Original Article

Epidemiological study of non-communicable diseases (NCD) risk factors in tribal district of Kinnaur, HP: A cross-sectional study

CrossMark

Prakash Chand Negi [a,*], Raman Chauhan [b], Vivek Rana [c], Vidyasagar [d], Kavinder Lal [e]

[a] Professor and Head, Department of Cardiology, Indira Gandhi Medical College, Shimla, H.P., India
[b] Senior Resident, Department of Community Medicine, Indira Gandhi Medical College, Shimla, H.P., India
[c] D.M. Resident, Department of Cardiology, Indira Gandhi Medical College, Shimla, India
[d] District NCD Control Officer, Kinnaur, Himachal Pradesh, India
[e] OSD State NCD Programme Officer, Shimla, Himachal Pradesh, India

ABSTRACT

Background: There are no data available on the prevalence of non-communicable diseases (NCD) risk factors among the tribal population of hill state of Himachal Pradesh (HP). The epidemiological study of NCD risk factors was done in the tribal population of district Kinnaur of HP to estimate the burden of NCD risk factors and their risk determinants.

Methods: WHO STEP wise approach was used for screening of the core NCD risk indicators in 3582 randomly selected natives of Kinnaur aged 20–70 years by trained Health workers of the district health services.

Results: The hypertension was prevalent in 19.7% (18.4–21.1%) and diabetes in 6.9% (6.1–7.8%) of the population. Awareness of hypertension and diabetes was 39.8% and 40.8% respectively. The adherence to prescribed medications was reported in 52.1% and 56.4% of patients of aware hypertension and diabetes respectively. Overall, 23.3% and 8.5% of the patients with hypertension and diabetes had controlled BP and blood glucose respectively. Overweight and obesity were observed in 38.2% (36.6–39.9%) and 8.8% (7.9–9.8%) of the population respectively. The consumption of tobacco and alcohol was reported in 22.6% and 24.9% of the population, respectively, and 34.5% were physically inactive. Physical inactivity, BMI, high alcohol consumption, and age were independently associated with risk of hypertension, while age was the only determinant of risk of diabetes. Education and women gender had a significant influence on tobacco and alcohol consumption behavior adjusted for age.

Conclusion: NCD risk factors are prevalent in the tribal district of Kinnaur. The awareness, treatment, control of blood pressure and blood glucose were found to be suboptimum in the study subjects.

Interpretation: Strengthening of primary health care services and community based interventions are urgently required to improve awareness and control of NCD risk factors in this tribal district of HP.

1. Introduction

The burden of cardiovascular diseases (CVD) is assuming an alarming proportion in developing countries and is turning out to be a leading cause of mortality in India.[1,2] The CVD contribute about 23% and 30% of the total mortality in rural and urban population, respectively, in India.[3–6] The rising trends of morbidity and mortality owing to CVD are primarily because of increasing burden of CV risk factors. The rapid urbanization, industrialization, and globalization are the prime drivers of socioeconomic transition that in turn influences the health risk behavior leading to increasing burden of obesity, hypertension, diabetes and dyslipidemia that are well established risk factors for CVD and events. These CV risk factors are measurable and are modifiable, and thus become the important targets for cost effective intervention for prevention and control of CVD risk.[7] The epidemiological studies conducted by a number of investigators at different time period in different parts of the country have demonstrated rising trends of hypertension, diabetes, and obesity. In order to capture the true trends in CV risk factors strong sustainable NCD risk surveillance system is required using validated tools and following correct methods.

The surveillance is an important public health tool for estimating the burden, prioritization for formulating health policies and program, and impact evaluation. The surveillance of NCD risk factors predicts the future risk of NCD in the population. However, establishing sustainable surveillance system is resource intensive, thus posing a challenge to its feasibility in low income countries.[8,9] Kinnaur, the tribal district of HP is sparsely populated and is situated north east of the state bordering with south west of Tibet. There has been a rapid social and economic transitions in last 3–4 decades due to shift from economically less viable and more labor intensive mode of agriculture to economically more viable cash crop based horticulture as a source of income generation and livelihood coupled with installation of number of hydropower generation projects and construction of networking of roads connecting most of the villages in the district.[10,11] Thus, socio economic and environmental transition as part of process of development may lead to change in health behavior of the natives. There are no data available about the prevalent health risk behavior and biological risk factors of CVD among the natives of tribal population of Kinnaur.

This paper reports the prevalence of NCD risk factors and self reported CVD in the tribal district of Kinnaur of H.P. based on survey study conducted by trained health workers of district health care services.

