



Article

Determinants of cardiovascular disease and sequential decision-making for treatment among women: A Heckman's approach

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1. Introduction

Cardiovascular diseases (CVDs) also called Heart diseases are a group of disorders of the heart and blood vessels. The numerous problem causing most of the CVD is atherosclerosis, a process mainly governed by lifestyle factors (American Heart Association, 2018; Vilahur, Badimon, Bugiardini & Badimon, 2014; World Health Organization (2017)). It is estimated that 17.7 million people died from CVDs in 2015, representing 31% of all deaths taking place worldwide; more people die every year from CVDs than from any other cause (World Health Organization (2017)). Cardiovascular diseases are showing an increase among the Indian population; the younger age groups of the population are at greater threat of developing the disease. It is now known to have a major share in the burden of diseases (Chauhan & Aeri, 2015). The country-wise statistics of the WHO on non-communicable diseases estimates that NCDs account for 53% of all deaths in India, out of which CVDs have a major share of 24% (World Health Organization Global Status Report on Non-Communicable Diseases (2010)). The Global Burden of Disease study estimates the age-standardized CVD mortality rate of 272 per 100,000 population in India which is higher than the global average of 235 per 100,000 population. Despite widespread heterogeneity in the prevalence of cardiovascular risk factors across different regions throughout the country, cardiovascular disease has appeared as the primary cause of death in all parts of India, including poorer states and rural areas (Prabhakaran, Jeemon & Roy, 2016).

1.1. Women and Cardiovascular disease

Currently, NCDs, such as cardiovascular disease, stroke, kidney disease, respiratory diseases, and trauma are the leading causes of death among women worldwide especially in high as well as low-income countries (World Health Organization (2010)). Cardiovascular disease remains the number-one threat to women's health; there is a pronounced gender difference in cardiovascular mortality, more women than men die each year (Coulter, 2011). In 2011, the age-standardized

death rate attributed to CVD was approximately 363 to 443 in men and 181 to 281 in women per 100,000 respectively (World Health Organization Global Atlas on Cardiovascular Disease Prevention and Control (2011)). In South-Asia there is a high prevalence of coronary heart disease among women, and there is an increase in incidence in both urban as well as rural areas (Gooneratne, 2013). The total years of life lost due to the disease among the males and females aged 35 to 64 years in India has been estimated to be higher than the countries such as Brazil and China (Leeder et al., 2004). Generally, in a country like India, women's health receives attention only during pregnancy and the immediate post-partum period (The George Institute for Global Health India, 2016). The recent decline in maternal mortality ratio from 167 in 2011-13 to 130 in 2014-16 is paradigmatic of the women's improving health status (SRS, 2016). On comparing the percentage prevalence of CVD among males and females across different age groups from 2000 to 2015, it was reckoned that some females would suffer from CVD at a later age as compared to men in India (Indrayan, 2005; Chauhan & Aeri, 2015). Studies examining the health-related quality of life in patients with cardiovascular disease suggest that women are more substantially affected by cardiac disease compared with men both physically and psychosocially (Brezinka & Kittel, 1996).

1.2. Risk factors

The most significant behavioral risk factors for cardiovascular disease and stroke are age, sex, unhealthy diet, sedentary lifestyle, tobacco consumption and harmful use of alcohol. The effect of behavioral risk factors may show up in individuals as raised blood pressure, elevated blood glucose, increased blood lipids, overweight, and obesity. (World Health Organization (2017); Coulter, 2011). CVD is now prevalent in almost all sections of the society from younger to older and from lower socio-economic background to upper class. There is an up-side-down growing trend in the socioeconomic gradient for cardiovascular disease, with the least affluent and deprived having equal and sometimes higher the burden of the disease, and associated risk factors (Ghaffar, Reddy & Singhi, 2004). Thus, the progression of the epidemic is characterized by

