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# An Assessment of Preventable Risk Factors for Chronic Non-Communicable Diseases in an Adult Population

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## ABSTRACT

To assess the prevalence of selected risk factors for chronic disease and the association of these risk factors with sociodemographic variables, a cross sectional study was conducted in a representative sample of adults aged 40 years or more in the district of Shimoga. A sample of 992 subjects was selected from all the blocks of the district using the World Health Organization's STEPwise approach to surveillance of chronic disease risk factors. The study participants' blood pressure was measured; their body mass index calculated and collected information on self-reported smoking status. The extent to which, being overweight, hypertension, smoking and various combinations of these risk factors were associated with the study participants' education level, occupational category and economic status was measured. Data analysis was done using SPSS version 14 and multivariate logistic regression model to note the associations between the outcome variables and select demographic variables. Mean blood pressure levels were higher among men than among women and increased progressively with age. Sixty three percent of men were current smokers and 58% were current daily smokers; less than 1% of women smoked. Mean body mass index was 19.6 among men and 19.9 among women and only 3.5% of the population was overweight. Education level was inversely associated with the prevalence of hypertension among both men and women and with the prevalence of smoking among men. Hypertension was directly associated with socioeconomic status among men but inversely associated with socioeconomic status among women. India is experiencing an increase in the prevalence of many risk factors for chronic diseases and is in urgent need of interventions to reduce the prevalence of these risk factors and to deal with the chronic diseases to which they contribute.

**Key words:** Chronic diseases, risk factors, hypertension, smoking, overweight

## INTRODUCTION

Chronic non-communicable diseases are diseases of long duration and generally slow progression. Chronic diseases, such as heart disease, stroke, cancer, chronic respiratory diseases and diabetes, are by far the leading cause of mortality, representing 60% of all deaths. The report of World Health Organization (WHO) says that they have emerged as a major health threat throughout the world but particularly in developing countries (WHO, 2000). In developed countries, the predominant health problems have been those associated with increased wealth leading to lifestyle habits that contribute to certain diseases, particularly cardiovascular disease. In contrast, diseases occurring among people in developing countries have been attributed to

poverty and relate to poor nutrition, a higher incidence of infectious diseases, poor healthcare infrastructure and limited access to care, all of which lead to reduced life spans. However, in recent years, there has been increasing economic and demographic development in developing countries resulting in a shift from diseases caused by poverty toward chronic, noncommunicable, lifestyle-related diseases. As a consequence, these developing countries are now experiencing high rates of both infectious and chronic diseases (Reid and Thrift, 2005).

The socio-economic impact of premature death due to non-communicable diseases is enormous since these deaths often affect the main income earner in the household and those who rear children. Second, the health delivery system must be reorganised in order to fight the growing burden of non-communicable diseases. Patients with non communicable diseases typically require care over a long period of time, sometimes decades and this may require technologically advanced equipment which may not be available in developing countries. It has been recommended that the management and control of non-communicable diseases requires clinical management in a primary care setting, population-based interventions on health promotion and macro-economic policy (Greenberg *et al*., 2005). Of the 58 million deaths that occurred worldwide in 2005, 35 million were attributable to chronic diseases and 80% of these 35 million deaths occurred in developing countries (Strong *et al*., 2005). The annual number of deaths from chronic diseases is projected to increase to 41 million in the next 10 years and most of these deaths will continue to occur in low-and middle-income countries (WHO, 2000; Strong *et al*., 2005). The emerging chronic disease epidemics in developing countries can be explained largely by social and economic changes that have led to increases in the prevalence of risk factors for these diseases. And increases in the prevalence of major risk factors such as high blood pressure, tobacco use, physical inactivity, obesity and alcohol consumption have been associated with a large portion of new cases of chronic diseases (Stamler *et al*., 1999). Evidence also shows that a large proportion of chronic disease cases are preventable and that the most cost-effective approach to containing emerging epidemics of chronic diseases is to reduce the prevalence of their risk factors (Leeder *et al*., 2004; Nissinen *et al*., 2004).

