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Optimal body mass index cutoff point for cardiovascular disease and high blood pressure

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Abstract
Increase in body mass index value is a serious health problem across the world. Humans with high body mass index value have the higher probability of getting the cardiovascular disease and high blood pressure. The proposed work is concerned in predicting the probability of CVD and high blood pressure in India. The disease has been predicted with body mass index value; from the health reports of India, the pervasiveness of CVD and HBP is identified. The demographic health survey 2016 of India is used in this work. Bayesian model is used to find the pervasiveness of CVD and HBP based on the gender and the place of living. Out of 432 articles studied, 34 articles suggested the pervasiveness of CVD and HBP. Pervasiveness of CVD increased (95% of interval) rapidly between 1992 and 2016 from 3.0% (0.3–5.7) to 16.4% (9.4–16.2) for men, and from 5.2% (2.3–8.6) to 15.4% (3.3–18.6) for women. Pervasiveness of high blood pressure increased rapidly between 1992 and 2016 from 11.0% (8.6–17.4) to 21.4% (19.4–23.6) for men and from 14.0% (4.3–16.7) to 20.4% (5.6–25.6) for women. The pervasiveness of CVD in 2030 is predicted as 24.6% (13.6–37.8), and pervasiveness of high blood pressure is predicted to be 21.7% (19.6–27.8). The annual average of pervasiveness of CVD is high for women in village areas, and pervasiveness of high blood pressure is found high for men in city regions. The cutoff point for pervasiveness of CVD for overall population is 23.02 kg/m^2.

Keywords Cardiovascular disease · High blood pressure · Body mass index · Cut-point · Prediction · Receiver operating characteristic curve · Pervasiveness

1 Introduction

The pervasiveness of cardiovascular disease and high blood pressure has been increasing rapidly in India, whereas the cardiovascular disease and high blood pressure are serious health concerns [1–3]. The cardiovascular disease is identified as a serious health issue, and it may damage the heart and can cause death [4]. In developing nations, around one-third of the people have high blood pressure and one in five has cardiovascular disease [5]. Obesity is considered as one of the modifiable diseases that causes cardiovascular disease, and the government is predicting the obese people through body mass index. The cardiovascular disease and blood pressure are considered as non-communicable diseases [6–9]. In case of non-communicable disease, the prediction of cardiovascular disease and blood pressure is done through the body mass index value; this could help the government and health organizations to take necessary actions [10]. The pervasiveness of cardiovascular disease and high blood pressure seems increasing rapidly in India. In a recent study, it has been said that the incidence of cardiovascular disease is 9.0% and high blood pressure is 26.7% in adults [11, 12]. The connection between the CVD and BMI is not clear [13, 14] because of the population-based data. Several studies have undergone to know the relationship between BMI (underweight, normal weight, and overweight) [15] and the risk of cardiovascular disease or high blood pressure [16]; from all these works, it's unclear whether CVD or HBP increases based on the BMI categories [17]. Befitting optimal cut-point for the body mass index is very useful in predicting the risk groups that causes the cardiovascular and blood pressure diseases

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[18, 19]. The current method for predicting the disease is based on the international cut-point value considering Asian and European population, and it may fail in case of African population because their fat percentage is more compared to the Asian and European [20, 21]. So country-specific cutoff point has to be obtained to predict the heart disease before it occurs. The country's wealth or economic statuses also induce in high BMI percentage, and very few works say about this issue. Finally, the pervasiveness of cardiovascular disease and high blood pressure in various studies is reported in India [22–25]. The proposed method finds the relationship between BMI and CVD or HBP and also finds a befitting cutoff point to predict the disease.

2 Related works

The present works are based on the body mass index value, which is calculated as weight divided by height meter square [26]. The height and weight of children and adults are influenced by many factors such as diet, disease, and infections. The BMI is a way of indicating the health by calculating the height and weight [27]. The risk of cardiovascular disease and high blood pressure is underrated, and with the help of promotion it can be changed [28]. Since the fat percentage differs from one nation to another, it's necessary for studying pervasiveness of disease in each country separately (Holland et al. 2011 [29]). From the study, it's found that Philippines people have higher risk of high blood pressure when compared to the others [30].