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the shift of socioeconomic gradients. It may be accounted to increase in the prevalence of tobacco consumption and insufficient uptake of fruits and vegetables among those belonging to lower strata. The National Family Health Survey-4 (NFHS-4), provides self-reported data on intake of fruit and vegetables; Fifty-four % of females do not consume fruits even once a week, and only half (47%) of women consume dark green, leafy vegetables daily (IIPS & ICF, 2017). India has gone through dramatic lifestyle changes, moving from agrarian diets and active lifestyles to fast foods and sedentary lifestyles in a much shorter span of time than other nations (Chauhan & Aeri, 2015). Although CVD risk factors are widely prevalent in India, there are significant variations between and within different regions. Diabetes mellitus and obesity appear to be more prevalent in the southern states of India, whereas hypertension is found to be higher in the north-eastern states (Anjana et al., 2011; Siddiqui, Kandala & Stranges, 2015). Cardiovascular disease is twice as common among females with diabetes in comparison to those females who don't have diabetes. Diabetic women are four times more likely to be hospitalized and have a higher risk for most clinical events than males (Majumder, Haque & Dastidar, 2011) Diabetic women need a thorough investigation to optimize management of cardiovascular risk factors (Recarti et al., 2015). Furthermore, women of a lower socioeconomic status and education level and those with little access to medical care have been shown to have an increased risk for CVD (Coulter, 2011).

1.3. Treatment seeking

The eighth target in the Global NCD action plan states that at least 50% of entitled people should receive drug therapy and counseling (including glycaemic control) to prevent heart attacks and strokes (World Health Organization (2017)). Research in this domain manifests that women with cardiovascular disease (CVD) are screened and treated less than males and are less likely to undergo cardiac procedures (Chou et al., (2007)). The concept of denial is usually used to explain the delay; women rate their cardiac disease as less severe and delay seeking care for cardiac-related symptoms compared with men (Theisen et al., 1995; Kudenchuk et al., 1996). The Health Belief Model postulates that patients undertake an action to avoid or relieve an illness when they perceive that they are susceptible to it and that there will be negative repercussions from failing to take action (i.e., the consequences may be severe) (Becker & Maiman, 1975). Both the health belief model and the self-regulation model suggest that patients' perceptions of the severity of their disease play a crucial role in determining the patients' engagement in behaviors related to the disease (Nau et al., 2005). Old age, female sex, low education level, low socioeconomic status, and race/ethnicity are associated with increased delays in seeking treatment (Lefler & Bondy, 2004). Patients are more inclined to seek treatment if they continued to suffer from the symptoms associated with their condition (i.e., shortness of breath, tiredness, chest pains, etc.) and had support from family and colleagues (Petricca et al., 2009). Gender disparities exist in symptom patterns; females exhibit less typical symptom patterns than men as well as their access to healthcare delivery and treatment. (Ravi & Bergkvist, 2014).

2. Need for the study

It is heartening that women have a low prevalence of heart disease than males. Possibly this is the main reason why the study of heart disease in women is relatively a recent one. The fact that women perceive their severity of the disease to be no riskier than men do, even when the clinical evidence advocates that they have the more severe disease, may help explain some of the variation in care seeking behavior and treatment decisions between men and women. There is also a limited conversation on the interrelation between socioeconomic status and gender-specific differences in heart disease. It appears that most of the evidence of an interrelation between sex and socio-demographic

status for both cardiovascular disease and its factors affecting it adversely comes from studies involving males. Cardiovascular disease (CVD) is the primary reason for a large proportion of all deaths and disability worldwide, and it poses a great challenge to the health system. CVDs is the leading cause of death in women all over the world, and in India too. At this rate, with the highest percentage of the population in the working age group in the world, India is set to lose its productive population to cardiovascular morbidity and mortality projecting a setback to the economy in an otherwise beneficial phase of demographic transition. Unfortunately, the diagnosis of heart disease is often missed out in women of a lower socioeconomic status and education level and those with little access to medical care, which is why they get less care than men. The reason behind delaying or denial of treatment among women is not adequately known in India. There are very few studies which try to explain the gap between available knowledge about the progression of risk factors affecting CVD and simultaneously taking decision for treatment-seeking. There is an urgent need to examine the determinants of heart disease and sequentially its treatment-seeking behavior among women in India.

3. Objectives

The study aims to acquire knowledge about the determinants of cardiovascular disease and treatment seeking behaviour among women.

4. Hypothesis

H₀: There is no relationship between having Cardiovascular disease and decision making for seeking treatment among women.