India is a developing country with a population of more than 1 billion, is undergoing a rapid epidemiologic transition characterized by an increase in the prevalence of chronic diseases. In India, deaths due to chronic diseases were 3.78 million in 1990 (40.4% of all deaths) and are expected to reach 7.63 million in 2020 (66.7% of all deaths) (Sahni, 2006). The health information system relies mainly on hospital-based statistics; however, these statistics describe only part of the nation's health situation and the nation's policy makers and health managers need more population-based health data in order to make informed public health decisions. So in 2009, to help provide such data, a study of risk factors for chronic non communicable diseases was conducted in Shimoga district, Karnataka by adopting a modification of the STEP wise approach of the World Health Organization (WHO) (Bonita *et al*., 2002). This study was done with an objective to ascertain the prevalence of obesity, high blood pressure and smoking, the three major preventable risk factors for chronic non communicable diseases and also to know the distribution of these risk factors by certain background characteristics in a representative sample of middle aged and elderly adult population in the entire district.

## MATERIALS AND METHODS

This cross-sectional community based study was conducted in the elderly population who are aged 40 years and above in Shimoga district, Karnataka, India, the study period being February to August 2009. Shimoga is a centrally located district in the state of Karnataka at a distance of

300 km from the capital town of Bangalore. It has a population of 1.7 million according to the census figures of 2001, agriculture being the predominant occupation among the residents. The study comprised of 992 individuals from all the seven blocks of the district and was conducted in partial accordance with STEPwise approach to surveillance of chronic disease risk factors. STEPwise approach involves three primary "steps": (1) the use of a structured questionnaire to assess study subjects' self-reported behavioural and lifestyle risk factors for chronic diseases. (2) The measurement of subjects' blood pressure and anthropometrical parameters and (3) the collection and biochemical analysis of subjects' blood samples (Bonita *et al*., 2002). Considering the limited resources and feasibility, only the first two steps were followed for the collection of data. Five villages with a population of more than five thousand were randomly selected from each of the seven blocks. Thirty people from each village aged 40 years and above were included by purposive sampling. Data was collected by making house to visits in the villages by eight health workers who were trained in all aspects of the study.

Weight and height of the subjects were measured while they were without footwear and wearing light clothes. Their weight was measured to the nearest 0.5 kg with standard digital weighing scales. The height was measured to the nearest 1 cm using standard techniques. Any participant with a Body Mass Index (BMI) of 25 or more was considered to be overweight (WHO Technical report series, 2000). Blood pressure of the subjects was measured thrice using a standard digital sphygmomanometer while they were in a sitting position after having rested for at least 5 min. The average of the lowest two readings was considered to classify the subjects for hypertension. They were considered to have hypertension if their Systolic Blood Pressure (SBP) was 140 mmHg or more and/or their Diastolic Blood Pressure (DBP) was 90 mm Hg or more or if they were on treatment with antihypertensives (Whitworth, 2003). The data on smoking habits were based on subjects' responses to questions in the tobacco use module of the STEPS questionnaire. The questions were designed to identify both current daily smokers and current nondaily smokers. Current daily smokers were defined as those who reported smoking at least one cigarette or beedi per day, and current nondaily smokers were defined as those who reported smoking less frequently. The study participants were categorised by their education, occupation and economic status on the basis of their responses. For the sake of convenience in analyses, the educational level was categorised as illiterate, primary, secondary or more, the occupational categories were unemployed, farmer or others; and the economic status categories were low, middle and high. Data analysis was done using SPSS version 14 and multivariate logistic regression model and was run on the same version to note the associations between the outcome variables (hypertension, smoking, overweight, and different combinations of these risk factors) and certain select background characteristics. 95% confidence intervals were used to determine whether associations were significant.