2. Methods

2.1. Study area, study population and sample size

The study protocol was approved by institutional IRB. Kinnaur is a tribal district of Himachal Pradesh adjoining border with Tibet with 100% rural population. As per 2011 census, total population of Kinnaur is 84,121 and has four development blocks. Pooh, Kalpa, Nichar and Sangla with a population of 23,206, 19,190, 27,683 and 14,042 respectively.[11] The natives of District Kinnaur aged 20–70 years formed the target population. The sample size was estimated with assumed prevalence of diabetes mellitus as 5%, among the various behavioral and biological risk factors surveyed. To determine the prevalence of diabetes in men and women with 95% C.I. at 1% confidence limit of assumed prevalence on either side and with assumed participation rate of 90% the required sample size calculated was 3968.

2.2. Sampling method

Out of 68 Panchayats in the district, 60 Panchayats were selected, as there were no health workers posted in remaining 8 Panchayats. The eligible target population was selected from latest voter's lists of each Panchayats by simple random sampling method using random numbers generated by computer. The number of eligible subjects sampled from each selected Panchayats was based on probability proportionate to the size of the target population in respective Panchayats.

2.3. Survey tools

WHO STEPS survey instrument was used to determine the prevalence of WHO recommended core NCD risk indicators.[12] STEP 11 instruments used were digital BP recorder, OMRON model HEM 7201, flat surface spring balance weighing machine, glucometer model Romeo and SECA Stadiometer for measuring blood glucose and height respectively. The validation of each screening tool was done by comparing with standard reference instruments. Mercury sphygmomanometer was used for validating digital BP recorder. The weighing machine was cross checked using standard weights. The glucose value was cross checked using same sample for

glucometer based and fully automatic auto analyzer based estimation using standard kits and following standard procedures.

2.4. Survey team

Sixty health workers working as frontline health workers in the district health system were trained and formed the survey teams.

2.5. Survey supervisors

Four survey supervisors were employed as the contractual staff for the survey to monitor the quality of data collected. The existing health supervisors were also trained to perform the survey supervisory role for the future surveys.

2.6. Training of survey team and survey supervisors

The health workers were given training in Batches of 20 each for two days at State Health department training center at Parimehal, Shimla by the investigators and were coordinated by state National Rural Health Mission training division. The field survey supervisors (hired for the survey) and health supervisors of the health system participated during the entire course of training. The training included brief introduction about NCD and role of behavioral and biological risk factors as the underlying risk factors for NCD. This was followed by detailed explanation of WHO STEPS survey instrument to capture core NCD risk indicators. The methods of recording anthropometry, BP and estimation of Blood sugar with glucometer were discussed and demonstrated in detail to enhance their skills to use survey tools. This was followed by mock test in which, each participant was asked to administer the questionnaire to fellow participant and was closely observed by other participants and the trainers. If any mistake was observed, other participants were asked to correct it and investigators assisted if required. Thus, each participant was given opportunity to participate in the mock test. Pretest trial of using the survey instrument on 10 target subjects was done by each health worker in their respective area and review meeting cum refresher training was conducted after two weeks of this training at district headquarters of Kinnaur, Reckong Peo. The survey instruments filled up by the workers were randomly reviewed by the investigators. In this exercise any mistakes committed and queries raised by the health workers were addressed during the review meeting. The review of the filled up survey instruments by the health workers was found to be satisfactory.

2.7. Data quality monitoring

To monitor the quality of data being recorded by health workers four trained field supervisors monitored the processes of administering questionnaires and examination to record BP, weight and height in their respective blocks. The indicators of processes followed by each health workers were observed and the reports of the same from each respective block were periodically mailed from the field by the survey supervisors to coordinating center.

