Original Research Article

Concomitant Behavioral Risk Factors of Non Communicable Diseases and its Associated Factors among Adults in the Selected Rural Areas of Puducherry, South India: A Community Based Cross-sectional Study

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Abstract

Background: Considering that knowledge of the burden of these risk factors in a community can aid in developing need based preventive strategies. Hence, attempt was made to profile the known risk factors of Non- Communicable Diseases among adults in in the selected rural areas of Puducherry, South India and to estimate the prevalence of concomitant risk factors and socio-demographic factors associated with having higher number of risk factors concomitantly. **Materials and Methods:**A community based cross-sectional analytical study was conducted in the selected rural areas of Puducherry. House to house enumeration survey was conducted in the purposively selected rural areas during September-2016 to February-2017. From adults in the enumerated houses information on alcohol use, tobacco use, non-consumption of adequate fruits/vegetables, high salt intake and physical inactivity were extracted using modified WHO STEPS-1 questionnaire. **Results:**Of the total 1844 enumerated individuals, 1423 (78.6%) were above 18 years of age. Of the 1423 participants, mean (SD) age was 41.9 (16.2) and 53.8% were females. The prevalence of self-reported hypertension and diabetes was found to be 7.2% (95%CI=5.9%-8.6%) and 5.7% (95%CI=4.6%-7.0%) respectively. The reported prevalence of behavioral risk factors were; Tobacco use- 6.6% (95%CI=5.4%-8.0%), alcohol use-9.3% (95%CI=7.8%-10.9%), physical inactivity- 76.4% (95%CI=74.1%-78.6%), low fruit intake- 68.2% (95%CI=65.7%-70.6%), low vegetables intake- 57.1% (95%CI= 54.4%- 60.0%) and high salt intake- 86.5% (95%CI=84.4%-88.3%). Out of 1423 individuals, 885 (62.2%, 95% CI- 59.7%-64.7%) had three or more concomitant risk factors. The multivariate generalized poisson model analysis showed that being male, lower socio-economic class, unemployed and backward class were independently associated with concomitant risk factors.**Conclusion:**The current study shows alarmingly high burden of risk factors and more so with concomitant risk factors. There is need for behavioral change communication and social mobilization activities to reduce physical inactivity and to improve the intake of fruits and vegetables.

Keywords: Non-communicable diseases, Behavioral Risk Factors, Concomitant Risk Factors, Tobacco Use, Physical Inactivity.

Introduction

Worldwide, Non-communicable diseases (NCD) are responsible for almost 70% of deaths and almost 75% of all NCD related deaths occur in low and middle income countries. Similarly 82% premature deaths i.e deaths among those aged between 30 to 70 years occur in these LMIC and MIC.[1] In India nearly 60% of deaths were due to Non-communicable diseases.[2] It was estimated that an economic loss of 3.55 trillion USD was incurred in India due to diabetes, cardiovascular diseases, cancers and chronic respiratory diseases during the period 2012-

2030.[3] The general Assembly of United Nations had called for reducing the premature deaths due to four NCD namely diabetes, cardiovascular diseases, cancers and chronic respiratory diseases. It has been agreed by the countries to reduce the premature deaths by 25 % from the 2010 levels by 2025.[4] The main strategy proposed to achieve the set target is by reducing the highly prevalent common risk factors of non- communicable diseases.

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The behavioral risk factors for non-communicable disease are unhealthy diet, physical inactivity, tobacco use and harmful use of alcohol.[2] Worldwide, 2.7 deaths were attributable to low consumption of vegetable and fruits. It has been shown that 31% of coronary heart diseases, 19% of gastrointestinal cancer and 17% of stroke were caused by low consumption of fruits and vegetables.[5] One third of the global population have inadequate physical activity and physical activity alone attribute to 6- 10% of Major non-communicable diseases. Tobacco kills half of its users and nearly 6 million deaths were due to tobacco use. Tobacco is a risk factor for six out of eight leading cause of deaths worldwide.[6] According to WHO's Global status report on alcohol and health 2014, worldwide 16% of drinkers engage in heavy episodic drinking. Around 3.3 million deaths were caused by alcohol consumption, which corresponds to one in every twenty deaths. The highest number deaths due to alcohol consumption were from cardiovascular diseases.[7] Also, it has been reported that there is a positive interaction between these risk factors in causing the non-communicable diseases. Hence, the individual with the concomitant modifiable risk factors are more prone to develop NCDs.