## RESULTS

Nine hundred and ninty two subjects (494 men and 498 women) participated in the study. Table 1 shows the background characteristics of the final study sample. Mean blood pressure levels were significantly higher among men than women. The mean SBP was 132 (95% CI, 124-138) among men compared to 126 (95%, 120-132) among women and the mean DBP was 78 (95% CI, 76-82) among men in comparison to 74 (95% CI, 72-78) among women. Table 2 and 3 show the distribution of selected major risk factors for chronic diseases for men and women respectively. The overall prevalence of hypertension was 18.8% (23.9% among men and 13.7% among women) (Table 4). Among the hypertensives, only 35.1% (37.8% of hypertensive men and 32.2% of

Table 1: Background characteristics of the study population

| Characteristic | Men (%) (n = 494) | Women (%) (n = 498) | Total (%) (n = 992) |
|---|---|---|---|
| **Age in year** | | | |
| 40-50 | 120 (24.4) | 132 (26.4) | 252 (25.4) |
| 50-60 | 130 (26.4) | 121 (24.2) | 251 (25.3) |
| 60-70 | 119 (24.1) | 127 (25.5) | 246 (24.8) |
| >70 | 125 (25.0) | 118 (24.0) | 243 (24.5) |
| **Education level** | | | |
| Illiterate | 132 (26.6) | 178 (35.9) | 310 (31.3) |
| Primary | 268 (54.3) | 241 (48.3) | 509 (51.3) |
| Secondary or more | 94 (19.0) | 79 (15.7) | 173 (17.4) |
| **Occupation** | | | |
| Farmer | 296 (59.9) | 381 (76.5) | 677 (68.2) |
| Unemployed | 15 (3.1) | 18 (3.5) | 33 (3.3) |
| Other | 183 (37.0) | 99 (20.0) | 282 (28.4) |
| **Economic status** | | | |
| Low | 56 (11.5) | 60 (11.9) | 116 (11.7) |
| Middle | 327 (66.3) | 323 (64.8) | 650 (65.5) |
| High | 111 (22.3) | 115 (23.3) | 226 (22.8) |

Table 2: Prevalence of select risk factors among men in the study population by age groups

| | Age in years% (95% CI) | | | | |
|---|---|---|---|---|---|
| Risk factor | 40-50 | 51-60 | 61-70 | >70 | All men |
| Hypertension | 10.0 (6.2-13.8) | 21.5 (16.4-26.5) | 25.6 (20.0-31.2) | 38.5 (32.4-44.6) | 23.9 (21.2-26.6) |
| Aware of having hypertension | 21.4 (10.3-32.5) | 21.3 (10.7-31.9) | 37.2 (27.3-47.2) | 29.4 (23.5-35.2) | 37.8 (23.9-61.7) |
| Receiving treatment for hypertension | 16.7 (7.8-18.5) | 7.1 (3.5-64.6) | 11.5 (4.1-85.2) | 28.4 (4.7-91.8) | 17.8 (2.5-72.7) |
| Current smoking | 62.9 (56.8-69.1) | 72.3 (66.8-77.8) | 61.3 (55.1-67.6) | 54.7 (48.4-60.9) | 62.9 (59.9-66.0) |
| Current daily smoking | 56.4 (50.1-62.7) | 67.4 (61.7-73.2) | 55.0 (48.7-61.4) | 52.2 (46.0-58.5) | 58.0 (54.9-61.0) |
| Overweight | 2.1 (0.3-3.9) | 2.7 (0.7-4.7) | 3.8 (1.3-6.2) | 3.6 (1.3-6.0) | 3.0 (2.0-4.1) |
| Hypertension and current smoking | 7.5 (4.1-10.8) | 14.2 (9.9-18.4) | 13.0 (8.7-17.3) | 21.9 (16.7-27.1) | 14.2 (12.0-16.4) |
| Hypertension and overweight | 0.4 (0.0-1.2) | 1.5 (0.0-3) | 2.5 (0.5-4.5) | 2.8 (0.8-4.9) | 1.8 (1.0-2.7) |
| Overweight and current smoking | 1.2 (0.0-2.7) | 0.8 (0.0-1.8) | 1.3 (0.0-2.7) | 2.0 (0.3-3.8) | 1.3 (0.6-2.0) |
| Hypertension, current smoking, and overweight | 0.4 (0.0-1.2) | 0.4 (0.0-1.1) | 0.4 (0.0-1.2) | 1.6 (0.0-3.2) | 0.7 (0.2-1.2) |

