Associates with technical assistance from ICF International of Rockville, Maryland, USA, and financial support from the U.S. Agency for International Development (USAID). Data collection lasted from June 28, 2014 to November 9 of the same year.

Bangladesh has seven administrative regions which are divided into sixty-four districts. Sample population covered the residents in noninstitutional dwellings in both urban and rural areas from all sixty-four districts. The primary sampling units (PSU) for the survey were enumeration areas (EAs) used in the Population and Housing Census in the country in 2011 that was provided by the Bangladesh Bureau of Statistics (BBS). Each EA is a collection of an average of about 120 households. At first, 600 EAs were selected for the survey with 207 EAs in urban areas and 393 in rural areas. In the second stage, on average 30 households were selected from each EA, which summed to about 18,000 households. The 2014 BDHS used three types of questionnaires: Household, Woman's Questionnaire, and Community Questionnaire. The main purpose of the Household Questionnaire was to identify women eligible for the individual interview. A total of 18,245 ever-married women ageing between 15 to 49 years were identified in these households from which 17,863 were finally interviewed, producing a response rate of 98 percent. Data for the present study was extracted from the Woman's Questionnaire which included themes such as basic sociodemographic, anthropometric, reproductive, fertility, immunization, and HIV knowledge [4,21]. More details of the survey is available in the final report published by the National Institute of Population Research and Training (NIPORT) [21].

Study variables

The outcome variables for this study were overweight and obesity measured by mass index (BMI), which was defined as weight in kg over height in m^2. BDHS carries out anthropometrics measurements such as height and weight for ever-married women ageing 15-49 years as an indicator of women's nutritional status. As per WHO recommendations, women were categorized as neither overweight nor obese when BMI was <25 kg/m^2, overweight if BMI was 25 kg/m^2 to 29.9 kg/m^2 and obese if BMI was >30 kg/m^2. Exclusion criteria were being currently pregnant and for whom information on height and/or weight was not available.

The explanatory variable of main interest was 'frequency of TV watching'. As the exact durations (hours or minutes/day) were not available, the frequencies per week were used as a proxy measure which included: 1) Not watching TV at all, 2) watching less than once a week, and 3) watching at least once a week.

Based on insights from literature review, the following covariates were deemed relevant to the topic and for inclusion in the study - Age: 15-24/25-34/>35 years; Division: Barisal/Chittagong/Dhaka/Khulna/Rajshahi/Rangpur/Sylhet; Educational attainment*: Nil/ Primary/ Secondary/ Higher; Husbands Educational attainment: Nil/ Primary/ Secondary/ Higher; Currently employed: Yes/No; Wealth index**: Poorest/ Poorer/ Middle/ Richer/ Richest; Parity: 1/2/3/3+.

*Educational attainment was categorized as per the highest level/class attended, regardless of the completion status of that level/class. Nil refers to no experience of formal education, primary as completing grade 5, and secondary as completing grade 10, higher as those who had pre-university/university level education.

** DHS surveys provide information on wealth status instead of any direct information on income. Household Wealth Index is a used as a proxy measure for household living status which takes into consideration household possessions e.g. TV, Radio, bicycle, and housing quality e.g. type of floor, wall, and roof. Calculation of the wealth index consists of assigning a factor score for a set of possessions which is generated through principal component analysis (PCA). The scores are then summed and standardized for each household which places them in a continuous scale based on relative wealth scores. Finally, the scores are categorized into quintiles where each households fall into a category, with the lowest scores representing the poorest and highest representing the richest households [17].

Data analysis

Data were analysed using STATA® version 12 and SPSS® version 20. Datasets were checked for missing values and outliers. Weighted baseline sociodemographic information were presented by descriptive statistics. x^2-tests were performed to examine the group differences (between overweight and obesity) for all the explanatory variables. The variables that showed significance at p<=0.25 were selected for final regression analysis. All variables were checked for multicollinearity and no significant multicollinearity was observed between any variables. The association between BMI and frequency of TV watching was measured by means of multinomial logistic regression. Results of the regression analysis were presented as crude and adjusted odds Ratios with corresponding 95% confidence intervals. All tests were two-tailed and was considered significant at the level of 5%.

