Risk factors for non-communicable diseases in villages of Tamil Nadu – A survey

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ABSTRACT

Background: Non-communicable diseases are among the leading causes of death in India, the rapid epidemiological transition as a consequence of economic and social changes is a major factor in the rise of patients suffering from non-communicable diseases (NCDs). **Objectives:** The objectives of the study were (1) to find out the prevalence of common risk factors among adults for NCDs, (2) to study the determinants of NCDs, and (3) to assess health-care seeking behavior and treatment adherence to NCDs. **Material and Methods:** The present study was undertaken in the field practice area of the Rural Health Training Center of the Department of Community Medicine, Sri Manakula Vinayagar Medical College and Hospital, Puducherry. It was a community-based cross-sectional study. A representative sample of 590 respondents was selected by two-stage cluster sampling. Chi-square tests were applied to find proportions. Confidence intervals values were constructed around the prevalence ratio values. Multivariate analysis (negative binomial regression) was done to get the adjusted prevalence ratio and to select the variables that best predict the risk of development of at least one NCD among the study sample. **Results:** The prevalence of at least one NCD (hypertension and or diabetes) among respondents was 18.1%. Most of the patients with hypertension and or diabetes received treatment from a public health facility (68.2%) followed by private health-care services (31.8%) at village/town level. The major perceived reasons for non-compliance to treatment among patients were related to the high cost of treatment (28%) from private services and sense of wellbeing without medication (28%). In multivariate analysis, two variables emerged as significant predictors for developing at least one NCD were alcohol consumption and obesity. **Conclusions:** Obesity was found be an independent risk factor for developing NCD. Hence, preventive measures should be applied to reducing BMI in obese individuals. Special efforts must be made to improve physical activity and dietary habits of these individuals from an early age so that the occurrence of NCD can be prevented. Awareness regarding physical activity and a healthy diet can be given in schools and colleges as it may have a better impact on the community. Opportunistic screening for NCD should be done for all adults in the outpatient department irrespective of their symptoms for early diagnosis of NCD.

KEY WORDS: Non-communicable Disease; Risk Factors; Rural; India

INTRODUCTION

Non-communicable diseases (NCDs) are an emerging public health challenge in India. Government of India has initiated the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Disease and Stroke in October 2010. The objectives of the program are risk reduction for prevention of NCDs (diabetes, cardiovascular disease, and stroke), early diagnosis and appropriate management of diabetes, cardiovascular diseases, and stroke.[1] From a program perspective, an important aspect related to NCDs is the disease burden, its determinants, treatment seeking and the poor level of treatment adherence, which is a much less researched topic among South Indian population, where the burden due to NCD is reported to be high.

Globally and regionally in South East Asia and India, several studies have been conducted to explore the risk factors for cardiovascular diseases among populations as a whole. However, several differences exist among the rural and urban population with regard to their lifestyle, dietary pattern, harmful habits of tobacco use, and alcohol consumption.[2,3] The studies predominantly done over the urban population in India cannot give a picture of cardiovascular risk factors among the rural population. The previous studies done in Tamil Nadu focused on an urban population with a little emphasis on the rural population.[4] Hence, the present study was carried out with the primary objectives to find out the prevalence of common risk factors among adults (25–60 years) for NCDs and to study the determinants of NCDs. Second, another objective of the study was to assess the health-care seeking behavior and treatment adherence to NCDs.

MATERIAL AND METHODS

Study Area and Setting

The present study was undertaken in the field practice area of the Rural Health Training Center (RHTC) of the Department of Community Medicine, Sri Manakula Vinayagar Medical College and Hospital (SMVMCH), Puducherry. It consisted of 50 villages of three Primary Health Centres (*Thiruvennainallur, Iruvelpattu, and Sirumadurai*) in Viluppuram district in Tamil Nadu, which is 200 km southwest of state capital Chennai. The total population in 50 villages was 118,072. Overall, life expectancy at birth in Tamil Nadu is 68.9 years.[5]

Study Design

The present study was a community-based cross-sectional study.

Study Population

The respondents who participated in the study were adults in the age group of 25–60 years.

Study Duration

The data were collected during the months of April 2015–July 2015.