Table 3: Prevalence of select risk factors among women in the study population by age groups

| | Age in years% (95% CI) | | | | |
|---|---|---|---|---|---|
| Risk factor | 40 -50 | 51-60 | 61-70 | >70 | All women |
| Hypertension | 3.4 (1.2-5.6) | 7.9 (4.5-11.3) | 14.6 (10.2-18.9) | 30.1 (24.3-36.0) | 13.7 (11.6-15.9) |
| Aware of having hypertension | 31.6 (8.6-54.6) | 29.7 (14.3-45.2) | 37.1 (25.5-48.7) | 37.0 (28.8-45.3) | 32.2 (27.4-36.9) |
| Receiving treatment for hypertension | 44.4 (17.6-106.6) | 15.8 (8.6-107.5) | 18.9 (6.5-97.5) | 26.4 (5.2-91.3) | 24.1 (3.7-79.6) |
| Current smoking | 0.8 (0-1.8) | 0.4 (0-1.2) | 0.8 (0-1.9) | 0.4 (0-1.2) | 0.6 (0.1-1.1) |
| Current daily smoking | 0.8 (0-1.8) | 0 (0-0) | 0.8 (0-1.9) | 0.4 (0-1.2) | 0.5 (0.1-0.9) |
| Overweight | 2.3 (0.5-4.1) | 3.7 (1.3-6.1) | 5.9 (3.0-8.8) | 4.2 (1.6-6.7) | 4.0 (2.8-5.2) |
| Hypertension and current smoking | 0 (0-0) | 0.4 (0-1.2) | 0 (0-0) | 0.4 (0-1.2) | 0.2 (0.1-0.5) |
| Hypertension and overweight | 0 (0-0) | 0 (0-0) | 0.8 (0-1.9) | 2.5 (0.5-4.5) | 0.8 (0.2-1.4) |
| Overweight and current smoking | 0 (0-0) | 0 (0-0) | 0 (0-0) | 0 (0-0) | 0 (0-0) |
| Hypertension, current smoking, and overweight | 0 (0-0) | 0 (0-0) | 0 (0-0) | 0 (0-0) | 0 (0-0) |

Table 4: Overall prevalence of select risk factors in the study population

| Risk factor | Prevalence% (95% CI) |
|---|---|
| Hypertension | 18.8 (17.1-20.5) |
| Aware of having hypertension | 35.1 (22.6-56.7) |
| Receiving treatment for hypertension | 20.1 (16.0-71.8) |
| Current smoking | 31.6 (29.6-33.7) |
| Current daily smoking | 29.1 (27.1-31.1) |
| Overweight | 3.5 (2.7-4.3) |
| Hypertension and current smoking | 7.2 (6.0-8.3) |
| Hypertension and overweight | 1.3 (0.8-1.8) |
| Overweight and current smoking | 0.7 (0.3-1.0) |
| Hypertension, current smoking, and overweight | 0.4 (0.1-0.6) |

Table 5: Multivariate analysis of select risk factors by sociodemographic variables

