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Comprehensive Glance at NCDs: Insights from a North-Eastern State on Diabetes, Hypertension and Cardiovascular Risk

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ABSTRACT

Background: With the rampant rise in globalization and urbanization, there is an alarming escalation in the burden of common Non-communicable diseases which are the prime causes of mortality and morbidity especially in a country like India, a country in rapid demographic transition.

Objectives: This study was conducted to estimate the burden of Hypertension and Diabetes along with 10 year fatal and nonfatal cardiovascular risk estimation.

Methods: A cross-sectional population-based study was conducted among adults aged 18 and above in Manipur. The study outcome was to estimate the prevalence of hypertension and diabetes using a validated questionnaire adapted from WHO PEN along with 10 year fatal and non-fatal cardiovascular risk using the WHO/ISH chart. Statistical analyses like mean, chi-square, and logistic regression tests were conducted. P value <0.05 was considered statistically significant.

Results: Of the 560 participants, 27.5% were hypertensive and 10.7% were diabetic. One in three of them had one of the NCDs and 5.7% had NCD multimorbidity. Higher age group [odds ratio (AOR): 5.2], inadequate physical activity [AOR: 2] and overweight [AOR:2] were significantly associated with the burden of hypertension whereas diabetes was significantly associated with higher age group [AOR: 9.5] and abdominal obesity. [AOR: 3]. A quarter of them had 10-19% risk of CVD and 10.7% of the individuals had 20-30% risk of developing CVD in the next 10 years.

Conclusion: A quarter of respondents were hypertensive which mirrors the rule of halves for hypertension, one in 10 of respondents were diabetic and a quarter of them had a CVD risk of 10-19%. Despite the high burden of these diseases, a majority of them were under diagnosed mandating the need for cost-effective, high-quality interventions in low-resource settings.

Key Words: *Diabetes, Hypertension, Cardiovascular risk, WHO PEN, STEPS survey, WHO ISH risk, Manipur, North-East India.*

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INTRODUCTION

Over the years, Non-communicable diseases (NCDs) have evolved into a major constituent of public health challenge with enormous human, economic and social repercussions. Globally, 70% of the deaths are attributed to NCDs with the low-and-middle-income countries (LMIC) affected disproportionately [1,2]. Cardiovascular diseases (CVDs) as the leading cause of NCD deaths are responsible for 17.9 million deaths globally and majority are due to metabolic risk factors like hypertension and diabetes [3,4]. The Indian subcontinent accounts for more than two-thirds of NCD deaths in the WHO SEAR and in Manipur, a North Eastern state of India, 23% of the population are reported to have elevated blood pressure and about 6.2% of the population have very high blood glucose levels [5-8]. NCD Multimorbidity, predominantly affects the LMIC posing an additional challenge to the health systems [9]. With a global aim to reduce the burden of NCDs, especially in the low-resource settings, WHO formulated several packages and tools like the Package of Essential NCDs (WHO PEN), WHO STEPs approach and WHO CVD risk prediction charts which encompasses cost

effective interventions that can be used in low-resource settings to combat major NCDs. In addition, the CVD risk prediction chart aids in identifying at risk patients which would further enable an effective and timely intervention for fatal and non-fatal CVD [10].

There are no published literature which provides a comprehensive picture of NCDs in Manipur and hence this study aimed to estimate the burden of Diabetes and Hypertension along with the 10 year fatal and nonfatal CVD risk in the state. This will ultimately facilitate and assist in policy making for scaling up the planning and implementation of NCD programs.