In another study of 98,943 patients, the risk of cardiovascular disease and high blood pressure is high in American women when compared to Asian men (Zhao et al. 2015 [31, 32]). The increased risk of cardiovascular disease and blood pressure in American women is because of overweight and obesity (Holland et al. 2015 [33]). The threshold value of determining the body mass index value of Americans has not been established (Ancheta et al. 2014). The current value of determining the overweight category is 26.7% and obesity category is 34.7% (Cornnor et al. 2006 [34]). The Asians have the high metabolic syndrome, and their threshold rate is lower in determining the CVD and blood pressure [35] (Table 1).

Lower body mass index is suggested for American women because of the increased metabolic rates in women (Banda et al. 2015 [36]). Among all other countries, the Filipinos have separate living styles, culture, and generic patterns [37]. The body mass index is the important term in determining the obesity and overweight categories [38]. The waist circumference and waist-to -height ratio give more accurate results in predicting the disease when compared to body mass index value [39]. According to the International Heart Disease Foundation, the threshold value for women is 31.5%. However, the lower threshold value has to be applied for Filipino women when compared to the other nations [40].

The medicinal work has been performed in order to find the relationship between the body mass index value and obesity, cardiovascular disease, cholesterol, stroke, heart attack, and ischemic heart disease [41]. The current method for predicting disease is based on the international cut-point value considering Asian and European populations, and it may fail in case of African population because their fat percentage is more compared to the Asian and European [42, 43]. So country-specific cutoff point has to be obtained to predict the heart disease before it occurs [44, 45]. The country's wealth or economic statuses also induce in high BMI percentage, and very few works say about this issue. Finally, the pervasiveness of cardiovascular disease and high blood pressure in various studies is reported in India [45–47]. The proposed method finds the relationship between BMI and CVD or HBP and also finds a befitting cutoff point to predict the disease (Tables 2 and 3).

The disease caused by high BMI value is seen in 32% of adults. The body mass index is also calculated based on age, gender, place of living, marital status, education, and income rate. The cardiovascular disease is higher in case of rural women of about 34%, and in case of high blood pressure based on the body mass index values they categorize weight into underweight, normal, overweight, and obesity.

The mean body mass index value for male is 23.4% and for women is 26.5%. High body mass index value is found in age-group of ≥ 30. The countries with no medical data are avoided from finding the body mass index values. The prevalence of disease can be predicted by calculating the mean body mass index value of male and female.

3 Methods

3.1 Data sources

Data were searched using two methods. First, PubMed was searched from its inception to August 2016, using keywords such as cardiovascular disease, blood pressure, fasting blood glucose, and India. Search was done based on proof related to the disease, which helped to find the prevalence of disease based on the place of living and status. Secondly, the search was done using Demographic Health Survey of India (DHSI), which it uses three-cluster sampling method to get the data from 8934 members of over 30 years. The overall rate of response is 90.25%; for additional information, refer to the DHL website [21].

Table 1 Mean body mass index value based on age-groups

Country (reference)	Sex	Mean BMI (kg/m^2) Age-group (years)						
		5–14	15–29	30–44	45–55	60–69	70–79	≥ 80
Cameroona (Rotimi et al. 1995)	Male	–	23.7	24.4	24.0	–	–	–
	Female	–	24.6	24.8	25.0	–	–	–
Gambia (Van der Sande et al. 1997)	Male	–	19.6	20.5	20.9	21.0	20.0	–
	Female	–	21.0	21.9	21.8	21.3	20.9	–
Ghana (DHS data provided by Macro International 1998)	Male	–	–	–	–	–	–	–
	Female	–	21.8	22.4	21.4	–	–	–
Mali (Re-analyzed by Ferro-Luzzi, personal communication)	Male	14.8	18.9	20.5	20.8	20.3	19.6	20.2
	Female	14.9	19.9	21.1	20.6	20	19.5	20.8
Nigeria (Okesina et al. 1999)	Male	–	19.8	20.9	21.5	–	–	–
	Female	–	21.0	21.8	20.3	–	–	–
Senegal (Re-analyzed by Ferro-Luzzi, personal communication)	Male	14.2	18.2	19.9	21.0	20.7	19.8	19.2
	Female	14.3	19.6	21.4	22.1	22.2	21.3	20.7
Seychelles (Bovet et al. 1991)	Male	–	22.9	23.5	23.1	23.2	–	–
	Female	–	23.2	25.7	27.2	27.5	–	–