Ethics statement

All participants gave informed consent prior to taking part in the voluntary interview. The survey was approved by the ICF International Institutional Review Board (IRB) who is responsible for reviewing the procedures and questionnaires for standard DHS surveys.

Results:

Basic characteristics of the sample population are presented in table 1. Table shows that majority of the women were of rural origin with highest participation from Dhaka division (17.4%) and lowest from Sylhet (11.3%). More than a quarter of the women were in the 15-24 years age group and more than one-third aged above 34 years, and about two-third (65.3%) were of rural origin. The rate of having no formal education was higher among women compared to their husbands (75.7% Vs 71.3%). Majority of the women (37%) and their husbands (29.4%) had secondary school level qualification. However, the rate of completion of higher education were lower among women (9.4%) compared to their husbands (14.9%). Less than one-third of the women reported having an employment at the time of interview, and rate of unemployment were slightly higher among urban women compared to rural women (68.8% Vs 66.8%). Regarding household wealth status, majority of the women belonged to the wealthiest group (21.7%). However, the rate of being in the wealthiest group was noticeably higher among urban women compared to their rural counterparts (44.4% Vs 9.6%). More than one-fifth of the women were primiparous and little less than one-third of the women had experienced more than three childbirths. About two-fifth of the women reported not watching TV at all (39.4%) and more than half reported watching at least once a week. Rate of watching TV at least once a week was almost twice as high among urban women compared to rural women (75.1% Vs 39.6%). Prevalence of overweight and obesity in the sample population were respective 4.5% and 20%. Urban women had a higher prevalence of both overweight (27.7 Vs 15.9%) and obesity (8.1 Vs 2.6%) compared to rural women.

Table 1: Baseline characteristics of the study population, BDHS 2014.

Variables	Frequency (%)
Age	
15-24	4433 (26.7)
25-34	5969 (35.9)
35/35+	6222 (37.4)
Division	
Barisal	1982 (11.9)
Chittagong	2639 (15.9)

Dhaka	2893 (17.4)
Khulna	2460 (14.8)
Rajshahi	2380 (14.3)
Rangpur	2389 (14.4)
Sylhet	1881 (11.3)
Residency	
Urban	5764 (34.7)
Rural	10860 (65.3)
Educational attainment	
Nil	4039 (24.3)
Primary	4875 (29.3)
Secondary	6153 (37.0)
Higher	1557 (9.4)
Husbands Educational attainment	
Nil	4764 (28.7)
Primary	4503 (27.1)
Secondary	4884 (29.4)
Higher	2473 (14.9)
Currently employment	
No	11221 (67.5)
Yes	5403 (32.5)
Wealth index	
Poorest	2999 (18.0)
Poorer	3102 (18.7)
Middle	3382 (20.3)
Richer	3534 (21.3)
Richest	3607 (21.7)
Parity	
1	3625 (21.8)
2	4495 (27.0)
3	3238 (19.5)
3+	5266 (31.7)
Frequency of watching TV	
Not at all	6544 (39.4)
Less than once a week	1453 (8.7)
At least once a week	8627 (51.9)
BMI	

BMI≥30	748 (4.2)
25 ≥BMI < 30	3325 (20.0)
BMI<25	12551 (75.8)

Cross-tabulation

Table 2 shows the results of chi-square tests of association among the three groups according to their BMI status in relation to the explanatory variables. Result shows that the prevalence of both overweight and obesity increased with higher age and was most common in Dhaka division. Women who had secondary level education, currently unemployed, belonging to the wealthier households, and had two children were more likely to be overweight and obese. Participants who reported watching TV at least once a week were also more likely to be overweight and obese compared to those who did not watch at all and watched less than once a week.

Table 2: Prevalence of overweight and obesity in the sample population across the explanatory variables, BDHS 2014.