METHODS

Study design and sampling

A cross-sectional study was carried out from May 2018 to April 2021 among the general populations in the urban and rural population of Imphal East and West, Manipur. The calculated sample size was 530, taking a prevalence at 21.2%, with 5% allowable error and design effect of 2 at 95% confidence interval [12]. A multi-stage stratified random cluster sampling with random selection based on simple random sampling was done. Fig. 1 demonstrates the sampling technique done in the study

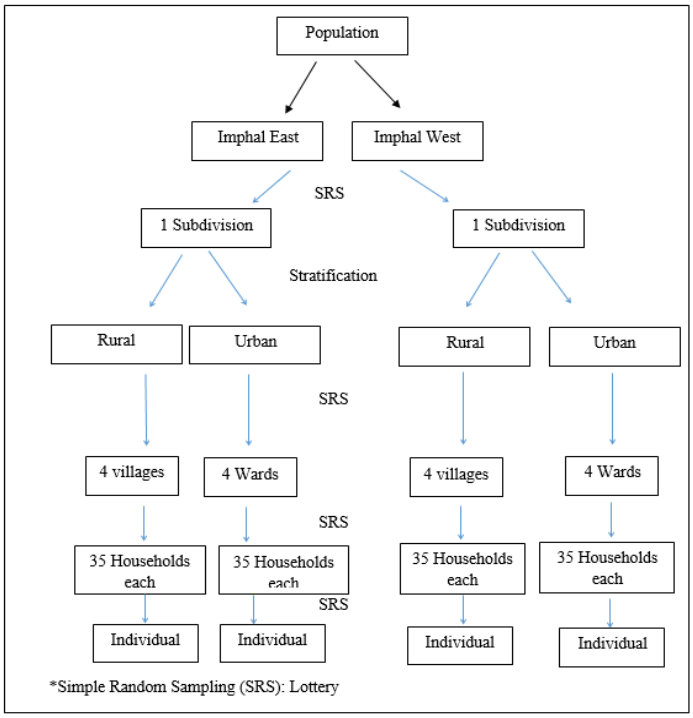

Fig. Sampling method for Estimation of Hypertension and Diabetes

Instrument and data collection

Data collection was done using using a pre-tested validated interview schedule adapted from WHO PEN, WHO STEP wise approach and WHO/ISH cardiovascular risk assessment chart for South East Asia sub Region- D [1,10&11].The interview schedule was divided into two major parts wherein Socioeconomic and demographic parameters and family history of NCDs constituted the first part and the second part included high risk behavioural factors like smoking, alcohol intake, dietary pattern and physical activity. Blood pressure was estimated using a WHO recommended OMRON M6 where two readings each for systolic (SBP) and diastolic (DBP) were taken and the average of it was considered as the final reading of SBP and DBP respectively. Blood glucose levels were measured using Morepan BG-03 either as fasting or random based on meal time of the participant. Appropriate chart for population specific risk assessment of CVD was identified and chosen (SEAR sub-D) and the chart was plotted in individuals aged 40 years and above using the parameters like diabetes, gender and Systolic blood pressure. The colour of the cell in the WHO CVD risk chart depicted the 10-year cardiovascular risk in terms of percentages. Participants who were found to be diabetic, hypertensive or had a raised CVD risk were referred to the appropriate health centre for further management.

Table 1: Operational Definitions

Diabetes	On insulin or any oral hypoglycaemic drugs or a fasting blood glucose levels above 125mg/dl or a Random blood glucose levels above 200mg/dl[1]
Hypertension	Stage 1 and stage 2 Hypertension according to WHO PEN[1]

Current smoker	Smoked tobacco or consumed smokeless tobacco at least once in the last 6 months[11]
Daily smoker	Smoked tobacco or consumed smokeless tobacco everyday[11]
Past smoker	Stopped and never smoked or chewed tobacco in the last 6 months[11]
Passive smoker	Ever exposed to second hand smoke at home or workplace[11]
Adequate physical activity	At least 600 MET-minutes[11]
Sedentary behaviour	More than 2 hours spent in a day reclining/sitting[11]

Statistical Analysis

The data was entered into MS excel spreadsheet and analysed using IBM SPSS V 20. Descriptive statistics such as mean, median and percentages were used to describe the data. Analytical tests like Chi-square, T test were used.A p value of <0.05 was considered statistically significant. Risk ratios for Diabetes and Hypertension were estimated using Logistic regression and variables with p <0.1 were entered into the multivariable regression model.