| | Hypertension | | | Overweight | | |
|---|---|---|---|---|---|---|
| | | | Smoking | | | Hypertension and |
| | Men | Women | Men | Men | Women | smoking Men |
| Risk factor | OR (95% CI) | OR (95% CI) | OR (95% CI) | OR (95% CI) | OR (95% CI) | OR (95% CI) |
| **Age in years** | | | | | | |
| 40-50 | 1 | 1 | 1 | 1 | 1 | 1 |
| 51-60 | 2.7 (1.6-4.5) | 2.7 (1.2-6.1) | 1.6 (1.1-2.4) | 1.0 (0.3-3.5) | 1.9 (0.6-6.0) | 2.2 (1.2-4.1) |
| 61-70 | 3.4 (1.2-4.8) | 5.3 (2.5-11.2) | 1.0 (0.7-1.5) | 1.1 (0.3-3.7) | 3.0 (1.1-8.7) | 2.0 (1.1-3.7) |
| >70 | 3.8 (1.6-5.2) | 11.7 (5.5-24.8) | 0.7 (0.5-1.1) | 0.7 (0.2-2.5) | 1.6 (0.5-5.3) | 3.7 (2.1-6.5) |
| **Education level** | | | | | | |
| Illiterate | 2.5 (1.5-4.1) | 0.9 (0.5-1.7) | 0.9 (0.6-1.4) | 1.4 (0.4-4.7) | 0.7 (0.2-2.2) | 2.1 (1.2-3.8) |
| Primary | 1.8 (1.1-2.8) | 0.8 (0.4-1.4) | 0.8 (0.6-1.2) | 1.2 (0.4-3.6) | 1.2 (0.4-3.1) | 1.3 (0.7-2.3) |
| Secondary or more | 1 | 1 | 1 | 1 | 1 | 1 |
| **Occupation** | | | | | | |
| Farmer | 1 | 1 | 1 | 1 | 1 | 1 |
| Unemployed | 1.8 (0.7-4.8) | 2.3 (0.7-7.0) | 0.4 (0.2-0.8) | 1.0 (0.1-9.9) | 0.9 (0.1-8.3) | 1.4 (0.4-4.5) |
| Other | 1.2 (0.8-1.7) | 1.7 (1.1-2.7) | 1.2 (0.9-1.7) | 2.0 (0.9-4.6) | 2.6 (1.2-5.8) | 1.2 (0.8-1.8) |
| **Economic status** | | | | | | |
| Low | 0.4 (0.2-0.8) | 2.6 (1.3-5.2) | 2.0 (1.2-3.4) | 0.4 (0.2-1.5) | 0.3 (0.1-2.7) | 0.8 (0.4-1.7) |
| Middle | 0.8 (0.6-1.2) | 1.6 (1.3-2.7) | 1.4 (1.1-2.0) | 0.6 (0.3-1.4) | 0.6 (0.1-2.9) | 0.4 (0.3-1.4) |
| High | 1 | 1 | 1 | 1 | 1 | 1 |

hypertensive women) were aware of their hypertension and only 20.1% (17.8% of the men and 24.1% of the women) were being treated for it. Smoking was found to be very common among men. About 63% of men reported that they currently smoked and 58% reported doing so every day. The prevalence of smoking among women was only 0.6%. Overweight was not a common feature among the residents. The mean BMI was 19.6 (95% CI, 19.3-19.9) among men and 19.9 (95% CI, 19.5-20.3) among women and the prevalence of overweight was only 3% among men and 4% among women. The most prevalent combination of risk factors was hypertension and smoking (7.2%), followed by hypertension and overweight (1.3%), overweight and current smoking (0.7%) and all three risk factors (0.4%).

Multivariate logistic regression models were used to further analyze the association between selected risk factors for chronic diseases and the certain characteristics like age, education level, occupational category and economic status. The risk factors analyzed were hypertension and overweight (among both men and women) and smoking and the combination of hypertension and

smoking (among men only). Table 5 shows age was significantly associated with hypertension among both men and women and with the combination of hypertension and smoking among men. The prevalence of hypertension increased significantly with age, especially among women (ORs v/s women aged 40-50 years were 2.7, 5.3 and 11.7, respectively, among women in the next three age categories). Among men, age was also significantly associated with the prevalence of hypertension and smoking combined (ORs v/s men aged 40-50 years were 2.2, 2.0 and 3.7, respectively, among men in the next three age categories). However, no significant association was found between age and current smoking prevalence among men or between age and overweight among men or women. It was also found that among all men, illiterates were more likely to have hypertension than those in the highest (OR 2.5) and that among men who smoked this association was only slightly weaker (OR 2.1). Among women, occupation was related to hypertension and overweight: those in the "other" occupational category were significantly more likely to be hypertensive (OR 1.7) and to be overweight (OR 2.6) than were those who were farmers. The relationship between economic status and hypertension among men differed substantially from that among women whereas men in the low economic status group had a significantly lower risk for hypertension than those in the high group (OR 0.4), women in the low and middle groups both had a significantly higher risk than those in the high group (ORs, 2.6 and 1.6, respectively). Men in the low and middle groups were more likely to currently smoke than were those in the high group (ORs, 2.0 and 1.4, respectively).