Variables	BMI status (%)			Chi-square	p-value
	BMI≥30	25 ≥BMI < 30	BMI<25		
Age				428.111	**<0.0001**
15-24	10.6	15.5	30.6		
25-34	37.2	41.2	34.4		
35/35+	52.3	43.3	35.0		
Division				176.299	**<0.0001**
Barisal	8.7	10.5	12.5		
Chittagong	18.7	18.2	15.1		
Dhaka	20.1	19.8	16.6		
Khulna	18.4	17.4	13.9		
Rajshahi	15.5	14.7	14.2		
Rangpur	10.2	11.3	15.4		
Sylhet	8.4	8.0	12.4		
Residency					
Urban	62.3	48.1	29.5	664,562	**<0.0001**

Rural	37.7	51.9	70.5		
Educational attainment				434.825	**0.001**
Nil	14.2	17.1	26.8		
Primary	23.9	25.4	30.7		
Secondary	44.9	42.2	35.2		
Higher	17.0	15.2	7.4		
Husbands Educational attainment				758.122	**<0.0001**
Nil	14.8	18.6	32.1		
Primary	20.1	22.7	28.7		
Secondary	34.8	33.8	27.9		
Higher	30.3	24.8	11.3		
Currently employment				53.861	**<0.0001**
No	77.8	69.9	66.2		
Yes	22.2	30.1	33.8		
Wealth index				36.790	**0.013**
Poorest	3.3	7.5	21.7		
Poorer	4.8	11.1	21.5		
Middle	12.0	17.4	21.6		
Richer	23.7	24.7	20.2		
Richest	56.1	39.2	15.0		
Parity				154.802	**0.004**
1	18.7	19.3	22.7		
2	31.8	33.1	25.1		
3	25.1	20.9	18.8		
3+	24.3	26.7	33.4		
Frequency of watching TV				18.898	**0.001**
Not at all	14.2	23.9	45.0		
Less than once a week	5.6	7.6	9.2		
At least once a week	80.2	68.5	45.8		

Association between frequency of TV watching and BMI status among the sample population were analysed by means of multivariable logistic regression with normal weight considering as the reference group. The crude and adjusted odds of being overweight and obese were shown in table 3 and table 4 respectively. Compared with women who did not watch TV at all, those who

watched at least once a week were 84% [AOR=1.840; 95%CI=1.215-2.788] and 58% [AOR=1.578; 95%CI=1.189-2.094] as likely to be overweight in urban and rural areas respectively. Urban women who watched TV less than once and at least once per week, were 2 [AOR=2.075; 95%CI=1.341-3.211)] and 4.7 [AOR=4.705; 95%CI=3.184-6.954] times as likely to be obese compared to those who did not watch TV at all. The corresponding figures for rural women were respectively 2.64 [AOR=2.643; 95%CI=1.639-4.264] and 3.6 [AOR=3.611; 95%CI=2.761-4.722] times.

In the adjusted model, however, no statistically significant association was found between TV viewing and being overweight. Urban women who watched TV at least once a week were 67% as likely to be obese [AOR=1.665; 95%=1.079-2.568] compared to those who did not watch at all. In the rural areas, women who watched TV less than once and at least once per week, had respectively 63% (AOR= 1.625; 95%CI=1.179-2.241) and 68% (AOR= 1.683; 95%CI=1.029-2.751) higher odds of being obese compared to those who did not watch TV at all.

Table 3: Association (crude) between frequency of watching TV and overweight and obesity among Bangladeshi women. BDHS 2014.

Variable	Overweight (COR)		Obesity (COR)	
Frequency of watching TV	**Urban**	**Rural**	**Urban**	**Rural**
Not at all	1	1	1	1
Less than once a week	1.412 (0.887-2.248)	1.542 (0.933-2.549)	2.075 (1.341-3.211)	2.643 (1.639-4.264)
At least once a week	1.840 (1.215-2.788)	1.578 (1.189-2.094)	4.705 (3.184-6.954)	3.611 (2.761-4.722)

N.B. COR= Crude Odds ratio.