2.8. Survey period and methods

The Survey study was conducted from May, 2014 to July, 2014. The Health workers of respective Panchayat, which selected the subjects from random sampling method were contacted in person, the purpose of the survey were explained and their informed consent was obtained. The questionnaire based data were recorded through house-to-house visit by recording the responses in a separate room to ensure confidentiality of the responses and accuracy of the data recorded. Anthropometric data, recording of BP and blood sugar estimation were done in the sub center next morning in fasting state. Three readings of BP were recorded with a gap of 2–5 min using appropriate size BP cuff with the subject sitting comfortably on the chair, uncrossed legs resting on the ground after five minutes of rest. The arm was supported on the table at the level of heart. An average of three readings was taken as the BP value. Hypertension was diagnosed, if the average BP was ≥140 mmHg SBP and or DBP ≥90 mmHg and patients with Diagnosed hypertension on Medication even if BP was ≤140/90 mmHg. Height was recorded in centimeters to nearest 0.5 cm without shoes and hat if any, standing erect with closed heals, buttock and occiput touching against the wall using wall mounted Stadiometer Seca, subject looking straight ahead with aligning tragus of the ear and inferior margin of the orbit parallel to ground. Weight was recorded in light clothing without shoes subject standing erect after correcting for zero error keeping weighing machine on smooth flat hard surface. Weight was recorded in kg to nearest 0.5 kg. Blood sugar was estimated after 8–12 h of fasting with blood sample drawn with finger prick method using sterile lancet with glucometer and displayed reading was recorded. Diabetes was diagnosed if patients are on anti diabetic medications and or fasting blood glucose of ≥126 mg/dl. Overweight was diagnosed if BMI was ≥23 to 29.9 and obesity when BMI was more than 30. Harmful consumption of alcohol was labeled when consumption in a typical session was more than 5 pegs of standard alcohol drink. Patients of diabetes were labeled to have controlled blood glucose and BP if their fasting blood glucose was ≤110 mg/dl and BP of ≤140/90 mmHg.

The NCD risk factor survey was started from 1st week of May, 2014 and continued till end of July, 2014. The data entry was started simultaneously and was finished by the end of September. The data was entered in Excel spread sheet. This was followed by data cross checking for any out of the range values entered by using the data filter and any value found out of range was reconfirmed from the source document and appropriate correction was made. Once the data cross checking was complete, the data was locked for analysis.

2.9. Statistical analysis

The data were reported as percentages and mean ± sd for categorical and continuous variables respectively. The differences in the distribution of socio-demographic, health behavior characteristics and biological risk factors among men and women were compared using χ^2 for categorical variables and unpaired t test for normally distributed continuous variables. χ^2 and ANOVA tests were used to compare the significance of differences in the distribution of categorical variables and continuous variables with normal distribution across age

Table 1 – Gender wise distribution socio demographic characteristics of the study population.				
Characteristics	Overall	Men (n = 1632) 45.6%	Women (n = 1950) 54.4%	p-Value
Age	43.7 ± 12.7	43.2 ± 12.2	44.0 ± 12.5	0.2
Age groups				
20–29	525 (14.7%)	260 (15.9%)	265 (13.6%)	0.13
30–39	923 (25.8%)	429 (26.3%)	494 (25.3%)	
40–49	961 (26.8%)	430 (26.3%)	531 (27.2%)	
50–59	673 (18.8%)	302 (18.5%)	371 (19.0%)	
60–69	439 (12.3%)	180 (11.0%)	259 (13.3%)	
>70 years	61 (1.7%)	31 (1.9%)	30 (1.5%)	
Education status (literates) %	2900 (80.9%)	1493 (91.5%)	1407 (72.2%)	0.001
Illiterates	682 (19.0%)	139 (8.5%)	543 (27.8%)	
Primary schooling	1400 (39.1%)	681 (41.7%)	719 (36.9%)	
Sr. schooling	1106 (30.9%)	565 (34.6%)	541 (27.7%)	
Graduation/post graduations	394 (11.0%)	247 (15.1%)	147 (7.5%)	
Block wise representation				
Pooh	1101 (30.7%)	534 (32.7%)	567 (29.1%)	
Kalpa	815 (22.8%)	344 (32.7%)	471 (24.2%)	
Sangla	431 (12.0%)	193 (11.8%)	238 (12.2%)	
Nichar	1235 (34.5%)	561 (34.4%)	674 (34.6%)	

groups respectively. The multivariate logistic regression analysis was used to model the socio demographic and health risk variables as the risk determinants of hypertension and diabetes as the outcome variable. The strength of association was calculated as Odds ratio with 95% C.I. and also Multi variable logistic regression modeling was used in determining socio demographic characteristics as the determinants of tobacco and alcohol consumption and leading sedentary life as the health risk behavior outcomes using step wise approach. Two-tailed significance at <0.05 was taken as statistically significant. Epi Info version 3 was used for statistical analysis.

3. Results

3.1. Socio demographic characteristics (Table 1)

3580 randomly selected subjects were surveyed to estimate the prevalence of NCD risk factors. The mean age of study population was 43.7 ± 12.7 years, 1632 (45.6%) were men and proportion of the study population among men and women from different age groups surveyed was similar. Overall 80.9% of the study subjects were literate. The literacy rate and grade of education was found to be significantly higher among men in comparison to women.