5. Data source

This study employs data from the National Family Health Survey, the fourth in the NFHS series which was conducted in 2015–2016 (NFHS-4). The survey covers a nationally representative sample of about 6,99,686 women in the age group 15–49 years. Data is collected in two phases from 29 states and seven union territories of India. A nationally representative household-based sample is created through a two-stage stratified cluster sampling technique. For the first time, NFHS-4 collected information on women suffering from cardiovascular disease and subsequently their treatment-seeking behavior. This evidence is reflective of the shift towards the burden of NCDs and necessitates the urgency to study this domain in detail.

6. Description of variables

6.1. Dependent variables

The present study uses two dependent variables, a self-reported Cardiovascular disease for the outcome equation and treatment seeking behaviour for the selection equation among women in India.

6.2. Independent variables

The socio-demographic variables considered for the outcome equation are age, place of residence, marital status, wealth quintile and level of education. The risk factors contributing to cardiovascular disease are hypertension, body mass index, self-reported diabetes and dietary pattern among females. NFHS-4 collects three readings within an interval of five minutes of systolic and diastolic blood pressure from each respondent. The last two readings were used to compute the hypertension variable. Females fall in the hypertensive category if the average of systolic blood pressure is above 140 mm of Hg and of diastolic blood pressure is above 90 mm of Hg. Similarly, the body mass index for females was created using the formula $weight\ in\ kg/Height\ in\ metre\ square$ further it was categorized from, thin,

normal weight to overweight and obese. The diet index was created from a set of questions on food intake, composed of healthy and unhealthy food items consumed daily, weekly, occasionally and never.

The selection equation has treatment-seeking behaviour as the response variable, and the explanatory variables which affect the treatment behaviour are age, place of residence, marital status, wealth quintile and level of education. Decision making for self-treatment, i.e. factors preventing females from receiving medical advice or treatment is used as a proxy variable for understanding treatment behaviour of women. Respondents were asked about the different type of problems they go through while seeking treatment; an index was created for decision making.

7. Methodology

The principal component analysis was used to create an index for decision making for treatment seeking variable. The factors affecting the decision making include taking permission from husband, distance from the health center, visiting alone to the health center, transportation availability, no female provider at the health center, no provider at the health center and unavailability of drugs at the health center. The variables were in binomial form, i.e. no problem in decision making and problem in decision making. The first component of the principal component analysis explains 47% of the variable, and this component was used to create the index. Further, the index was divided into two categories, no problem and problem and the treatment decision making variable was used to understand the treatment behaviour among females.

Diet index was created using the multiple correspondence analysis, which is constructed using nine types of food items, for example, milk or curd, chicken, eggs, pulses, oily food, etc. and how often are they being consumed, i.e., daily, weekly, occasionally and never. Multiple correspondence analysis was used in place of principal component analysis because the food items consumption has four categories. The first dimension of the multiple correspondence analysis explains the 39.64% of the diet variable. This dimension was used to construct the diet index. Further, it was categorized as unhealthy and healthy and used as life-style risk factors for cardiovascular disease.

The available models such as two-stage regression, Tobit model, etc. are acknowledged as restrictive because they are unable to provide a holistic picture that demonstrates an individual's underlying sequential decision-making process: whether or not having the disease (i.e., participation decision) leading on to whether to seek treatment or not (i.e., the treatment decision). This present study employed the Heckman sample selection model (Heckman, 1979) to rectify this critical drawback of other models. It is possible to estimate a sample selection model when both dependent variables (cardiovascular disease and treatment-seeking) are dichotomous. Thus we employed a probit model in the selection equation and a probit model in the outcome equation.

This study employed a Heckman probit selection model. The analysis was conducted under the assumption that reporting for the disease and going for the treatment is a sequential decision-making process. Heckman selection model handles not only the discrete/continuous modeling issue but also addresses unobserved heterogeneity and selectivity bias/endogeneity problems simultaneously; which helps to compare the suitability of models. The model provides a two-step analysis and deals with the zero-sample issue, based on which it can accommodate the heterogeneity (i.e., shared unobserved factors) between women and then address the endogeneity (between cardiovascular disease and treatment seeking) for a female. The Heckman model is identified when the same independent variables in the selection equation appear in the outcome equation. However, this does not provide precise estimates in the outcome equation because of high multicollinearity; it is suggested to have at least one independent variable that appears in the selection equation and not in the outcome equation (Sartori, 2003). The present study uses decision-making

variable for the selection equation but not for the outcome equation.