With known untoward impact of these risk factors on the health of the individual, it is necessary to monitor the extent of these risk factors in the community and plan for strategies to reduce the same. World Health Organization has recommended STEPS tool, a stepwise approach to surveillance for chronic diseases and their risk factors. The STEPS tool has three steps namely step 1, step 2 and step 3 in which the step 1 was designed to obtain information about socio-demographic profile and behavioral risk factors of NCD namely inadequate fruits and vegetables intake, high salt intake, physical inactivity, alcohol use and tobacco use.[8] Considering that knowledge of the burden of these risk factors in a community can aid in developing need based preventive strategies. Hence, attempt was made to profile the known risk factors of Non- Communicable Diseases among people aged more than 18 in in the selected rural areas of Puducherry, South India. Also, in the current study we estimated the prevalence of concomitant risk factors and socio-demographic factors associated with have higher number of risk factors concomitantly.

METHODOLOGY

Study design and Study setting: A community based cross-sectional analytical study was conducted among the adults residing in rural areas of Puducherry. Puducherry is an Union Territory with four districts spread across the south Indian states of Tamil Nadu, Kerala and Andhra Pradesh. The district of Puducherry is on the shores of Bay of Bengal, surrounded by state of Tamil Nadu on all the other three sides. The population of district of Puducherry is approximately ten lakhs, with almost 65% residing in the urban areas.

Study Population and Sample size: We included all the individuals aged more than eighteen years and residing in the selected areas of rural Puducherry. The sample size was calculated using nMaster version 2.0. The minimum sample size was calculated to be 1028 adult individuals, assuming the prevalence of not being screened for hypertension to be 70%, with a relative precision of 5% and adjusting for design effect of 1.5. The design effect was used to minimize the clustering due to selection of villages as primary sampling units and also for including all the individuals in the enumerated houses.

Four villages namely Bahourpet, Pillaiyarkuppam, Kuruvinatham and Irulansanthai were selected conveniently, which were located closer to the parent institute, Mahatma Gandhi Medical College & Research Institute. In each of these selected villages, all the houses were enumerated. Interviews were conducted by trained MBBS students supervised by the faculties and residents from the Department of Community Medicine. Interviews were done among available individuals using semi-structured interview schedule and information about those not available at the time of interview was extracted from the informant. If houses were locked or individual eligible for study was not present during investigators initial visit, two revisits were made.

Study Tool and Study variables: A semi-structured interview schedule was used to collect information from the study participants. A paper based semi-structured interview schedule was used in two villages and mobile app (Epicollect5 software) based forms were used in other two villages. The study tool included details on socio-demographic factors and known risk factors of non-communicable diseases.

Information on age, gender, occupation status, education status, total family income, number of individuals in the family and type of family were collected as part of socio-demographic details. The information on tobacco use, alcohol use, intake of fruit and vegetables, physical activity and total salt intake in the family per month was collected to profile the non-communicable disease risk profile of the participants.

The following operational definitions adapted from WHO-STEPS survey to assess

Tobacco use: Use of tobacco in any form in last one year.
Alcohol use: Consumption of alcohol in any form in last one year.
Inadequate fruit intake: Not consuming five servings of fruit per day.
Inadequate vegetable intake: Not consuming five servings of vegetables per day.

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Inadequate physical activity: Not doing 150 minutes of leisure time physical activity per week.

High salt intake: Consuming more than 6 gram of salt per day (calculated based on monthly raw ration of the family).

Concomitant risk factors: Individuals having more than one risk factor concomitantly was considered as having concomitant risk factors.

Data Entry and Analysis: The information collected using questionnaire using paper based forms were entered using EpiData software version 3.1. The data was entered directly during data collection in the two surveys where Epicollect5 mobile application was used. Data was analyzed using EpiData analysis software and Stata 12 software. Percentage was used to summarize the categorical variables. 95% confidence interval was calculated for all outcomes of interest. The count data of number of concomitant risk factors was considered as outcome variable for assessing the factors associated with having concomitant risk factors. As there was underdispersion in the outcome count data (*Pearson dispersion= 0.602*) and hence we used Generalized Poisson Model for assessing the association between socio-demographic characteristics and concomitant risk factors. Generalized Poisson Model after adjusting for clustering at village was used to assess independent association of socio-demographic factors with concomitant risk factors. Prevalence ratios (as it is numerically same as Incidence Rate Ratios) with 95% confidence interval was used to express the association in both univariate and multivariate model.