Table 2 Mean BMI on age

References	Gender	Mean BMI (kg/m^2) Age-group (years)						
		5–14	15–29	30–44	45–59	60–69	70–79	≥ 80
National Institute of Health (2003)[a]	Male	19.1	23.7	25.6	26.8	26.6	26.3	–
	Female	20.2	23.2	24.1	26.3	26.7	26.4	–
Seidall et al. (2002)[b]	Male	–	22.2	23.5	23.5	–	–	–
	Female	–	22.4	24.3	25.4	–	–	–
Schoerider et al. (2004)[a]	Male	18.5	24.2	26.6	27.8	27.5	26.8	25.1
	Female	18.6	24.0	26.4	28.0	27.6	27.0	25.0

[a] Childhood data

[b] Adult data

Table 3 Mean BMI on age

References	Gender	Mean BMI (kg/m^2) Age-group (years)						
		5–14	15–29	30–44	45–59	60–69	70–79	≥ 80
Flegal and Troiano (2004)[b]	Male	14.6	–	–	–	–	–	–
	Female	14.9	24.4	25.8	26.8	–	–	–
International Development Sponsored Series (2005)	Male	15.2	–	–	–	–	–	–
	Female	15.3	24.4	25.8	26.5	–	–	–

[b] Adult data

3.2 Recognition of CVD and HBP

High blood pressure values are classified into systolic and diastolic blood pressure based on the glucose level: ≥ 140 mg and ≥ 90 mg, respectively. A body mass index mean value ≥ 30% predicts the incidence of cardiovascular disease.

3.3 Discombobulate variables

With respect to age and gender, some additional characteristics are collected. The first characteristic is qualification like no education, primary education, and secondary education. The second characteristic is place of living (city, village). The third characteristic is marital status (unmarried, newly married). The fourth one is economic or income status (poorest, poor, middle class, and rich). Finally, location-based characteristic is also collected (northeast, central, west, and southeast).

4 Results

4.1 Prediction of CVD and HBP

From the various studies, the record of 435 works has been collected, by leaving the title and related works done. In total, 53 records have been taken, out of which 12 have been left out because of the information stated in appendix. Based on 43 articles, it shows the prevalence of CVD and HBP. On which, 38 articles predict the cardiovascular disease and high blood pressure in the humans.

Figure 1 represents the prevalence of cardiovascular disease and blood pressure from 1992 to 2016, which shows that there is an increasing trend. The prevalence of CVD increases to 7% in women and 6% in case of men. Likewise, the high blood pressure increases to 2% in women and 7% in men. The increase in the prevalence of cardiovascular disease and blood pressure in men is higher in 2011 and 2015. While considering the place of living, the prevalence of the disease is higher in city people compared to the people living in villages. In women, the prevalence of disease is predicted to increase to 15.7% (0.8–18.9) in 2021 compared to 3.0% (0.3–5.7) in 1992. In men, it increases from 5.2% (3.3–7.2) to 18.7% (0.2–21.4). By the year 2030, the prevalence of cardiovascular disease is predicted to be 22.23% in women and 34.6% in men with 24.45% overall. For the high blood pressure, the prevalence is predicted to reach 32% in women and 36.7% in men with 34.5% overall.

The predicted prevalence varies based on the place of living, i.e., the prevalence of high blood pressure increases rapidly in city areas.

The CVD is found high in women in rural areas, and in 2010 it increased more than men.