3.2. Behavioral risk factors (Table 2)

The prevalence of tobacco and alcohol consumption was significantly higher among men than in women, 47.9% vs. 1.5% and 53.6% vs. 0.9% respectively. The prevalence increased with increasing age till about 60 years of age. Proportion of the population consuming vegetables and fruits daily was substantially low both in men (21.8% and 4.7%) and women (21.9% and 2.7%) respectively and across all the age groups. Overall men were physically more inactive than women 36.7%

vs. 32.6% ($p < 0.01$) and proportion of the population leading sedentary lifestyle increased after the age of 60 years.

3.3. Biological risk factors (Tables 2 and 3)

The prevalence of hypertension and diabetes was 19.7% (18.4–21.1%) and 6.9% (6.1–7.8%) respectively. The proportion of population with hypertension and diabetes increased significantly with increasing age ($p < 0.001$). The prevalence hypertension was significantly higher in men than in women 22.4% vs.17.5% ($p < 0.01$), while diabetes was more prevalent among women than in men 7.6% vs. 6.0% $p < 0.05$. The mean SBP and DBP increased significantly with age ($p < 0.001$). The mean blood glucose level was significantly low in men than in women [92.9 mg/dl vs. 95.7 mg/dl respectively ($p < 0.01$)] and the levels increased with age significantly ($p < 0.001$). Overweight and obesity were seen in 38.2% (36.6–39.9%) and 8.8% (7.9–9.8%) of the population, respectively. Proportion of the population with overweight and obesity was significantly higher among women than men ($p < 0.001$). The mean BMI in women was significantly higher than in men [23.6 ± 4.3 vs. 22.8 ± 4.0 ($p < 0.001$)] and BMI increased with age significantly till about 60 years of age ($p < 0.001$).

3.4. Prevalence of self reported MI/CVA (Table 2)

The overall prevalence of self reported MI/CVA was 4.4% (3.5–4.8%). It was found to be 3.9% in men and 4.5% in women. There was a trend of increasing prevalence with age in both the genders.

3.5. Socio demographic determinants of behavioral risk factors (Table 4)

Education and women gender had a significant independent influence on consumption behavior for tobacco, alcohol and in leading sedentary life style. Odds of consuming tobacco among

Table 2 – Gender wise distribution of NCD risk factors.

Characteristics	Overall study population	Men	Women	p-Value
Tobacco smoker	810 (22.6%) (21.3–24.0%)	781 (47.9%) (45.4–50.3%)	29 (1.5%) (1.0–2.2%)	0.001
Alcohol consumer	892 (24.9%)	874 (53.6%)	18 (0.9%)	0.001
Consumption of fruits	129 (3.6%)	76 (4.7%)	53 (2.7%)	0.01
Consumption of vegetables	783 (21.9%) (20.5–23.3%)	356 (21.8%) (19.8–23.9%)	427 (21.9%) (20.1–23.8%)	0.1
Sedentary lifestyle	1235 (34.5%) (32.6–37.4%)	599 (36.7%) (34.4–39.1%)	636 (32.6%) (30.5–34.8%)	0.01
Over weight (BMI 23–28.9)	1370 (38.2%) (36.6–39.9%)	599 (36.7%) (34.4–39.1%)	771 (39.5%) (37.4–41.8%)	0.04
Obesity (BMI > 30)	316 (8.8%) (7.9–9.8%)	106 (6.5%) (5.4–7.8%)	210 (10.8%) (9.4–12.3%)	0.001
Hypertension	706 (19.7%) (18.4–21.1%)	365 (22.4%) (20.4–24.5%)	341 (17.5%) (15.8–19.3%)	0.001
Diabetes	247 (6.9%) (6.1–7.8%)	98 (6.0%) (4.9–7.3%)	149 (7.6%) (6.5–8.9%)	0.05
CVD (CAD/CVA)	147 (4.4%) (3.5–4.8%)	64 (3.9%) (3.1%to 5.0%)	83 (4.5%) (3.4–5.3%)	0.67

Table 3 – Age group wise distribution of mean BP, blood glucose and BMI.

CV risk factors	Overall	20–29	30–39	40–49	50–59	60–69	≥70	p-Value
BMI (mean ± sd)	3555 (23.2 ± 4.2)	520 (21.7 ± 3.6)	918 (23.3 ± 4.0)	955 (23.8 ± 4.4)	666 (23.5 ± 4.2)	435 (23.1 ± 4.1)	61 (21.8 ± 3.5)	0.001
SBP (mean ± sd)	3569 (121.3 ± 18.9)	522 (114.3 ± 14.3)	921 (115.6 ± 13.4)	957 (121.7 ± 16.5)	669 (125.8 ± 18.9)	438 (131.7 ± 22.8)	61 (134.7 ± 23.7)	0.001
DBP (mean ± sd)	3569 (76.0 ± 10.5)	522 (72.2 ± 9.6)	921 (74.4 ± 9.2)	957 (77.5 ± 10.1)	669 (77.9 ± 11.6)	438 (77.3 ± 11.6)	61 (77.2 ± 12.3)	0.001
Fasting blood glucose (mean ± sd)	3554 (94.4 ± 22.5)	518 (90.3 ± 21.3)	918 (90.3 ± 15.8)	954 (94.8 ± 21.9)	666 (99.0 ± 26.6)	436 (99.7 ± 27.6)	1 (98)	0.001

women was significantly low compared to men (odds ratio of 0.01) and for leading sedentary life of 0.79 (95% C.I. 0.68–0.91) ($p < 0.004$).