The Heckman selection model is a two-equation model. First, there is the regression model

$$y_i = X_i \beta + \mu_1$$

Second, there is the selection model

$$Z_i \gamma + \mu_2 > 0$$

With the following holds:

$$\mu_1 \sim N(0, \sigma)$$

$$\mu_2 \sim N(0, 1)$$

$$\text{Corr}(\mu_1, \mu_2) = \rho$$

where y_i denotes the self-reported the cardiovascular disease variables, X_i denotes the observable features of the independent variables, β denote parameters to be estimated, and μ_1 is a normally distributed error term with a mean of 0 and a standard deviation σ to be estimated. Z_i denotes observable features including the variables which are overlapping with X_i , and γ denotes the vectors of parameters to be estimated. μ_2 is the distributed error term with a mean of 0 and a standard deviation equal to 1. ρ represents the correlation between the error terms to be estimated. Using these two equations, samples larger than zero can be selected and estimated based on various modeling methods. The Heckman selection model provides consistent, asymptotically efficient estimates for all of the parameters.

In the main equation of this study, it is assumed that a regression model can be used to explain the determinants of CVDs:

$$Y_i = X_{i1}\beta_1 + C_i\beta_2 + \mu_i + X_{i1}\beta + \mu_i$$

where y_i denotes the prevalence of cardiovascular disease; X_i is a vector of observable features related to determinants of the disease, in which X_{i1} represents the endogenous variables; C_i stands for the exogenous variables; β_1 , β_2 and β are vectors of parameters to be estimated; and μ_i is a normally distributed error term $N(0, \sigma)$ to be estimated. Therefore, in the selection model, the dependent variable is observed if

$$Z_{i1}\gamma_1 + C_i\gamma_2 + v_i + Z_i\gamma + v_i > 0$$

where Z_i is a vector of observable features related to the decision-making of treatment seeking, which includes the overlapping variables with X_i ; Z_{i1} represents the endogenous variables that may or may not be the same as X_{i1} ; γ_1 , γ_2 , and γ are vectors of the parameters to be estimated. And v_i is a distributed error term $N(0, 1)$. This equation describes the probability that the decision for treatment seeking is greater than zero.

8. Results

8.1. Proportion distribution of characteristics of females suffering from cardiovascular disease and seeking treatment

Tables 1a and 1b show the proportion distribution of females suffering from cardiovascular disease and seeking treatment by their socio-demographic characteristics and risk factors. The prevalence of cardiovascular disease increases significantly with increasing age; it is 0.32 in 30–39 years age group and 0.42 in 40–49 years age group among females. The proportion of disease among poor is 0.40 and 0.38 among rich it is found to be lowest among middle-class females 0.22. Cardiovascular disease is highly prevailing in a rural area with a proportion of 0.68. Similarly, females with no education have a high proportion of 0.37, of the disease, and lowest among females with a higher level of education at 0.07. The proportion of disease is 0.83 among married females. The prevalence of risk factors such as hypertension is 0.18 among females suffering from cardiovascular disease. The proportion of overweight and obese females having the disease are 0.21 and 0.11

Table 1
Proportion distribution of characteristics of females suffering from cardiovascular disease.

Characteristics	Proportion	N = 10,452 95% Confidence interval
Age category		
15–29	0.25	0.24–0.27
30–39	0.32	0.31–0.34
40–49	0.42	0.41–0.44
Wealth quintile		
Poor	0.40	0.38–0.41
Middle	0.22	0.21–0.23
Rich	0.38	0.37–0.40
Place of residence		
Urban	0.32	0.30–0.33
Rural	0.68	0.67–0.70
Education level		
Illiterate	0.37	0.36–0.39
Primary	0.17	0.16–0.18
Secondary	0.39	0.37–0.40
Higher	0.07	0.06–0.08
Marital status		
Never Married	0.09	0.08–0.10
Married	0.83	0.82–0.84
Widowed/Divorced/Separated	0.07	0.06–0.08
Hypertension		
No	0.82	0.81–0.83
Yes	0.18	0.17–0.19
Body mass index		
Below Normal	0.14	0.13–0.15
Normal Weight	0.54	0.53–0.55
Overweight	0.21	0.20–0.23
Obese	0.11	0.10–0.12
Diabetes		
No	0.88	0.87–0.89
Yes	0.12	0.11–0.13
Diet		
Unhealthy	0.54	0.53–0.56
Healthy	0.46	0.44–0.47