4.2 Cardiovascular disease and high blood pressure by BMI levels

Survey data based on the BMI values are represented in Table 4. People with high BMI are said to have systolic, diastolic blood pressure, and fasting blood glucose. The

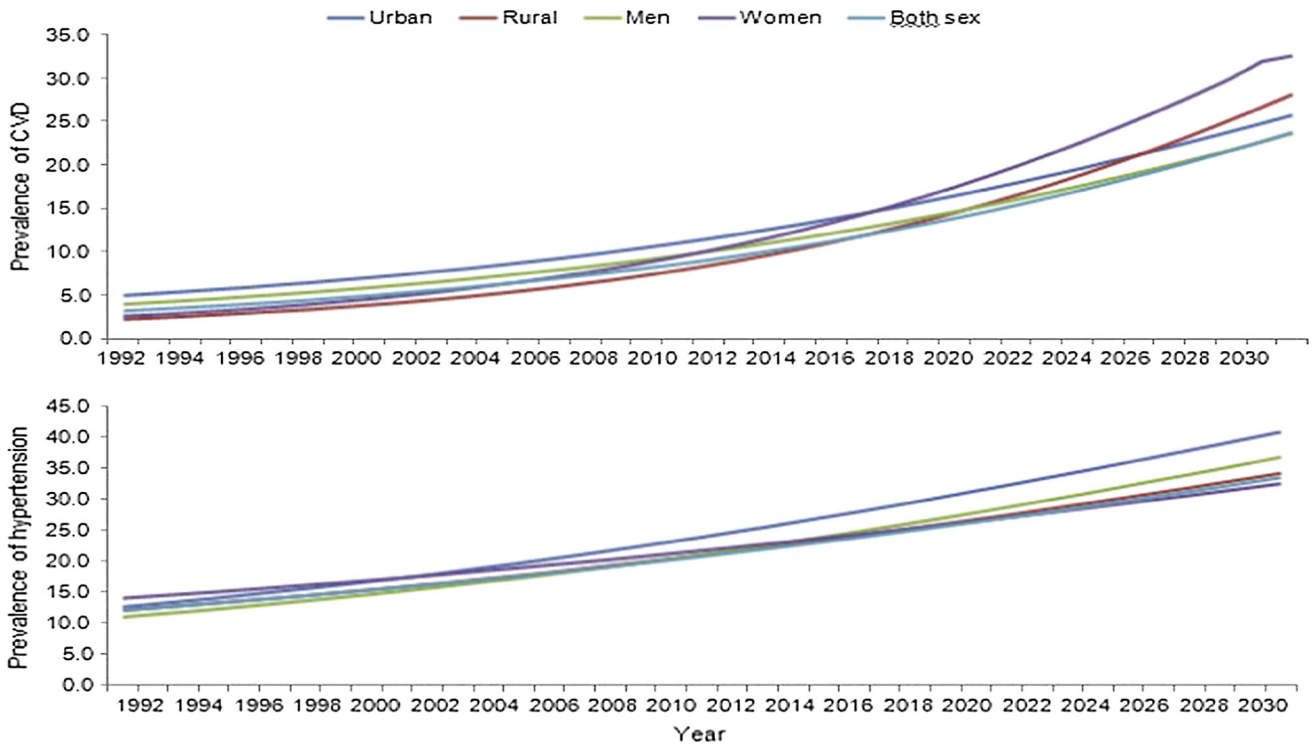

Fig. 1 Prevalence of CVD and HBP during 1992–2030

Table 4 Change of BMI values from the year 1992 to 2030

Year	Rate of change (95% CrI)				
	Place of living		Gender		
	City	Village	Men	Women	Both gender
CVD					
1992–1994	3.0 (0.3–5.7)	5.0 (3.0–7.1)	3.5 (2.0–5.2)	5.2 (3.3–7.2)	3.9 (2.1–5.6)
1995–1999	4.4 (0.5–8.5)	7.5 (4.4–10.8)	5.3 (3.0–7.8)	7.9 (4.9–10.9)	5.8 (3.2–8.5)
2000–2004	4.4 (0.5–8.2)	7.4 (4.4–10.6)	5.2 (3.0–7.6)	7.8 (4.9–10.7)	5.8 (3.2–8.4)
2005–2009	4.3 (0.5–7.9)	7.3 (4.3–10.3)	5.1 (2.9–7.4)	7.6 (4.8–10.3)	5.7 (3.1–8.1)
2010–2014	4.1 (0.5–7.5)	7.1 (4.3–9.8)	5.0 (2.9–7.1)	7.3 (4.7–9.7)	5.5 (3.1–7.8)
2015–2030	3.7 (0.5–6.0)	6.3 (4.1–7.9)	4.5 (2.8–6.1)	6.3 (4.4–7.5)	5.0 (3.0–6.7)
1992–2030	3.9 (0.4–7.0)	6.7 (4.1–9.1)	4.8 (2.8–6.7)	6.9 (4.5–8.9)	5.3 (3.0–7.4)
Probability of increase, 2015–2030	98.6%	100%	100%	100%	100%
High blood pressure					
1992–1994	2.4 (1.3–3.6)	2.1 (0.9–3.3)	2.5 (1.4–3.6)	1.7 (0.3–3.2)	2.0 (1.2–3.0)
1995–1999	3.6 (1.9–5.3)	3.1 (1.4–4.9)	3.7 (2.1–5.4)	2.5 (0.4–4.8)	3.0 (1.7–4.3)
2000–2004	3.4 (1.8–5.1)	3.0 (1.4–4.7)	3.6 (2.1–5.2)	2.4 (0.4–4.6)	2.9 (1.7–4.3)
2005–2009	3.3 (1.8–4.8)	2.9 (1.4–4.5)	3.4 (2.0–4.9)	2.3 (0.4–4.4)	2.8 (1.7–4.1)
2010–2014	3.1 (1.7–4.5)	2.8 (1.3–4.2)	3.3 (2.0–4.6)	2.3 (0.4–4.1)	2.7 (1.7–3.9)
2015–2030	2.7 (1.6–3.7)	2.5 (1.3–3.5)	2.9 (1.9–3.8)	2.1 (0.4–3.5)	2.5 (1.6–3.4)
1992–2030	3.0 (1.7–4.3)	2.7 (1.3–4.1)	3.2 (1.9–4.4)	2.2 (0.4–4.0)	2.7 (1.6–3.8)
Probability of increase, 2015–2030	100%	99.9%	100%	99.5%	100%

95% CrI = 95% credible interval

people with high BMI are said to live in city areas; they are educated and they are all high in economic status. The adults in city areas are said to have the incidence of 12% of cardiovascular disease and 25% of high blood pressure. Figure 2 shows modified age and gender BMI values based on 8 categories such as place of living, marital status, educational qualification, and economic status. The mean of high blood pressure is modified for less than $\geq$ 20 kg/m^2, and this value goes high when the value of BMI also increases. The prevalence of cardiovascular disease and high blood pressure seems to increase after $>$ 20 mg/m^2.