Ethical issues

Ethical approval was obtained from institutional ethics committee of the State medical college and written informed consent taken from each participant before the start of interview.

Role of funding source

The study was funded by Indian Council of Medical research (ICMR). The study funder had no role in the study design, collection, analysis, interpretation and reporting of data. The corresponding author had full access to the data and the final responsibility to submit for publication

RESULTS

Socio-demographic characteristics of the participants:

Data was collected from 560 participants wherein the mean age of the participants were 44.2 (SD-16.2) and majority of them (76%) were 30 years and above.

Table 2: Demographic characteristics of study participants

Variables	Categories	N (%)
Gender	Male Female	284 (51) 276 (49)
Age group (years)	18-29 30-44 45-59 60 and above	133 (23.8) 169 (30.2) 130 (23.2) 128 (22.9)
Residence	Rural Urban	245 (44) 315 (56)
Religion	Hindu Christian Islam	390 (69.6) 50 (8.9) 120 (21.4)
Level of education	Illiterate Primary Secondary Graduate & above	76 (13.6) 101(18) 303(54.1) 80 (13.3)
Occupation	Salaried Homemaker Student Unemployed/ Retired	271 (48.4) 164 (29.3) 73 (13) 52 (9.3)
Marital status	Unmarried Married Divorced/ Widowed	103 (18.4) 418 (74.6) 39 (7)
Monthly income (rupees)	Less than 8000 8000-11,999 12,000-22,000 More than 22,000	363 (64.8) 66 (11.8) 66 (11.8) 65 (11.6)

Table 3: Unadjusted prevalence of Lifestyle risk Factors of NCDs by Gender

Variables	Total (N=560)	
	Male (N=284)	Female (N=276)
Current use of tobacco (any form) (N=354)	185 (65.1)	160 (58)
Smoking Tobacco use		
Ever smoked (N=152)	127 (44.7)	25 (9.1)
Current smoker (N=106)	88 (30.9)	17 (6.1)
Smokeless tobacco use		
Ever smoked (N=333)	168 (59.2)	165 (59.8)
Current smoker (N=310)	158 (55.6)	152 (55)
Passive smoking		
At home	28 (9.9)	29 (10.5)
At workplace	22 (7.7)	6 (2.2)
Alcohol use		
Ever consumed	206 (72.5)	41 (14.9)
Consumed in last 12 months (N=211)	179 (63)	32 (11.6)
Consumed in last 1 month (N=95)	83 (29.2)	12 (4.3)
Physical Activity Inadequate (N=346)	196 (69)	150 (54.3)

Data are n(%)

Behavioural risk factors of NCDs

Table 3 demonstrates the behavioural risk factors for NCDs.More than two-thirds of the participants reported to currently smoke either tobacco products or smokeless tobacco products or both, in which, rate of usage was higher among men when compared to women. Amongst those currently smoking tobacco, 31.1% reported to smoke on daily basis whereas the rest 68.9% smoked every week. Participants smoked a mean of 2.48(±1.2) cigarettes or 2.9 bidis every day. It was reported that study subjects reported initiation of smoking cigarette or bidi as early as 15 years and even as late as 50 years. Only 30.3% of the ever smokers quit smoking within a mean duration of 12.7(±11.6) years. Regarding the consumption of smokeless tobacco, among the 55.4% of those who currently chew tobacco 47% chewed it every day while the rest chewed it on weekly basis. Those who chewed every day, consumed a mean of 2.78(±1.5) packets whereas weekly users consumed 3(±1.2) packets on average. Median duration of daily and weekly chewers were 21 years and 23 years respectively. As few as 6.9% of the respondents quit smokeless tobacco. Though 71.1% of individuals who have ever smoked tobacco were counselled by their doctor to quit smoking, only 39.3% of tobacco chewers were counselled to quit smokeless tobacco. Only 44% of the respondents have ever consumed alcohol where as 37.6% of them have consumed in the last 1 year. The most commonly consumed type of alcohol was whiskey (47.4%) followed by Rum, vodka and locally brewed alcohol like sekmai. As low as 7.1% of the current users reported to have binge drank ((≥6 Standard drinks≈180ml) alcohol in the past one month. Only 38% of the respondents met the adequate criteria of physical activity level by WHO and almost all the participants (99.6%) exhibited sedentary behaviour.