respectively. Among the females suffering from the disease, the proportion of having diabetes is 0.12, and the proportion of females having unhealthy food is 0.46. Table 1b shows the proportion of females having the disease and seeking treatment, in the age group 30–39 and 40–49 the proportion of females seeking treatment is 0.32 and 0.45 respectively. The proportion of females suffering from cardiovascular disease and going for treatment in lower wealth quintile is 0.37 and in upper quintile is 0.41. In a rural area, the proportion of females seeking treatment is 0.67. The proportion of females seeking treatment with no education is 0.37, and it's highest among females with secondary education 0.39. Married females seek treatment more (0.85), in comparison to never married (0.08) and widowed/ divorced or separated (0.07). The proportion of females facing problem in seeking treatment for cardiovascular disease is 0.51.(Table 2).

8.2. Heckprobit model for cardiovascular disease and treatment seeking

The analyses followed the phenomenological method as described; reporting of cardiovascular disease and sequentially decision making to seek treatment. Considering the disease as the dependent variable, the result shows that with increasing age females are highly susceptible to develop heart disease. In the age group 30–39 years the chances of having the disease is 0.27, and in the 40–49 years age group, it is 0.40 times more likely. A similar pattern was found for the treatment behaviour of females suffering from the disease, females in the age group 30–39 years are 0.06 times and in the age group, 40–49 years are 0.14 times highly likely to go for treatment. It is evident from the analysis

Table 2
Proportion distribution of characteristics of females seeking treatment for cardiovascular disease.

Characteristics	Proportion	N = 7391 95% Confidence interval
Age category		
15–29	0.23	0.22–0.25
30–39	0.32	0.30–0.33
40–49	0.45	0.43–0.47
Wealth quintile		
Poor	0.37	0.36–0.39
Middle	0.21	0.20–0.23
Rich	0.41	0.40–0.43
Place of residence		
Urban	0.33	0.31–0.34
Rural	0.67	0.66–0.69
Education		
Illiterate	0.37	0.35–0.38
Primary	0.17	0.15–0.18
Secondary	0.39	0.37–0.40
Higher	0.08	0.07–0.09
Marital status		
Never Married	0.08	0.07–0.09
Married	0.85	0.83–0.86
Widowed/Divorced/Separated	0.07	0.06–0.08
Decision making		
No Problem	0.49	0.47–0.50
Problem	0.51	0.50–0.53

that females from higher wealth quintile are 0.02 times less likely to develop the disease, in contrary females from the upper class are more inclined in seeking treatment. Females belonging to rural areas are more prone, 0.04 times likely to develop the disease, Simultaneously, 0.04 times more likely to go for treatment. Females educated up to a higher level are 0.12 times less likely to report cardiovascular disease whereas they are 0.08 times more likely to seek treatment. It is of importance to notice that widowed/ separated/divorced females are 0.09 times more likely to develop the disease but are 0.03 times less likely to go for treatment. Females facing problems in seeking medical advice or treatment are 0.06 times less likely to go for treatment. Risk factors contributing to developing cardiovascular disease were analyzed in the outcome equation, and it was found that females suffering from hypertension are 0.07 times more likely to develop the disease. Similarly, overweight and obese females are 0.10 and 0.17 times more prone to develop the disease. Females suffering from diabetes are at elevated risk of developing cardiovascular disease, i.e. 0.77 times more likely. The results show that females consuming healthy food items frequently are 0.05 times less likely to suffer from cardiovascular disease.