Sample Size

The sample size of 510 was calculated after considering the prevalence of hypertension, which is a prevalent NCD, as 33% based on various studies reported from Tamil Nadu[6] and keeping 1.5 as a design effect. The sample size was further inflated, considering 15% as non-response among the respondents in the local community. Thus, the final sample

size was 586, which was rounded off to the nearest high figure of 590 (calculated by Epi Info version 3.5.4).

Sampling Technique

A list of all the villages in the study area and their population was obtained from the Block Development Office (BDO) of Thiruvennainallur. Two-stage cluster sampling was adapted to select the representative sample of 590 participants. At the first stage, 30 clusters were selected by population proportional to size method from the list of 50 villages. To begin with, cluster interval (3935) was calculated by dividing the total number of population (118,072) and the number of clusters (30). Later, a random number (3352), which lied between one and cluster interval was generated using the random number generator in Epi Info software.

At the second stage, 20 respondents (25–60 years) were selected from each selected cluster by the "random walk" method.[7] To reach the sample size of 590, from the first 29 clusters, 20 respondents were selected, and in the last cluster, ten respondents were selected.

Data Collection Tool

The WHO STEP questionnaire – step-1 and step-2 was used. Step-1 (Interview) included a questionnaire-based survey for sociodemographic variables such as age, gender, sociodemographic status, tobacco and alcohol use, measures on dietary habits, and physical inactivity.[8]

In the present study, the questionnaire was pilot tested on a convenient sample of 30 adult respondents (25–60 years) in the area other than the study site using a "conventional pilot testing technique."[9]

Data Collection

The data were collected by a team comprising of trained female postgraduate in Community Medicine as a lead investigator and medical interns as assistants in the data collection process. The investigators paid a house-to-house visit and interviewed the selected respondent by conversational interview technique, where if required, the respondents were offered clarifications on the asked questions. The English version of the questionnaire was administered by the native Tamil speaking investigator.

After obtaining the informed consent, the interviewer collected the information using the pre-designed and pre-tested WHO-STEPS questionnaire. To begin with, respondents were asked about their sociodemographic details such as age, gender, education, occupation, socioeconomic status, marital status, and religion. The socioeconomic status was measured by noting the color of ration card (Pink-Below Poverty Line, BPL, and Green-above poverty line) and the marital status

was recorded as married, never married, widowed, and separated. The educational status was classified as illiterate, primary (1–5 standards), middle school (6–8 standards), high school (9–10 standards), higher secondary (11–12 standards), and degree.

Information on lifestyle factors such as diet consumption, physical activity, smoking and other smokeless forms of tobacco use, and alcohol intake was obtained. Information on self-reported hypertension, diabetes, and health-care seeking for this condition was collected. The various reasons for non-compliance if any, were enquired. Non-compliance is defined as when patients were not adherent to the treatment for the past 3 months.[10]

Operational Definitions

As per World Health Organisation the following operational definitions were used in the present study.

Smokers were classified in to "ever smoker" and "current smoker." "Ever smoker" was defined as one who had smoked at least once in their lifetime. "Current smoker" was defined as who had smoked for past 1 month.[8]

"Past users" of alcohol was defined as one who had consumed alcohol within the past 1 year. The amount of alcohol consumed per day was classified based on a number of cuttings of alcohol. One cutting was taken as equivalent to 45 ml of alcohol.[8]

Physical activity was measured as one of the risk factors for NCD. The person was labeled as physically inactive when metabolic equivalent was <600 per week, and the person was said to be physically active when metabolic equivalent was >600 per week.[11]

Anthropometric Measurements

The anthropometric measurements such as height, weight, waist circumference, and hip circumference were measured using the WHO-STEPS standards of anthropometric measurements guidelines.[12] According to standards for adult Asian Indian, BMI value <18.5 was classified as underweight, 18.5–22.9 was classified as normal, 23–24.9 as overweight, and ≥25 as obesity.[13] Waist circumference value >90 cm for males and >80 cm for female was considered as abnormal. Waist-hip ratio value >0.9 for males and >0.85 for females was considered as abnormal.