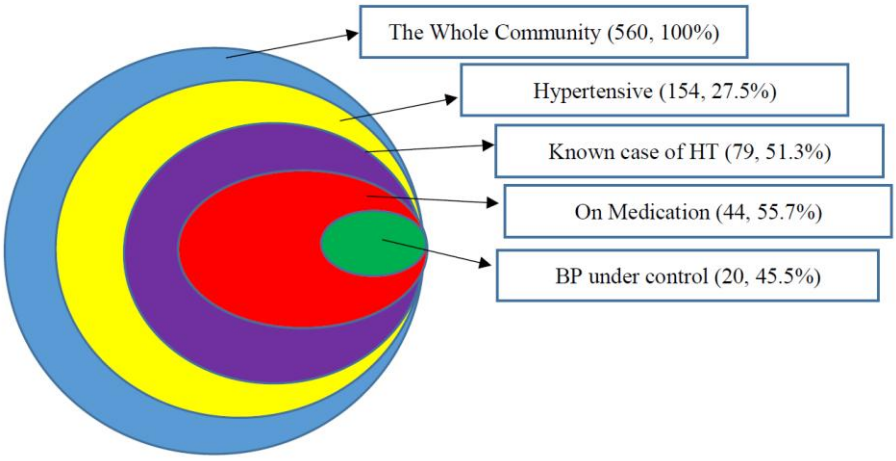

Fig. 2 Prevalence of Hypertension –Rule of halves (N=560)

Metabolic risk factors of NCDs:

In our study, the prevalence of hypertension among the respondents mirrored the rule of halves of hypertension in a community. Amongst the 27.5% of them who were hypertensive, only half (51.3%) of them were aware of their status of hypertension. Amongst the known hypertensives, only half of them were on allopathic medication (55.7%) and there was no report of treatment from herbal or traditional medicines. Whilst, out of those on medication, nearly half of them were had BP under adequate control (Fig. 2). Most hypertensives remained undiagnosed and were more marked in the rural settings and among females. Male respondents had a significantly higher mean SBP when compared to females (p value<0.001). Similarly, those who had inadequate physical activity levels and were current smokers had a significantly higher mean SBP (p value <0.001).Additionally, the mean years of smoking tobacco products were significantly higher among those who were hypertensive (30.7±10.4) when compared to those who were not (19.9±13.4).

Table 4: Unadjusted prevalence estimates of Diabetes Mellitus and 10 year cardiovascular risk

	Total N=560 N (%)
Diabetes	
Overall prevalence	60 (10.7)
Known case of diabetes	50 (83.3)
Currently on medication	34 (68)
Blood Glucose Under control	25 (73.5)
10 year Cardiovascular disease risk (N=327)	
<10%	204 (62.4)
10-20%	84 (25.7)
20-29%	23 (7)
30% and above	16 (4.9)

The overall prevalence of Diabetes mellitus in our study was estimated to be 10.7% wherein almost all of them knew their status of diabetes, of whom more than two thirds of them were on medication for diabetes (Table 3). Participants in this study had a mean blood glucose level of 116.3 (±43.1) and the prevalence of diabetes was almost equal in both the men (10.9%) and women (10.5%) in our study. The mean years of smoking tobacco products were significantly higher among those who were diabetic (30.7±6.7) when compared to those who were not (23.2±14.1). Cardiovascular risk assessment done in individuals aged 40 and above revealed that a quarter of them had a 10-20% risk of impending fatal or nonfatal CVD. CVD risk was also significantly higher among individuals who had inadequate physical activity levels. About 5.7% of the population had multi-morbidity wherein they had both diabetes and hypertension.