4.3 Association of BMI with CVD and HBP

The prevalence of CVD and HBP is represented in Table 5. For the cardiovascular disease, the BMI levels are 23.4–25.6 at the lower case. The CVD is found in people with BMI values ranging 14.7–16.6, 16.7–19.2, and 19.3–21.3. The OR values are 0.34 (0.23–0.41), 0.47 (0.35–0.51), and 0.61 (0.54–0.73). In case of higher odds the values are 23.4–24.7 and 24.8–29.6, and the OR values are 1.01 (0.7–1.6) and 3.4 (2.8–4.2). For high blood pressure, the prevalence lies between the body mass index and high blood pressure. In case of high blood pressure, BMI values are adjusted according to the values, whose category lies in the range 23.4–26.7. The lower case of values is found between (0.13 and 0.23) $>$ 15 mg and higher values are found in (1.78–7.36) $>$ 30 mg (Table 6).

4.4 Optimal cut-point for CVD and HBP

The optimal cut-point values for cardiovascular disease and high blood pressure are represented in Table 7. The results show that the age- and gender-adjusted optimal cut-point for cardiovascular disease and high blood pressure in Indians is modified to 20 mg and it gets maximum value and distance. The optimal body mass index cut-point for cardiovascular disease is 20.02 kg/m^2 for men with specificity of 57.4% and sensitivity of 57.3% in men and 23.03 kg/m^2 for women with specificity of 66.5% and sensitivity of 57.5%. The body mass index varies in place of living, educational status, and marital status, for example, 21.6% for age 35–39 years and 23.4% for age above 50 years. The area under the ROC curve is 0.64 for women and 0.65 for men. By which BMI is used to find the prevalence of cardiovascular disease and high blood pressure. Due to the small change in optimal points, the cut-point is 22.0 kg/m^2 for men and 23.0% kg/m^2 for women.