9. Discussions

This study strongly resonates with the fact that, females are at elevated risk of developing the Cardiovascular disease (World Health Organization (2017); Chauhan & Aeri, 2015) and are sequentially seeking treatment as they grow older (Reddy et al., 2007). Older females are of concern, but preventive interventions need to be targeted at younger females as much as possible because most of the exposure start earlier in life, often during adolescence, (World Health Organization (2009)). Early detection and treatment with the use of both conventional and innovative techniques can help curb the disease burden (Prabhakaran et al., 2016). There is an increasing trend for reversal in the socioeconomic gradient for cardiovascular disease, with the poor and less educated having equal and sometimes higher, the burden of CVD, and its risk factors (Chauhan & Aeri, 2015; Yeates et al., 2015; Prabhakaran et al., 2016). Females from lower socio-economic backgrounds are at higher risk of developing the disease but are less

Table 3
 Heckprobit model for cardiovascular disease and treatment seeking.

Cardiovascular disease (No) *	Outcome equation
Age category (15–29) *	
30–39	0.27 (0.24, 0.29) ***
40–49	0.40 (0.37, 0.42) ***
Wealth quintile (Poor) *	
Medium	0.03 (0.01, 0.05) ***
Rich	-0.02 (-0.05, 0.00) **
Place of residence (Urban) *	
Rural	0.04 (0.02, 0.06) ***
Education level (Illiterate) *	
Primary	0.04 (0.02, 0.07) ***
Secondary	-0.01 (-0.03, 0.01)
Higher	-0.12 (-0.15, -0.08) ***
Marital status (Never married) *	
Married	0.02 (-0.01, 0.05)
Widowed/Divorced/Separated	0.09 (0.04, 0.13) ***
Hypertension (No) *	
Yes	0.07 (0.05, 0.10) ***
Body mass index (Below normal) *	
Normal Weight	0.03 (0.01, 0.06) ***
Overweight	0.10 (0.07, 0.13) ***
Obese	0.17 (0.13, 0.21) ***
Diabetes (No) *	
Yes	0.77 (0.73, 0.81) ***
Diet (Unhealthy) *	
Healthy	-0.05 (-0.06, -0.03) ***
Treatment seeking (No) *	Selection Equation
Age category (15–29) *	
30–39	0.06 (-0.03, 0.14)
40–49	0.14 (0.04, 0.23) ***
Wealth quintile (Poor) *	
Medium	0.15 (0.08, 0.22) ***
Rich	0.28 (0.21, 0.36) ***
Place of residence (Urban) *	
Rural	0.04 (-0.03, 0.11)
Education level (Illiterate) *	
Primary	-0.06 (-0.14, 0.02)
Secondary	-0.03 (-0.10, 0.04)
Higher	0.08 (-0.05, 0.21)
Marital status (Never married) *	
Married	0.07 (-0.03, 0.16)
Widowed/Divorced/Separated	-0.03 (-0.17, 0.11)
Decision making (No problem) *	
Problem	-0.06 (-0.11, 0.00) ***

Note: * = Reference Category, *** = $p < 0.01$ ** = $p < 0.05$ * = $p < 0.1$, rho (ρ) = -0.08, Wald $\chi^2 = 117.40$ ***

concerned about its treatment whereas females from the upper socio-economic background are more concerned about preventive measures of cardiovascular disease (Coulter, 2011; Lefler & Bondy, 2004). These findings corroborate that formal education levels did not influence females to make a decision to seek treatment. Females from a rural part of the country are more prone to develop the disease and simultaneously seek treatment (Chauhan & Aeri, 2015). Marital status plays a crucial role in one's life, married females are less prone to disease and seek treatment but in contrary widowed/divorced/separated females are at elevated risk of disease and are less inclined to seek treatment (Schultz et al., 2017). The treatment behaviour of females are influenced by many factors like autonomy, accessibility, availability, and affordability; study shows that females lacking above-mentioned domains face problem in seeking treatment. The Government of India included Coronary Stents in the National List of Essential Medicines, 2015 (NLEM, 2015) with a focus to decrease the stent cost for the universal coverage of patients seeking treatment for the cardiovascular disease

(The Hindu, 2017). It is evident from the available literature that prevalence of cardiovascular disease is rising in urban as well as rural areas, findings suggest that females in rural areas are seeking treatment more than the urban areas (Ravi & Bergkvist, 2014; Gooneratne, 2013).