3.6. Socio demographic and behavioral risk factors as the determinants of diabetes mellitus and hypertension (Table 5)

Age, leading sedentary life and consumption of harmful alcohol and BMI had strong and independent association with hypertension with adjusted odds of 1.05, 1.44, 5.5 and 1.09 respectively ($p < 0.01$). Gender also had an independent and significant association with hypertension with odd of hypertension in women was 0.64 ($p < 0.001$). Sedentary lifestyle, consumption of tobacco had no significant association with diabetes after adjustment of age and gender. Increasing age was the only important risk factor associated with diabetes.

3.7. Health seeking behavior, awareness, compliance for medications and NCD risk factors control (Figs. 1–4)

The proportion of women having had BP recorded in preceding 12 months was significantly higher than men 72.7% vs. 59.7% ($p < 0.001$). The overall awareness of hypertension was 39.8% among population with hypertension. The awareness about hypertension was more in women than men [(45.4% vs. 34.5%) $p < 0.01$]. Among population with aware hypertension, 52.1% were on antihypertensive treatment and 43.5% had controlled blood pressure. Overall only 23.2% of hypertensive population had controlled blood pressure. The control rate of blood pressure and blood glucose was not significantly different among men and women. Population seeking blood sugar estimation was significantly lower both in men (9.2%) and in women (8.0%). Overall, 40.8% of the patients with diabetes

Table 4 – Socio-demographic risk factors for health risk behavior, adjusted odds ratio.

Variables	Tobacco consumers		Sedentary lifestyle		Alcohol consumption	
	Odds ratio (95% C.I.)	p-Value	Odds ratio (95% C.I.)	p-Value	Odds ratio (95% C.I.)	p-Value
Age	0.98 (0.97–0.99)	0.001	1.00 (0.99–1.01)	0.11	1.00 (0.99–1.01)	0.055
Gender (women)	0.01 (0.008–0.018)	0.0001	0.79 (0.68–0.91)	0.002	0.008 (0.0005–0.012)	0.0001
Education level	0.91 (0.89–0.93)	0.001	0.98 (0.96–0.99)	0.04	0.95 (0.93–0.98)	0.001

Table 5 – Socio demographic and health risk behaviors as risk determinants of hypertension.

Term	Diabetes			Hypertension		
	Adjusted odds ratio	95% C.I.	*p*-Value	Adjusted odds ratio	95% C.I.	*p*-Value
Gender (female)	1.33	0.96–1.84	0.08	0.64	0.52–0.78	0.0001
Age in years	1.04	1.03–1.05	0.0001	1.05	1.05–1.06	0.0001
Sedentary lifestyle	1.16	0.88–1.52	0.27	1.48	1.23–1.77	0.0001
Tobacco consumption (yes)	1.22	0.82–1.81	0.31	0.98	0.76–1.20	0.88
Harmful alcohol consumption	1	–	–	5.5	1.84–17.0	0.002
BMI	1.03	1.00–1.06	0.01	1.09	1.07–1.11	0.001

were aware of having diabetes and out of which about 56.4% were on treatment and 20.7% of the patients with diabetes on treatment had controlled blood glucose. Similarly, the proportion of men and women, who were getting their blood lipid levels checked was low (6.7% vs. 4.1% respectively). Population using traditional medicines for control of BP and blood sugar was low (3.2% and 2.5% respectively).