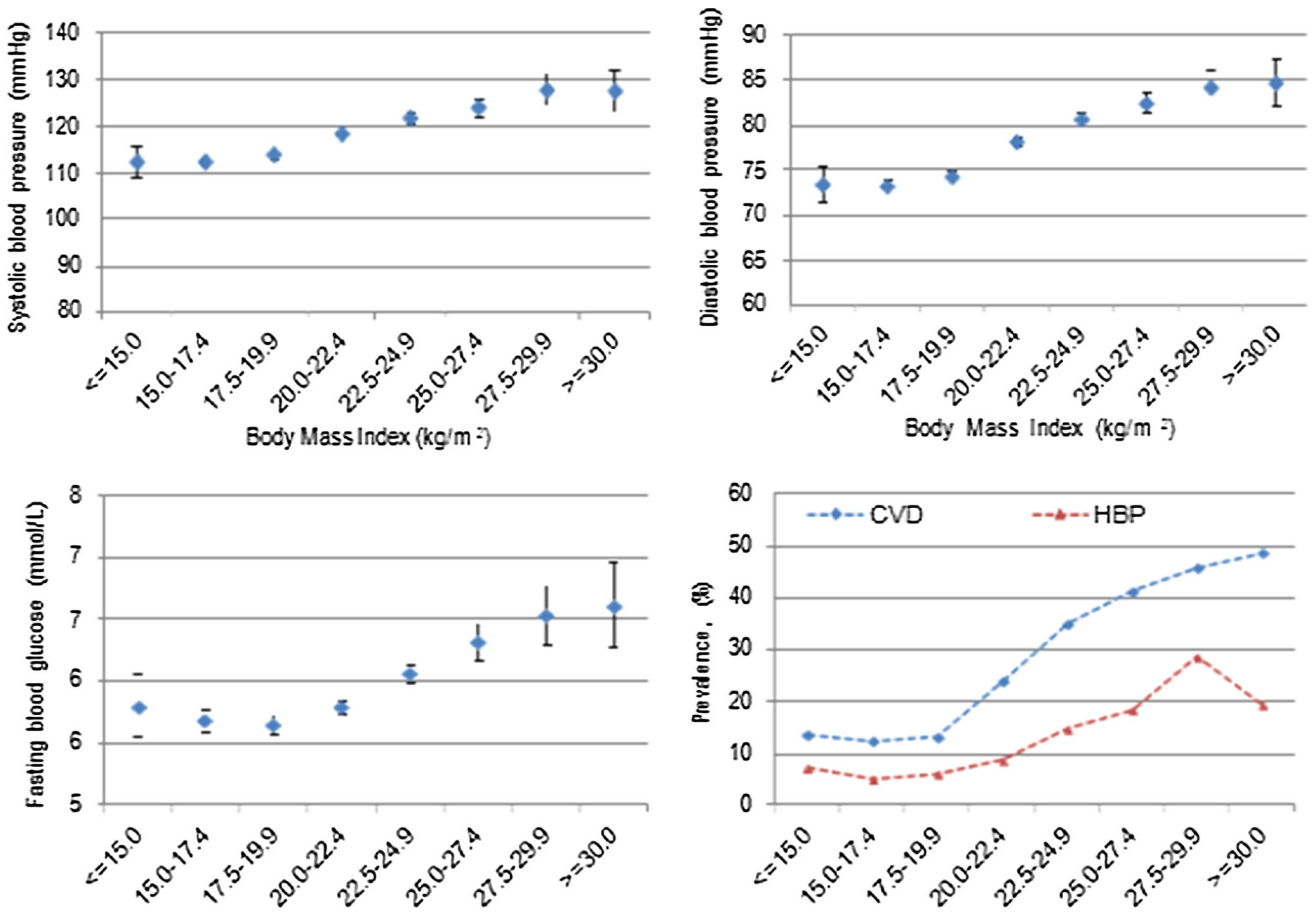

Fig. 2 Age- and gender-modified mean and the prevalence of characteristics of body mass index