Results

In total, 1423 people were included in the study. Of total 1423 participants, 397 (27.9%) were from Pillayarkuppam village, 517 (36.3%) were from Bahourpet, 299 (18.0%) were from Kuruvinatham and 253 (17.8%) individuals were from Irulansandhai village. The mean (SD) age of participants was 41.9 (16.2) and 765 (53.8%) were females. Of the 1423 individuals participated in the study, 402 (28.3%) had no formal education and 258 (18.2%) were graduates. Among study participants, 749 (52.7%) were unemployed/ housewife and 1093 (76.8%) were married. Of the total participants, 147 (12.6%) were from upper socio-economic class, 200 (17.2%) were from lower socio-economic class and majority (73.8%) of the participants were from schedule caste. The socio-demographic characteristics of study participants were shown in Table-1.

The prevalence of self-reported hypertension and diabetes was found to be 7.2% (95%CI=5.9%-8.6%) and 5.7% (95%CI=4.6%-7.0%) respectively. The prevalence of tobacco use was 94 (6.6%, 95% CI- 5.4%- 8.0%) and alcohol use was 132 (9.3%, 95% CI-7.8%- 10.9%). Among study participants, 970 (68.2%, 95% CI- 65.7%-

Tables 1: Socio-demographic characteristics of adults in the selected villages of rural Puducherry, N=1423

Socio-demographic characteristics	Frequency (%)	Socio-demographic characteristics	Frequency (%)
Age (in years)		**Marital Status**	
18-29	399 (28.0)	Never Married	267 (18.8)
30-44	437 (30.7)	Married	1093
45-59	343 (24.1)	Widow/Separated	63 (4.4)
60 and above	244 (17.2)	**Socio-Economic status (Modified BG Prasad's Classification)***	
Gender			
Male	658 (46.2)	Upper	147 (12.6)
Female	765 (53.8)	Upper Middle	178 (15.3)
Education		Middle	315 (27.0)
No formal Education	402 (28.3)	Lower Middle	325 (27.9)
Primary	190 (13.4)	Lower	200 (17.2)
Secondary	302 (21.0)	**Caste***	
Higher Secondary	157 (11.1)	Forward Caste	3 (0.3)
Intermediate/Diploma	114 (8.0)	Backward Caste	196 (16.8)
Graduate and above	258 (18.2)	Most Backward Caste	107 (9.2)
Occupation		Scheduled Caste	861 (73.8)
Unemployed/Housewife	749 (52.7)	**Village**	
Unskilled	279 (19.6)	Pillayarkuppam	397 (27.9)
Semiskilled	138 (9.7)	Bahourpet	517 (36.3)
Skilled	130 (9.1)	Kuruvinatham	299 (18.0)
Semi-professional and Professional	127 (8.9)	Irulansandhai	253 (17.8)

* Data was available only for 1167 individuals

Table 2: Distribution of known and concomitant NCD risk factors among adults in the selected villages of rural Puducherry, N=1423

NCD risk factor	Frequency, (%, 95% CI)
Tobacco Use	94 (6.6, 5.4-8.0)
Alcohol Use	132 (9.3, 7.8-10.9)
Inadequate intake of fruits	970 (68.2, 65.7-70.6)
Inadequate intake of vegetables	812 (57.1, 54.4-60.0)
Physical Inactivity	1087 (76.4, 74.1-78.6)
High Salt Intake	1006 (70.7, 68.3-73.1)
Concomitant Risk Factors	
Zero	68 (4.8, 3.7-6.0)
One	172 (12.1, 10.4-13.9)
Two	298 (20.9, 18.8-23.1)
Three	291 (20.5, 18.4-22.7)
Four	531 (37.3, 34.8-39.9)
Five	42 (2.9, 2.1-3.9)
Six	21 (1.5, 0.9-2.2)

70.6%) had inadequate intake of fruits and 812 (57.1%, 95% CI- 54.4%- 60.0%) had inadequate intake of vegetables. Of total 1423 study individuals, 1087 (76.4%, 95% CI- 74.1%- 78.6%) had physical inactivity and 1006 (70.7%, 95% CI- 68.3%- 73.1%) have consumed high salt intake. Out of 1423 individuals, 531 (37.3%, 95% CI-34.8%-39.9%) had four concomitant risk factors, 42 (2.9%, 95% CI-2.1%-3.9%) had five concomitant risk factors and 21 (1.5%, 95% CI- 0.9%-2.2%) all the six concomitant risk factors. The distributions of known and concomitant NCD risk factors are shown in Table-2.