In addition, blood pressure was measured for all the respondents using a mercury sphygmomanometer in the upper limb. Since the participants had already been seated for 15 min for behavioral measurements, blood pressure was measured immediately after the step one questions. Three blood pressure measurements were taken 3 min apart, and the average of three

readings was taken.[12] The principal investigator recorded all the forementioned measurements. Blood pressure was classified as per the Joint National Committee (JNC) eight guidelines, when systolic blood pressure (SBP) <120 mm Hg and diastolic blood pressure (DBP) <80 mm Hg were classified as normal, SBP 120–139 mm Hg or DBP 80–89 was classified as prehypertension and SBP ≥140 mm Hg or DBP ≥ 90 mm Hg was classified as hypertension.[14]

Ethical Issues

The present study was cleared by the Research Committee of SMVMCH and the Institutional Ethics Committee (Human studies) (IEC No - 85/2014) of SMVMCH, Puducherry. Those respondents, who were newly diagnosed hypertensive were referred to our RHTC for free medical treatment.

Date Entry and Analysis

The data were entered into Epi Info (version 3.5.4) software package. The entered data were transferred into SPSS 24 software (SPSS Inc., Chicago, Illinois, USA) package for analysis.

Descriptive statistics were calculated for all the variables. Chi-square test was applied to proportions to test the level of significance. The level of significance was fixed at 5%. 95% Confidence interval (CI) values were constructed around each proportion values using the StatCalc program in Epi Info (version 3.5.4) software package.

Bivariate analysis was done to calculate the unadjusted prevalence ratio (PR) to establish the strength of association between at least one NCD with various risk factors. 95% CI was constructed around the PR values. Since the overall prevalence of at least one NCD among respondents was higher than 10%; we carried out multivariate analysis (negative binomial regression) to get the adjusted PR and to select the variables that best predict the risk of development of at least one NCD among the study sample. The outcome variable was at least one NCD. Nine variables such as age, gender, socioeconomic status, marital status, tobacco and alcohol consumption, physical activity, obesity, and dietary practices were pulled as a predictor in the multivariate regression model to obtain the significant predictors by calculating adjusted PRs. Respondents who had waist-hip ratio and BMI more than cutoff were classified as an overweight or obese category, and normal and underweight were classified as others category. The level of significance was set at 5%.

Guidelines used for Reporting the Study

To ensure the systemic reporting of the present cross-sectional study, "strengthening the reporting of an observational study in Epidemiology" guideline was followed.[15]

RESULTS

The total number of respondents for the study was 590 persons. Majority of respondents were females (51.5%) with the mean age of 44.21 ± 11.15 years (median – 45 years). Significantly more male respondents (48.6%) were involved in agricultural work compared to females (*P* = 0.016). Significantly more female respondents (50.2%) were illiterate compared to males. More than three quarters of the respondents 585 (99.2%) were Hindus and were married (91.2%). About 99 (16.8%) respondents were "below the poverty line."

In Table 1, among men 28.3% were "ever smokers" of tobacco and 22.7% were found to be "current smokers" (smoking for past 1 month) of tobacco. None of the female respondents reported using any smoking form of tobacco. The overall prevalence of "ever users" and "current users" of smokeless tobacco products (*khaini, gutka*, and dry tobacco leaves) was 60% and 51%, respectively. The prevalence of "past users" (reference period for past 1 year) of alcohol was high with 39.5% among men. None of the women reported having alcohol-containing drinks at the time of the survey. Overall, 49.8% of respondents were physically active and 50.2% were physically inactive. For diet, 83.1% and 5.4% of respondents reported that they never consume to consumed fruits and vegetable 1–2 days in a week, respectively. The prevalence of overweight and obesity was 48.3% in men and 44.4% in women.

Out of 123 respondents, 82 (66.7%; CI: 58.3–75) of them had hypertension and 41 (33.3%; CI: 25-41.6) respondents had diabetes.

In bivariate analysis, the respondents who consumed alcohol had 1.59 times (CI: 1.09–2.30, *P* = 0.017) higher prevalence of developing at least one NCD compared to those did not consumed alcohol. As compared to "others" category, overweight and obese had 1.80 times (CI: 1.26–2.56, *P* = 0.001) higher prevalence of developing at least one NCD. In multivariate analysis, two variables emerged as significant predictors for the risk of developing at least one NCD. The respondents who consumed alcohol had 1.87 times (CI: 1.10–3.17, *P* = 0.021) higher prevalence of developing at least one NCD compared to those who did not consume alcohol. As compared to "others" category, overweight and obese had 1.92 times (CI: 1.28–2.89, *P* = 0.002) higher prevalence of developing at least one NCD [Table 2].