Table 4: **Association (Adjusted) between frequency of watching TV and overweight and obesity among Bangladeshi women. BDHS 2014.**

Variable	Overweight (AOR)		Obesity (AOR)	
Frequency of watching TV	**Urban**	**Rural**	**Urban**	**Rural**
Not at all	1	1	1	1
Less than once a week	1.173 (0.728-1.891)	1.258 (0.899-1.761)	1.210 (0.763-1.919)	1.625 (1.179-2.241)
At least once a week	1.261 (0.801-1.985)	1.352 (0.810-2.257)	1.665 (1.079-2.568)	1.683 (1.029-2.751)

N.B. AOR= Adjusted Odds ratio. Adjusted for Age, Division, Educational attainment, Husbands Educational attainment, employment status, Wealth index, and Parity.

Model goodness-of-fit: Several goodness-of-fit statistics are used to check for internal validity of regression models. However, for this study McFadden R^2 value was used as it is one of the most commonly reported one. The McFadden R^2 was 0.197 in the adjusted model, and indicated a satisfactory model fitness.

Discussion

Main findings

Based on a nationally representative cross-sectional data, this study attempted to show the current prevalence of overweight and obesity among non-pregnant adult women in Bangladesh, and the association between frequency of TV viewing and being overweight and obese. Our findings indicate a net increase in the prevalence of overweight and obesity among women ageing between 15 and 49 years. In 2004 BDHS, which was the first to include anthropometric measurements for adult women, the prevalence of women with BMI≥25.0 was 8.9% (7.5% overweight and 1.4% obese), which increased to 16.4% (13.5% overweight and 2.9 % obese) in 2011 and 24% in 2014 (19.4% overweight and 4.4% obese). As seen in the previous surveys, urban women had notably higher prevalence of both overweight (27.7% Vs 15.9%) and obese (8.1% Vs 2.6%) compared to their rural counterparts.

As expected, the frequency of TV watching was also higher among women in urban areas than in rural areas. This is understandable as urban residents enjoy a higher coverage of electric grids and access to more diverse TV channels. Another possible reason can be the higher rate of employment among rural women which may allow them less time for recreation. TV watching was significantly associated with obesity among rural women. Women who reported watching TV less than once a week had higher odds of being obese compared to those did not watch TV at all. Those who watched at least once a week had the highest likelihood of being overweight and obese. Regardless of the frequency of watching TV, urban women had higher odds of being obese than their rural counterparts. This might be due to the type of work they are engaged with and the types of food consumed. Types of employment is rural areas are supposed to be more labor consuming and involve greater movement due to less developed transportation and technological infrastructure. Moreover, dietary environment in rural areas are also supposed to be less obesogenic than in urban areas due to lesser concentration of fast-food, restaurant and supermarket chains.

Comparison with previous studies

Prevalence of overweight and obesity is rising in not only in Bangladesh, but also in other South Asian countries with varying trend across age, sex and region. In India, the percentage of overweight and obese women ageing 15 to 49 years rose from 11% in National Family Health Survey (NFHS)-2 to 15% in NFHS-3; with highest rates in Punjab (29.9%) followed by Kerala (28.1%) and Delhi (26.4%) [22]. According to World Health Organisation (WHO) estimates, the percentage of overweight and obesity among Pakistani women was respectively 25.5% and 3.6% with higher prevalence of overweight and obesity among women than among men [23]. For Nepal, the increase in combined prevalence of overweight and obesity was about six times (1.6% in 1996 Vs 10.1% in 2006) between 1996 and 2006 [24].

Evidence regarding the association between TV viewing and overweight and obesity in South Asia is scarce, however studies from other countries shows that TV viewing is strongly associated with overweight and obesity among preschool children, adolescent and adults of both sexes [25-29] which is consistent with our findings on adult women in Bangladesh. Similar findings were observed in USA [25] japan [28] and Australia [29]. Among Iranian adolescents, TV Viewing was associated with increasing rates of overweight and obesity independent of PA and consumption of obesogenic foods [27]. One review study proposed that TV viewing may act through mechanisms other than reducing the expenditure of energy and increasing the consumption of obesogenic

foods [30] as the amount of obesogenic foods consumption is not always related to the length of time the adolescents spent on watching TV [31].