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Table 3: Association of socio-demographic characteristics with concomitant NCD risk factors among adults in the selected villages of rural Puducherry, N=1423

Characteristic	Total	Rate of Concomitant risk factor	Unadjusted PR (95% CI)	Adjusted PR (95% CI)
Age (in years)				
18-29	399	2.75	1	1
30-44	437	2.86	1.04 (0.98-1.10)	1.01 (0.96-1.07)
45-59	343	2.97	1.08 (1.02-1.15)	1.02 (0.97-1.07)
60 and above	244	3	1.10 (1.02-1.17)	1.01 (0.98-1.04)
Gender				
Male	658	2.95	1.07 (1.03-1.12)	1.11 (1.05-1.17)
Female	765	2.82	1	1
Education				
No formal Education	402	3.06	1.13 (1.06-1.21)	1.06 (0.93-1.22)
Primary	190	2.92	1.09 (1.01-1.18)	1.07 (0.95-1.20)
Secondary	302	2.73	1.02 (0.95-1.09)	0.98 (0.87-1.10)
Higher Secondary	157	2.98	1.08 (0.99-1.18)	1.03 (0.95-1.11)
Intermediate/Diploma	114	2.92	1.07 (0.97-1.17)	1.02 (0.97-1.08)
Graduate and above	258	2.68	1	1
Occupation				
Unemployed	749	2.87	1.06 (0.97-1.15)	1.07 (1.02-1.12)
Unskilled	279	2.95	1.11 (1.01-1.21)	1.10 (0.95-1.28)
Semiskilled	138	3.16	1.14 (1.03-1.27)	1.03 (0.97-1.10)
Skilled	130	2.68	1.01 (0.90-1.12)	0.97 (0.80-1.19)
Professional	127	2.71	1	1
Marital Status				
Never Married	267	2.83	1.03 (0.97-1.09)	-
Married	1093	2.89	1	
Widow/Separated	63	2.86	0.99 (0.88-1.12)	
Socio-Economic status				
Upper	147	2.83	1	1
Upper Middle	178	3.04	1.04 (0.96-1.12)	1.05 (0.96-1.15)
Middle	315	3.16	1.08 (1.01-1.15)	1.08 (0.96-1.22)
Lower Middle	325	3.21	1.09 (1.02-1.17)	1.08 (0.93-1.26)
Lower	200	3.28	1.13 (1.05-1.22)	1.12 (1.08-1.15)
Caste				
Forward Caste	3	3	1.23 (0.88-1.72)	1.10 (0.96-1.27)
Backward Caste	196	3.08	1.05 (0.97-1.14)	1.06 (1.03-1.10)
Most Backward Caste	107	2.88	1	1
Scheduled Caste	861	3.18	1.09 (1.02-1.17)	1.10 (0.98-1.24)

Table 3 shows the univariate analysis and multivariate analysis to assess the socio-demographic factors associated with concomitant risk factors. The univariate analysis showed that the factors like age, gender, education, occupation, socio-economic status and caste were associated with concomitant risk factors. The marital status was not associated with concomitant risk factors. The multivariate generalized poisson model analysis showed that being male 1.11 (95% CI- 1.05-1.17), lower socio-economic class 1.12 (95% CI-1.08-1.15), unemployed 1.07 (95% CI-1.02-1.12) and backward class 1.06 (95% CI- 1.03-1.10) were independently associated with concomitant risk factors.

Discussion

A community based cross-sectional analytical study was conducted among the adults residing in the selected rural areas of Puducherry to profile the NCD risk factors. There was high prevalence of physical inactivity, high salt intake, low intake of fruits selected vegetables. Around 95% of the study participants had more than one known risk factor for non-communicable disease. Male gender, being in lower socio-economic status, belonging to backward class and being unemployed were independently associated with having concomitantly higher number of behavioral risk factors.