Source of Treatment

Among diabetic and hypertensive patients, the majority of them received treatment from a public health facility (68.2%) followed by private health-care services (31.8%) at village/town level. Major reasons for non-compliance to treatment were high treatment cost (28%) among those accessed private providers.

Table 1: Prevalence of various risk factors for non-communicable diseases in the study population by sex (*n*=590)

Variables	Male (*n*=286)	Female (*n*=304)	Total (*n*=590)
	n (%) [95% CI]	*n* (%) [95% CI]	*n* (%) [95% CI]
Smoking tobacco use			
Ever smokers	81 (28.3) [23.1–33.5]	0	81 (13.7) [10.9–16.5]
Current smokers	65 (22.7) [17.8–27.5]	0	65 (11) [8.4–13.5]
Smokeless tobacco use			
Ever users*	37 (12.9) [9–16.8]	23 (7.5) [4.5–10.5]	60 (10.1) [7.7–12.6]
Current users (reference period 1 month)	29 (10.1) [6.6–13.6]	22 (7.2) [4.3–10.1]	51 (8.6) [6.3–10.9]
Alcohol consumption			
Past users	113 (39.5) [33.8–45.1]	0	113 (19.1) [15.9–22.3]
Physical activity			
Active	141 (49.3) [43.5–55]	153 (50.3) [44.7–55.9]	294 (49.8) [45.8–53.8]
Inactive	145 (50.7) [44.9–56.4]	151 (49.7) [44–55.2]	296 (50.2) [46.1–54.2]
Dietary habits			
Never consumed to consumed fruits 1–2 days in a week	236 (82.5) [78.1–86.9]	254 (83.6) [79.3–87.7]	490 (83.1) [80–86]
≥3 days of consumption of fruits	50 (17.5) [13–21.8]	50 (16.4) [12.2–20.6]	100 (16.9) [13.9–19.9]
Never consumed to consumed vegetable 1–2 days in a week	17 (5.9) [3.2–8.6]	15 (4.9) [2.5–7.3]	32 (5.4) [3.5–7.2]
≥3 days of consumption of vegetables	269 (94.1) [91.3–96.8]	289 (95.1) [92.6–97.5]	558 (94.6) [92.7–96.4]
Obesity			
Overweight or obese	138 (48.3) [42.4–54]	135 (44.4) [38.8–49.9]	273 (46.3) [42.2–50.2]
Others	148 (51.7) [45.9–57.5]	169 (55.6) [50–61.1]	317 (53.7) [49.7–57.7]

CI: Confidence interval

Table 2: Bivariate and multivariate analysis for at least one non-communicable disease

Characteristic	Number (*n*=590)	*n* (%) with at least one NCD	PR (95% CI)	*P* value	aPR (95% CI)	*P* value
Age group						
25–34	149	23 (15.4)	1	0.322		
≥35	441	84 (19)	1.23 (0.81–1.88)			
Gender						
Female	304	52 (17.1)	1	0.503		
Male	286	55 (19.2)	1.12 (0.80–1.58)			
Socioeconomic status						
Above poverty line	483	81 (16.8)	1	0.067		
Below poverty line	107	26 (24.3)	1.45 (0.98–2.14)			
Marital status						
Married	538	93 (17.3)	1	0.085		
Others	52	14 (26.9)	1.56 (0.96–2.53)			
Tobacco use						
Yes	113	26 (23)	1.35 (0.92–2)	0.134		
No	477	81 (17)	1			
Alcohol use*						
Yes	112	29 (25.9)	1.59 (1.09–2.30)	0.017	1.87 (1.10–3.17)	0.021
No	478	78 (16.3)	1		1	
Physical activity						
Active	294	47 (16)	1	0.176		
Inactive	296	60 (20.3)	1.27 (0.90–1.79)			
Nutritional status*						
Others	317	42 (13.2)	1	0.001	1	0.002
Overweight or obese	273	65 (23.8)	1.80 (1.26–2.56)		1.92 (1.28–2.89)	
Fruits consumption in a typical week						
Never consumed to consumed 1–2 days	490	91 (18.6)	1.16 (0.71–1.89)	0.543		
≥3 days consumption	100	16 (16)	1			
Vegetables consumption in a typical week						
Never consumed to consumed 1–2 days	32	7 (21.9)	1.22 (0.62–2.41)	0.572		
≥3 Consumption	558	100 (17.9)	1			