4. Discussion

The prevalence of behavioral and biological NCD risk factors were assessed in tribal district of Kinnaur in HP through trained health workers of the health care system. The data revealed that health behavior of adult population of remote tribal district of HP is not conducive for promoting cardiovascular health. About one third of the population was physically inactive, vegetables and fruits were consumed by just less than one fifth of the population mostly during vegetable and fruits season. About one fifth of the population was consuming tobacco and alcohol. The prevalent health risk behavior of the tribal population was reflected by high prevalence of overweight and or obesity (48%), hypertension (19.7%) and diabetes mellitus (6.9%) that is similar to other rural population in the country.[13,14] The prevalence of hypertension observed in present study is lower than the prevalence reported from rural population in Utrakand[19] (30.9%) and higher than the reported prevalence from rural population of Haryana in 1999 (4.5%)[20] and 7.2% from rural population of Maharashtra.[18]

The analysis of socio-demographic characteristics as the determinants of health risk behavior revealed that education level and gender were independent determinants of leading sedentary life, consuming tobacco and alcohol. The risk of tobacco and alcohol consumption decreased significantly with

Increasing level of education adjusted for age and gender odds ratio of 0.98 (95% C.I. 0.96–0.99) and 0.95 (0.93–0.98). Thus, the present study suggests that education influences the tobacco consumption behavior favorably as has been observed in other epidemiological studies.[15] Gender was an important determinant of tobacco consumption behavior in the tribal population of Kinnaur and is being consumed primary by the men folks. The odds for consumption of tobacco among women were significantly low [odds ratio 0.012 (95% C.I. of 0.008–0.018) *p* < 0.0001]. Tobacco consumption increased till the age of about 60 years and declined later. Consumption of vegetables was similar in men and women across all the age groups.

The association of demographics and behavioral risk factors with hypertension and diabetes mellitus revealed increasing age, sedentary lifestyle, harmful consumption of alcohol and BMI were the independent risk factors for hypertension while age was the only risk factor observed for diabetes mellitus although there was a trend of increased risk among people leading sedentary lifestyle [adjusted odds ratio 1.15 (95% C.I. 0.88–1.51)]. Tobacco consumption had no association with diabetes mellitus and hypertension adjusted for age, gender and physical inactivity. The association of BMI, age, and high alcohol consumption with hypertension was also reported in other epidemiological studies.[18–20] However, its association with tobacco consumption is not consistent.[18,19] Thus, observation of an independent and significant association of physical inactivity, increasing BMI and high consumption of alcohol has important implications from the perspectives of public health intervention for prevention and control of hypertension.

One of the major challenges in reducing the morbidity and mortality related to CVD is control of hypertension and diabetes sustainably. Large proportion of hypertensive and diabetic patients are unaware of having hypertension and
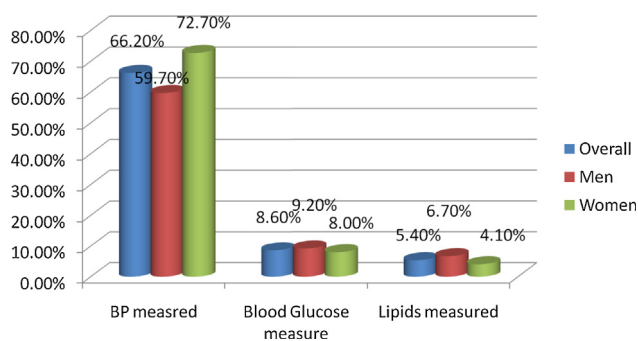

Fig. 1 – Proportion of population getting BP, Blood glucose and lipid levels measured in preceding 12 months.
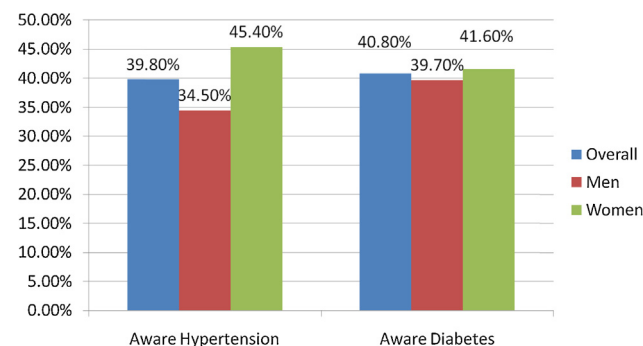

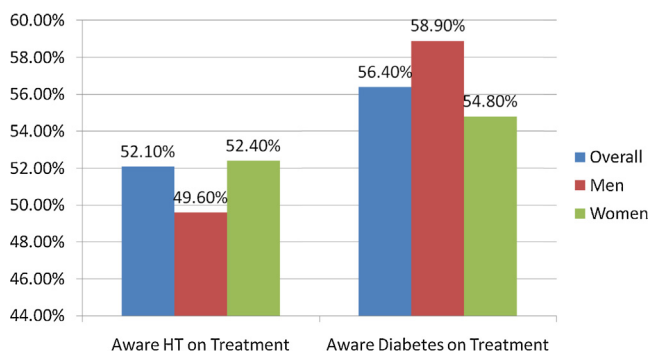**Fig. 2 – Proportion of hypertensive and diabetic population with aware hypertension and diabetes.**