Research implications and general discussion

Recent research evidence suggests a rapid rise in the burden of overweight/obesity and associated NCDs which a growing concern for the underdeveloped healthcare system in Bangladesh. As the country is progressing in terms of socioeconomic development and improving living standards, more and more people are adopting modern technological conveniences and embracing widely spread western lifestyle. Rate of literacy is still low and the general population is largely unaware of the consequences of unhealthy behaviour and lifestyle related risk factors of overweight/obesity and NCDs. Given the rising prevalence of overweight and obesity in the country, it is becoming an urgent imperative for the health policy makers to develop socio-culturally appropriate guidelines and creating the opportunities for averting the onset of overweight/obesity among children and intervention among the already overweight/obese population. This is certainly a challenging task, and effective implementation of which is reliant on evidences from large scale population based studies. Though the present study is very limited in its scope, it sets out the avenue for more in-depth studies to probe into the underlying determinants of inadequate PA and TV watching and the mechanisms through which they are contributing to the increasing prevalence of overweight/obesity among adult women and in the population in general.

Strengths and limitations

This study has several important strengths and limitations to mention. To our knowledge, this is the first nationally representative study to investigate the frequency of TV viewing in relation to overweight/obesity among Bangladeshi women, so the findings are generalizable for adult women ageing below 50 years in Bangladesh. The findings are expected to serve useful tools for developing proper intervention methods. However, as the survey collected data on outcome and explanatory variables at the same point of time, no causal inferences can be made. Secondly, TV viewing *frequency per week* was used instead of precise *duration per day* which could have produced more precise picture of the association provided data were available on exact number of hours of TV watching. More importantly, women reported the frequency themselves which may be subject to reporting bias and recall error. Future surveys are recommended to focus on the

impact of total number of hours instead of days and also include dietary and associated behaviours to TV watching.

Abbreviations: BDHS: Bangladesh Demographic and Health Survey; DALYs: Disability-adjusted life-years; GDP: Gross domestic product; NCDs: Non-communicable chronic diseases; WHO: World health organisation.

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Competing interests: None declared.

Funding: None

Data sharing statement: Dataset used for this study was obtained from DHS website. DHS holds the sole authority to distribute the data through the public domain which is available at: http://dhsprogram.com/data/available-datasets.cfm

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STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Page 2 line 7-10.
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Page 2 line 11-18.
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Page 3-4.
Objectives	3	State specific objectives, including any prespecified hypotheses	Page 4 line 6-14
Methods			
Study design	4	Present key elements of study design early in the paper	Page 4 line 18- page 5 line 19
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Page 4 line 18-25
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	Page 3 line 13-15.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Page 5 line 21 to page 6 line 19.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Page 4 line 27- page 5 line 3.
Bias	9	Describe any efforts to address potential sources of bias	Page 5 line 17-19.
Study size	10	Explain how the study size was arrived at	Page 5 line 17-19.
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Page 5 line 21-27/
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	page 6 line 43-58
		(*b*) Describe any methods used to examine subgroups and interactions	Page 6 line 25-26
		(*c*) Explain how missing data were addressed	NA
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	Page 6 line 22
		(*e*) Describe any sensitivity analyses	Page 6 line 28
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Page 7 line 5-7
		(b) Give reasons for non-participation at each stage	NA

		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Page 7 line 7-20
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	page 7 line 20-23
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Page 9 line 1- page 10 line 12.
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	page 12 line 6-9
Discussion			
Key results	18	Summarise key results with reference to study objectives	Page 12 line 13 to page 13 line 13.
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	page 14 line 19-29
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Page 13 line 15-23.
Generalisability	21	Discuss the generalisability (external validity) of the study results	Page 14 line 21-22.
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Page 15 line 6

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.