5 Discussion

The current study involves 65 published articles from 32 studies from the year 1992, and population survey was conducted in 2011 from the continuous studies. The prevalence of cardiovascular disease and high blood pressure is predicted to be 25 and 34%. The rate of BMI is larger for women in village areas, and for men it's large in city areas. The rate of cardiovascular increases as the body mass index increases. In case of type 2 cardiovascular diseases, the optimal cut-point for men is 23.0 and 24.0 kg/m^2 in female. The first step to find the prevalence of cardiovascular disease and high blood pressure is done manually. On population-based data, the prevalence of cardiovascular disease and high blood pressure is found to be 11 and 26%.

The prevalence of cardiovascular disease and high blood pressure was found in Bangladesh (11%), China (10%), and Korea (8%) [32–37]; the prevalence of high blood pressure was found in India (25%), China (24%), and Korea (26%). The cardiovascular disease and high blood pressure vary on different parameters such as place of living, educational status, economic status, and marital status. The prevalence of cardiovascular disease increased to 13% in women and 12% in men in the year 2015 and predicted to be 24% in women and 34% in men by the year 2030.

From the previous reports, it's predicted that body mass value greater than 22.5% kg/m^2 is considered as dangerous for cardiovascular disease and high blood pressure. The optimal cutoff point for cardiovascular disease is 22.0% kg/m^2 for men and 23.0% kg/m^2 for women. The previous study stated that the optimal cut-point for cardiovascular disease for women is 21% and for men it is 22%. The difference in value of our proposed model data and previous reports is because of their place of living and their sample size. Our data are similar to the data of other countries like China with overall prevalence of 24%, Indonesia with 22%, and Vietnam with 21% [35]. The present model has many advantages since it has considered the place of living, marital status, educational qualification and the economic status of the participants and it also has large data size.

Table 5 Study of population based on BMI

Characteristics	Body mass index (kg/m^2)				
	Underweight (BMI < 17.5 kg/m^2) (n = 1623)	Normal (BMI 17.5 to < 25 kg/m^2) (n = 5580)	Overweight (BMI 25.0 to < 30 kg/m^2) (n = 584)	Obese (BMI P30 kg/m^2) (n = 88)	Total numbers (n = 7875)
Mean (SE)					
Age (years)	58.5 (0.4)	49.2 (0.2)	52.3 (0.3)	56.2 (1.3)	51.4 (0.2)
Body mass index (kg/m^2)	16.9 (0.0)	21.2 (0.0)	26.8 (0.1)	32.9 (0.4)	20.8 (0.0)
Systolic blood pressure (mmHg)	115.7 (0.7)	117.7 (0.4)	125.3 (0.9)	133.5 (2.6)	117.9 (0.3)
Diastolic blood pressure (mmHg)	73.8 (0.4)	78.8 (0.2)	82.6 (0.6)	86.9 (1.4)	77.5 (0.2)
Fasting blood glucose (mmol L^{-1})	5.8 (0.0)	5.8 (0.0)	6.2 (0.1)	6.5 (0.2)	5.8 (0.0)
Frequency (%)					
Gender					
Male	1036 (64.4)	2444 (43.9)	384 (64.3)	37 (36.7)	3901 (49.5)
Female	587 (35.6)	3136 (56.2)	200 (35.7)	51 (63.4)	3974 (50.5)
Educational status					
No education	975 (62.4)	2457 (46.7)	127 (23.5)	24 (29.2)	3583 (48.3)
Primary education	400 (23.1)	1599 (27.8)	151 (27.3)	17 (19.8)	2167 (26.7)
Secondary education	218 (12.9)	1054 (17.8)	160 (26.7)	24 (21.3)	1456 (17.3)
Higher education	30 (1.6)	470 (7.7)	146 (22.5)	23 (29.7)	669 (7.6)
Socioeconomic status					
Poorest	440 (29.3)	993 (18.8)	20 (3.7)	3 (3.1)	1401 (19.4)
Poorer	393 (25.0)	938 (18.2)	37 (7.6)	3 (4.5)	1426 (19.3)
Richer	274 (15.9)	1209 (21.5)	134 (25.6)	21 (26.5)	1638 (20.6)
Richest	157 (8.2)	1344 (21.5)	324 (49.5)	58 (61.8)	1883 (20.9)
Place of living					
City	389 (14.8)	1943 (25.3)	343 (44.5)	56 (52.6)	2659 (24.5)
Village	1354 (87.6)	3867 (76.8)	263 (57.7)	36 (46.5)	5389 (77.9)
Prevalence					
CVD	124 (6.3)	542 (10.5)	145 (25.4)	23 (25.9)	799 (10.6)
High blood pressure	312 (19.7)	1543 (26.6)	265 (45.9)	56 (75.4)	2145 (26.6)