Fig. 3 – Proportion of the patients with aware hypertension and diabetes on treatment.
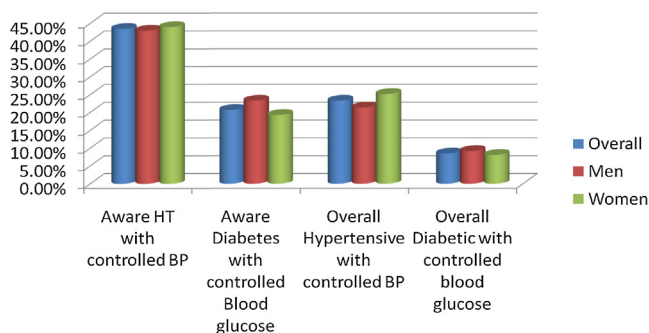

Fig. 4 – Proportion of aware hypertension and diabetes with controlled BP and Blood glucose.

diabetes and thus are not treated and controlled. Even among patients with aware hypertension and diabetes proportion of patients taking prescribed medications are low which varies from population to population. Thus, effectively patients with hypertension and diabetes with controlled BP and blood glucose is very small. In present study only 39.8% and 40.8% of the patients with hypertension and diabetes, respectively were aware of their diagnosis and 52.1% and 56.4%, respectively among them were compliant to their prescribed medicines but only 43.5% and 20.7%, respectively had their blood pressure and blood glucose controlled. Overall, only 20.3% of the hypertensive and 8.5% of the patients with hypertension and diabetes had their BP and blood glucose controlled. Thus large proportion of hypertensive and diabetic population have uncontrolled blood pressure and blood glucose level.

The awareness about hypertension was reported to be 32.8% in urban population of Chennai and 51.5% in Parsi community in Mumbai while compliance for medication was higher in Chennai and Mumbai compared to tribal population of Kinnaur 70.8% and 63.5%, respectively. Proportion of hypertensive patients with controlled BP was 45.9% in the Chennai urban population[16] and was significantly low in Parsi community 13.6%.[17] The status of awareness of hypertension and compliance for medication and overall control of BP was reported to be dismal among rural population of Haryana, 26.3%, 15.8% and 3.5%, respectively.[20]

Thus there is a need to identify and address the barriers in improving health seeking behavior, early detection, compliance for medication, and control of BP and blood glucose.

The health seeking behavior of the tribal population was satisfactory. Blood pressure recorded in previous one year among men and women is 59.7% and 72.7% respectively. This could be related to antenatal check up services delivered by primary health care centers to pregnant women. However, the blood sugar screening was not significantly different among men and women and only less than 10% got their blood sugar estimated. The low level of screening for blood glucose level in the population could be related to lack of awareness about importance of screening for blood glucose and may also be due to lack of availability and accessibility for the estimation of blood glucose level in the study area.

There is a need for strengthening of primary health care services in the health care system to initiate appropriate responses at population and health care centers level to improve health literacy of community to facilitate self referral for screening and detection of high risk group and implementation of evidence based risk management to reduce the increasing trends of NCD risk factors and morbidity and mortality related to NCDs.

4.1. Summary

The epidemiological study of NCD risk factors, their determinants, health seeking behavior and compliance to medication was conducted in the tribal population of Kinnaur. The data revealed that behavioral and biological CV risk factors are prevalent in the population. Awareness about diabetes mellitus is low. Compliance to treatment for control of hypertension and diabetes mellitus is less than 50% and overall control of blood pressure and blood glucose was very low. Physical inactivity, increasing BMI and harmful alcohol consumptions were the modifiable health risk behavior associated with risk of hypertension. Education had a significant favorable influence on tobacco and alcohol consumption behavior. There is an urgent need for launching aggressive community health education activities for creating awareness about health risk behaviors and their health consequences and importance for getting BP and blood glucose levels measured periodically. There is also a need for strengthening of primary health care services for opportunistic screening for high risk groups and their evidence based management. An effective and strong electronic health recording system to monitor and track the adherence to medications and risk factor management of the patients needs to be put in place. The sustainable NCD risk surveillance system could be established in the health care system by training frontline health workers to monitor the trends and evaluate the outcomes of the national NCD risk and NCD control program.

4.2. Limitations

Diabetes mellitus was diagnosed based on capillary blood based estimation of blood sugar using glucometer. It is likely that overall values may be higher than venous blood based

estimation thus estimates of diabetes mellitus may have been over estimated.

4.3. Strengths

This is the first study in the state of HP, where data related to NCD risk factors are collected in district representative sample. The study was conducted by the trained frontline health workers thus raises the hope of establishing sustainable NCD risk surveillance system in the district.