## DISCUSSION

The prevalence of hypertension found in this study indicates that the condition already affects a large proportion of the adult population in the Shimoga. Similar findings about high and increasing rates of hypertension have also been reported in studies of rural communities of Indonesia (Ng *et al*., 2006), China (WHO, 2000) and in some rural communities of India (Singh *et al*., 1997). The results of this study show that the individuals with hypertension in the district were more aware of their condition and were more likely to be receiving treatment for it when compared to similar kind of study done in a district of Vietnam (Minh *et al*., 2006). These higher awareness and treatment rates could be due in part to the higher literacy rates in the district compared to the population in the district of Vietnam and increased accessibility of our population to improved health care facilities. However, the higher awareness and treatment rates did not seem to have a marked impact on the hypertension problem, indicating the need for a more comprehensive approach to dealing with hypertension. The high prevalence of current smoking among men that we found in the study population was slightly higher when compared to the data in a study done elsewhere in India (Prabhat *et al*., 2008). Smoking prevalence has also been reported to be on the rise in other Asian countries, including China and Indonesia (Ng *et al*., 2006). The findings from this study suggest this district is now at the latter stage of the smoking epidemic described by WHO (Ezzate *et al*., 2004) and that if the smoking epidemic model applies, it can be expected to experience a substantial increase in rates of smoking-related illness and death in the coming decades (Lopez *et al*., 1994). The findings from this study indicate that 14% of men had hypertension and smoked. Because people with multiple risk factors are at significantly increased risk for cardiovascular disease (Jousilahti *et al*., 1995), this high rate of multiple risk factors indicates an urgent need for comprehensive and integrated interventions to reduce the prevalence of cardiovascular disease and its risk factors in the district. Of particular interest are the associations found between risk factors (hypertension, smoking, overweight and combinations of these factors) and sociodemographic factors. Hypertension and smoking were each significantly

more prevalent among men than among women. Despite the lower prevalence of hypertension and smoking rates among women, the danger that these risk factors pose for the cardiovascular health of women must not be underestimated, as hypertension and smoking have been shown to be strongly associated with coronary heart disease among women (Hsia, 1998) as well as among men. The results of this study also confirm results from an international study (Colhoun *et al.*, 1998) showing that age is a key predictor of hypertension. It was also found that the prevalence of hypertension and the prevalence of multiple risk factors were both inversely associated with education among men, even after adjusting for other independent variables such as age and economic status. The inverse association between hypertension and education was also found in the studies conducted in developed countries (Barker, 2004). In other developing countries, the pattern of the association between hypertension and education level varied; it was found to be inverse in China but direct in a study done in other parts of India (Nissinen *et al.*, 2004). In terms of occupation, women who were housewives were at significantly higher risk for hypertension than women who were farmers, possibly because of less physically active lifestyles, work pressure and psychosocial stress. It was found that hypertension had a complex association with economic status. Among men, hypertension was highest among those categorized as belonging to upper socioeconomic class, but among women, it was highest among those categorized as being in the poorest. The high rate of hypertension among the elite men in the district may reflect their adoption of western lifestyles such as high-fat diets, less physical activity, higher alcohol consumption and job stress. The relatively high prevalence of hypertension among poor women may reflect alternative risk factors in this setting, such as early malnutrition.

## CONCLUSION

The findings suggest that India is undergoing a rapid epidemiological transition characterized by an increase in the prevalence of risk factors for chronic diseases and that different sociodemographic groups in the population have moved through the course of the transition to different extents. The findings also show that actions to reduce levels of chronic disease risk factors in the country are clearly urgent. The area needs comprehensive and integrated interventions designed to reduce these risk factors, including both primary and secondary approaches, as well as policy-level involvements. The highest priority should be put on primary prevention, as it has been shown to be the most cost-effective approach (Barker, 2004; Nissinen *et al.*, 2004). The aim should be to make small reductions in the prevalence of smoking and hypertension in a large proportion of the population. The interventions should address all people in society, but should focus especially on disadvantaged groups.

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