Value in parentheses represents percentages. Data are presented as mean (SE) otherwise specified

The optimal cutoff point analysis suggests that anything beyond 22.5 kg/m^2 is risky, and body mass index value increases when the risk increases. These reports do not have attributes like smoking habits, drinking, physical activities, and waist circumference, so the model can't be used for regression model in predicting the risk between body mass index and cardiovascular disease.

6 Conclusion

The findings of the present study show that the prevalence of cardiovascular disease and high blood pressure increases rapidly in women present in village areas and in case of men it increases in city areas. The BMI more than 22.5% kg/m^2 can lead to the cardiovascular disease and high blood pressure. The optimal cutoff point for men is 22.0% kg/m^2 and for women is 23% kg/m^2. From the reports, if

Table 6 Association between BMI and prevalence of CVD and HBP

Population	Body mass index categories							
	≤ 15	15.0–17.4	17.5–19.9	20.0–22.4	22.5–24.9	25.0–27.4	27.5–29.9	≥ 30.0
No. of volunteers	132	896	1725	2902	1604	421	172	91
CVD								
CVD	11	55	121	243	234	86	55	22
Age–gender adopted, OR (95% CI)	0.34 (0.12–0.77	0.24 (0.15–0.37)	0.29 (0.21–0.41)	0.47 (0.36–0.61)	1.00	1.20 (0.78–1.84)	3.50 (1.9–6.44)	1.32 (0.59–2.95
Multivariable adopted, OR (95% CI)[b]	0.48 (0.18–1.19	0.37 (0.23–0.59)	0 45 (0.31–0.64)	0.61 (0.46–0.82)	1.00	1.13 (0.74–1.73)	3.07 (1.63–5.76)	1.05 (0.46–2.36
Hypertension								
Hypertensive subjects	28	185	316	703	56	186	78	58
Age–gender adopted, OR (95% CI)	0.29 (0.11–0.44	0.23 (0.17–0.3)	0.25 (0.19–0.32)	0.50 (0.41–0.62)	1.00	1.38 (1.00–1.91)	1.75 (1.07–2.87)	4.17 (2.05–8.48
Multiple variable adopted, OR (95% CI)[c]	0.35 (0.13–0.57	0.28 (0.21–0.38)	0.30 (0.23–0.4)	0.58 (0.46–0.72)	1.00	1.29 (0.94–1.79)	1.67 (1.03–2.71)	3.62 (1.78–7.36)

OR = odds ratios, 95% CI = 95% confidence interval

[a]Reference group

[b]Adopted for age, sex, educational status, working status, marital status, prevalence of high blood pressure, household socioeconomic status, city or village residence, location of living

[c]Adopted for age, sex, educational status, working status, marital status, prevalence of diabetes, household socioeconomic status, city or village residence, location of living

Table 7 Optimal cut-point for CVD and HBP

Age-group	Body mass index cut-points	Sensitivity (%)	Specificity (%)	Distance	Area under curve[a]
35–39	22.9	44.5	69.9	63.1	0.59
40–49	21.8	51.6	65.6	59.3	0.59
>50	21.4	59.5	70.32	50.2	0.67
Gender					
Men	21.73	66.9	57.3	54.0	0.65
Women	23.02	56.7	66.5	54.8	0.65
Overall	23.02	61.9	60.0	55.2	0.64

[a] Area under curve for the ROC curve of sensitivity versus 1-specificity of Body Mass Index to detect a positive state of diabetes

the body mass index increases, then there is an increase in rate of cardiovascular disease and high blood pressure in India that can be prevented.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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