PR: Prevalence ratio, CI: Confidence interval, aPR: Adjusted prevalence ratio

DISCUSSION

The prevalence of current consumption of smoke-form tobacco was 22.7% among men and none of the women reported using smoke-form of tobacco. Current smokeless tobacco use was 10.1% and 7.2% for men and women, respectively. The prevalence of current alcohol consumption was 39.5% among men and none of the women reported consumption of alcohol. Nearly half of the target population were physically less active (50.1%) based on work and leisure time activities. Noteworthy, 83% of the study participants never consume fruits in a week. Obesity was found more among females (36.8%) than males (30.1%). The prevalence of at least one NCD among respondents was 18.1%. Obesity and alcohol consumption emerged as a significant predictor for developing at least one NCD. Most of the patients with hypertension and/or diabetes received treatment from a public health facility (68.2%) followed by private health-care services (31.8%) at village/town level. Non-compliance to treatment among those accessed private providers was 28% due to high treatment cost.

In the present study, the overall prevalence of smoking, smokeless-form of tobacco, and alcohol consumption was 11%, 8.6%, and 19.2%, respectively. The prevalence of inadequate physical activity, less consumption of fruits, and obesity was 50.1%, 83%, and 33.6%, respectively. A study by Chauhan *et al*. among participants aged >18 years in Puducherry found similar prevalence for risk factors except for alcohol consumption, where it was 14.2%.[16] A small survey among participants aged >40 years in Puducherry found a relatively high prevalence of smoking (32%), smokeless-form of tobacco (24.4%), and alcohol consumption (53%).[17] A survey in another neighboring

state Kerala reported the prevalence of current smoking (40%), current users of alcohol (41%), less physical activity (22.3%), and obesity (25.2%).[18] Overall, our study reports less prevalence of smoking, smokeless form of tobacco, nd alcohol consumption as compared to neighboring states such as Kerala and Puducherry. Such a variation could be due to differences in culture and government policies on liquor taxation. Notably, in the study area of Tamil Nadu, the prevalence of less physical activity and obesity was high as compared to findings reported from a study in Kerala.

In the present study, the overall prevalence of hypertension (self-reported and newly diagnosed) and self-reported diabetes was 13.9% and 7%, respectively. A study in rural Puducherry found the prevalence of hypertension and diabetes as 27.3% and 17%, respectively.[17] The probable reason for such results is due to the high prevalence of risk factors and the difference in diagnostic criteria. Majority of the study population (68.2%) rely on free government health facility for treatment and medication of NCD. It emphasizes the need for strengthening of government health facility and regular supply of drugs.

In the present study, alcohol consumption and obesity emerged as two risk factors for developing at least one NCD among the study participants. A study done in the urban population of Puducherry found that alcohol intake was associated with hypertension.[19] Ramachandran et al. in Tamil Nadu found that the waist circumference as a significant risk factor for diabetes among age group ≥20 years.[20] Pandey et al., in four urban and five rural locations in India, found that literacy, dietary fats, low physical activity, obesity, and truncal obesity as risk factors.[21] Overall, in Tamil Nadu and Puducherry, the high prevalence of alcohol consumption and obesity seems to contribute to NCD burden. Hence, public health intervention based on the promotion of physical activity and reduction of alcohol consumption through community education and raising government taxation on liquor might help.

The findings of the present study are based on a representative sample selected from a wider geographical area of three primary health centers in a rural setting. The present study used a valid and pre-tested questionnaire for NCD surveillance in our community setting. However, the limitation of the present study should be kept in mind. Recall bias could occur due to self-reported information, the WHO STEP-3 (biochemical measurements) was not done due to practical feasibility and cost. In additiny, cross-sectional studies cannot find temporality of association between exposures and outcome.

CONCLUSIONS

The prevalence of at least one NCD among respondents was found to be 18.1%. Majority of the patients with hypertension and/or diabetes received treatment from a public health facility (68.2%) followed by private health-care services (31.8%) at village/town level. Alcohol consumption and obesity were the two significant predictors for developing at least one NCD among study participants. Hence, efforts should be taken to reduce alcohol consumption and obesity among the people in the given geographical area.

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