4.4. Funding source

Study was funded by NIH as a part of PH leadership training program of the Dr. P.C. Negi under Rollins School of Public Health Emory University Atlanta, Georgia, USA and Public Health Foundation of India, New Delhi and by NRHM, HP.

Conflicts of interest

The authors have none to declare.

Author contributions

Prakash Chand Negi: Involved in conceptualizing the study, study designing and study implementation, Training of the health care workers, Monitoring the study progress, Data analysis and manuscript writing. Raman Chauhan: Training of survey teams and Sampling of study population by generating random numbers from computer. Vivek Rana: Review of literature and Assisted in manuscript writing. Vidyasagar: Monitoring of implementation of NCD survey study. Kavinder Lal: Providing logistic support for conducting training of survey team at state training center Parimahal.

Acknowledgements

REFERENCES

1. Reddy KS, Yusuf S. Emerging epidemic of cardiovascular disease in developing countries. *Circulation*. 1998;97:596–601.

2. World Health Organization. *Non-communicable Diseases in South-East Asia Region. A Profile*. New Delhi: World Health Organization; 2002.

3. *Report on Causes of Death in India 2001–2003. Office of the Registrar General, India*. Ministry of Home Affairs: New Delhi; 2003

4. *Burden of Disease in India, Background Papers for the National Commission on Macroeconomics*. New Delhi: Ministry of Health and Family Welfare, Government of India; 2005.

5. Gupta R. Burden of coronary heart disease in India. *Indian Heart J*. 2005;57:632–638.

6. *Report of the ICMR – WHO Study on Assessment of Burden of Non-communicable Diseases*. New Delhi: Indian Council of Medical Research; 2006.

7. Gupta R, Joshi P, Mohan V, Reddy KS, Yusuf S. Epidemiology and causation of coronary heart disease and stroke in India. *Heart*. 2008;94:16–26.

8. Mohan V, Deepa M, Farooq S, Prabhakaran D, Reddy KS. Surveillance for risk factors of cardiovascular disease among an industrial population in southern India. *Natl Med J India*. 2008;21:8–13.

9. Behavioral Risk Factor Surveillance System. National Center for Chronic Disease Prevention and Health Promotion. Available from: http://www.cdc.gov/BRFSS/ [accessed 25.07.08].

10. Directorate of Economics and Statistics. *Statistical Abstracts of Himachal Pradesh*. 1989–90.

11. Department of Economics & Statistics Himachal Pradesh. *State Statistical Abstract of Himachal Pradesh*. 2013–14.

12. *Surveillance of Risk Factors for Non-communicable Diseases. The WHO STEPwise Approach Non-communicable Diseases and Mental Health*. Geneva: World Health Organization; 2003. Available from: http://www.who.int/ncd_surveillance/steps/riskfactor/en/index.html [accessed 25.11.14].

13. Shah B, Mathur P. Surveillance of cardiovascular disease risk factors in India: the need & scope. *Indian J Med Res*. 2010;132:634–642.

14. Chow C, Cardona M, Raju PK, et al. Cardiovascular disease and risk factors among 345 adults in rural India the Andhra Pradesh Rural Health Initiative. *Int J Cardiol*. 2007;116:180–185.

15. Kuulasmaa K, Tunstall-Pedoe H, Dobson A, et al. Estimation of contribution of changes in classic risk factors to trends in coronary-event rates across the WHO MONICA Project populations. *Lancet*. 2000;355:675–687.

16. Mohan V, Deepa M, Farooq S, Datta M, Deepa R. Prevalence awareness and control of hypertension in Chennai—the Chennai Urban Rural Epidemiology Study (CURES-52). *J Assoc Phys India*. 2007;55:326–332.

17. Bharucha NE, Kuruvilla T. Hypertension in Parsi community in Bombay: study of awareness and compliance to treatment. *BMJ Public Health*. 2003;3:1–6.

18. Todker SS, Gujarathi VV, Tapare VS. Period prevalence and sociodemographic factors of hypertension in rural Maharashtra: a cross sectional study. *Indian J Community Med*. 2009;34:183–187.

19. Bansal SK, Saxena V, Kandpal SD, Gray WK, Walker RW, Goel D. Prevalence of hypertension and hypertension risk factors in rural Indian community: a prospective door to door study. *J Cardiovasc Dis Res*. 2012;3:117–123.

20. Malohtra P, Kumari S, Kumar R, Jain S, Sharma BK. Prevalence of hypertension and determinants of hypertension in unindustrialized rural population of north India. *J Human Hypertens*. 1999;13:467–472.