Increasing blood pressure is a major risk factor in developing cardiovascular disease among females (Gupta, 2004). The India Hypertension Management Initiative (IHMI) resolves to save lives initiative of vital strategies. The agenda is to reduce morbidity and mortality due to CVDs, by improving the control over high blood pressure, among adults in India. Similarly, with an increase in body mass index females are at greater risk to develop the disease (Apovian & Gokce, 2012) which is similar in findings with studies from developed and developing world. Diabetes is one of the comorbidities among females which causes cardiovascular disease most prominently; it enhances the risk of cardiovascular disease among women to a greater extent than it does among men. Congruent to this fact, our findings establish a greater positive association between diabetes and cardiovascular disease (Majumder et al., 2011). Fruits and vegetables may promote cardiovascular health through a variety of micronutrients, antioxidants, phytochemicals, flavonoids, fiber and potassium (World Health Organization (2007)), this study establishes the fact that females consuming healthy foods are at lesser risk of developing cardiovascular disease.

Women are often belittled in heart disease research. This gender-specific research on heart disease continues to show differences between men and women, yet gaps remain in how to diagnose best, treat and prevent this number one killer of women worldwide. A national level survey data on Indian women suffering from heart disease and their treatment seeking behavior would set a benchmark for assessing progress depicting the true health status of women. This study is a humble attempt to accentuate this neglected public health issue, which is in line with the current government priorities. The Union Government of India has conferred increasing attention on CVDs, with the initiation of the National Programme for the Prevention and Control of Cancer, Diabetes, CVD, and stroke. In 2004 the American Heart Association launched their "Go Red for Women" campaign to raise awareness about heart disease in women. This campaign can provide an important blueprint for India's response to the growing burden of cardiovascular disease among women. Recently Government Of India has adopted "Global Hearts," a new initiative from WHO; to scale up prevention and control of CVD. There is an urgent need to better understand the dynamics of cardiac symptoms in women, in order to facilitate diagnosis and treatment, to initiate aggressive risk factor intervention and to improve the quality of life. The psychological, social, and cultural barriers to cardiovascular health awareness in women need to be addressed before these programs can be fully and successfully implemented. The treatment behaviour can be promoted among females by increasing awareness about the severity of cardiovascular disease and by empowering them to make the decision to seek treatment for self when needed.

10. Limitations

The present study comes out with several remarkable findings; the 'web of causation' of cardiovascular disease is not only limited to elite class or among the urban areas rather it has been spanning throughout irrespective of socio-economic status and area. Some limitations may lead to future research. Smoking and drinking is a major factor for cardiovascular disease weren't found to be significant because the proportion of females consuming is found to be too low in India. More research focussing on determinants and treatment behavior of females can give a deeper insight into the dynamic characteristics of the cardiovascular disease. Since this study is solely based on self-reported cardiovascular disease so may not adequately portray the ground reality due to the presence of measurement error and recall bias. There is a scope for further research on how to reduce the risk factors specially co-

Table A1
Principal component analysis for self-medication index.

Component	Eigenvalue	Proportion	Cumulative
Comp1	3.7529	0.4691	0.4691
Comp2	1.44175	0.1802	0.6493
Comp3	0.803494	0.1004	0.7498
Comp4	0.592963	0.0741	0.8239
Comp5	0.481513	0.0602	0.8841
Comp6	0.410117	0.0513	0.9353
Comp7	0.300584	0.0376	0.9729
Comp8	0.216683	0.0271	1

Table A2
Multiple correspondence analysis for diet index.

Dimension	Principal Inertia	Percent	percent
dim 1	0.0481564	39.64	39.64
dim 2	0.0350498	28.85	68.49
dim 3	0.0061735	5.08	73.57
dim 4	0.0038366	3.16	76.73
dim 5	0.0018945	1.56	78.29
dim 6	0.0013711	1.13	79.42
dim 7	0.000285	0.23	79.65
dim 8	0.0000587	0.05	79.7
dim 9	0.0000451	0.04	79.74
dim 10	0.000015	0	79.74
Total	0.1214832	100	

morbidities to prevent the disease from occurring and affecting females at a large scale.

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Appendix

See Tables A1 and A2.

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Competing interest

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