Though previous studies have estimated the burden of known risk factors, very few studies have reported the burden of multiple risk factors. A study conducted by Zaman et al in Bangladesh showed that the prevalence of three or more than three non- communicable risk factors was 37%. Also, a study conducted by INDEPTH in rural India showed prevalence of multiple risk factors (three or more) to be not exceeding 25%.[9, 10] However in the current study just more than 60% of the participants had three or more risk factors. There is alarmingly high burden of concomitant risk factors among the adults in the current study setting. Worrying fact is that the previous studies included more than six risk factors but had relatively lower burden. Whereas, in the current study we explored only six behavioral risk factors of which three or more were present among higher proportion of participants compared to previous studies. The study population across the studies were comparable, except for the fact that the current had relatively higher proportion of the elderly compared to previous studies. The reason for this high burden of concomitant risk factors might be the potential reason for high burden of NCDs. However the relationship between the presence concomitant risk factors and early onset of NCDs needs to be explored in the current study setting.

The previous study conducted in Bangladesh showed that the ageing was associated with clustering of risk factors which was not found in this study population, but male gender were associated with clustering of risk factors in both the studies.[9] In the present study socio-economic status and caste were independently associated with concomitant risk factors. However similar association were not explored in the previous studies.

The present study population had 76.4% inadequate physical activity, which was much higher when compared to the reported prevalence from the same setting (54.2%).[10] The prevalence of high salt intake was 70.7% among the study participants, which was similar to the study conducted in Chennai.[11]These studies have shown that the amount of salt intake in both rural and urban settings were high when compared to the WHO recommendation of not more than 6g per day. The present study and a study conducted in Kerala, both showed very high prevalence of inadequate fruits intake, which was 68.2% and 87% respectively.[12] Similarly, more than half of the study participants were consuming inadequate amount of vegetables.The prevalence of low vegetable intake was relatively lower when compared to the study conducted in similar setting.[13]A study conducted among Asians showed that 100% of men and 99.8% of women in India were consuming inadequate fruits and

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vegetables.[10]The proportion of alcohol use and tobacco use in the present study population was 9.3% and 6.6% respectively, which was relatively lower when compared to the studyconducted in Kerala that showed the prevalence of alcohol use and tobacco use was 15.4% and 28% respectively.[14]However social desirability bias might have led to under reporting the behavioral risk factors and hence the under estimation of the same.

The current study has few strengths. First, the study had relatively good sample size to estimate the burden of known risk factors and also presence of concomitant risk factors. Second, standard guidelines adapted from STEPS were used to measure the known risk factors. Third, the investigators monitored in field for the completeness of data during the data collection. Fourth, the data management tools like EpiData software and Epicollect5 were used for data entry and hence ensuring the data quality during data entry. Fifth, we used generalized poisson model for assessing the association of socio-demographic factors with multiple risk factors. The previous studies had categorized the outcome (concomitant risk factors) using arbitrary cut-off of either three or four. As there are no standard guidelines for defining concomitant risk factors and also there are inherent problems in statistical inference on dividing the outcome into binary, we used generalized poisson model. The used model considered the outcome as the count data, with necessary adjustments for the under dispersion in the outcome data.

The study had few limitations. First, we failed to include the biochemical and anthropometric risk factors of non-communicable diseases. Including these risk factors would have given a better estimate regarding the concomitant risk factor burden. Second, the non-probability sampling was used to select the villages which were considered to be primary sampling units. However, socio-demographically the selected villages were comparable to the villages in the study setting. Third, multiple teams were involved in data collection. However we maintained at most standards in training and also field level assessment of risk factors. Fourth, the sample size might not have been adequate for exploring the association between socio-demographic factors and having multiple risk factors.

The current study shows alarmingly high burden of risk factors and more so with concomitant risk factors. There is need for qualitative exploration of reasons for this high level of risk factors in the community and also potential interventions to reduce the same. There is need for behavioral change communication and social mobilization activities to reduce physical inactivity and to improve the intake of fruits and vegetables. The self-help groups can be involved in raising the awareness regarding the known risk factors of NCDs and also to actively advocate for healthy lifestyle among their own community. Improving the access to physical activity through parks, play grounds and regular provider initiated sports completion needs to be tried. The availability and cost of fruits and vegetables can be optimized through community cooperative cultivation of the indigenous fruits and vegetables.

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