Table 5: Multivariable Logistic Regression analysis for NCDs with selected risk factors

Variables	**Diabetes (N=60)**		**Hypertension (N=154)**		**Any one NCD (N=182)**		**Multimorbidity (N=32)**	
	Adjusted OR (95%CI)	P value	Adjusted OR (95%CI)	P value	Adjusted OR (95%CI)	P value	Adjusted OR (95%CI)	P value
Education								
Illiterate	4(1.2-12.82)		2.79(1.36-5.73)	**0.001**	3.17(1.55-6.5)	0.001	2.63(1.11-13.8)	**0.01**
Primary	2.5(1.2-8.26)	**0.02**	1.87(1.92-3.79)		2.08(1.1-4.18)		2.36(1.47-11.9)	
Secondary	1.6(1.1-4.67)		1.22(1.11-1.63)		1.01(0.5-1.84)		1.06(0.22-5.06)	
Graduate	1		1		1		1	
Occupation								
Unemployed	Not retained	-	Not retained	-	Not retained	-	2.28(1.21-5.26)	
Salaried							1	
Marital status							Not retained	-
Unmarried	1	0.2	1	0.03	1	0.01		
Married	1.6(0.7-3.63)		1.75(1.14-2.96)		1.91(1.4-3.20)			
Current smoker								
Yes	2(1.1 to 3.9)	0.03	1.64(1.05-2.54)	0.02	1.70(1.1-2.60)	0.01	2.62(1.04-6.59)	0.04
No	1							

			1		1		1	
Physical activity Inadequate Adequate	Not retained	-	2.42(1.56-3.77) 1	0.001	2.31(1.53.52) 1	<0.001	Not retained	-

Evidence states, lifestyle risk factors are major drivers for NCDs. In our study, individuals with lower education were more likely to be diabetic or hypertensive or both. Individuals who were unemployed were twice likely to have multimorbidity. Participants who were married had significantly higher risk of being hypertensive or having any one of the NCD. Respondents who were current smokers had twice the risk of having NCDs whereas individuals who were physically inactive more likely to be hypertensive or have any one of the NCDs. However, risk factors like Gender, residence, monthly income, religion and alcohol usage were not significant in the multivariable regression model.

DISCUSSION

Unhealthy diet, physical inactivity, harmful use of alcohol and tobacco use has led to the alarming upsurge in common NCDs like Hypertension, Diabetes and Obesity further amplifying the risk of fatal and non-fatal Cardio-vascular diseases. Rapid urbanization in India has resulted an epidemiological transition from infectious diseases to NCDs wherein the lifestyle risk factors are major drivers.

Burden of hypertension in our study (27.5%) corroborated with the prevalence of Hypertension estimated by NFHS-5 in our state [8].Although the national program for NCD is fully functional yet in our study only half of the hypertensives knew their diseases status which in turn poses dire need for not only scaling up of NCD screening mechanisms but also for monitoring the NCD related interventions in the state. Evidence states than targeted health education, early diagnosis and management of Hypertension would in turn benefit the community as even 2mmHg reduction in DBP is associated with 17% decrease in prevalence of Hypertension and 6% reduction in the risk of Cardiovascular diseases in the community [13].Similar to the NFHS-5 results, in our study too, the prevalence of Hypertension was higher among men than women [8]. Contrastingly, Shah et al estimated the prevalence of HT among Muslims in Manipur to be 16.6%, wherein our study 27.5% of those belonging to Muslim community were hypertensive [14]. On the other hand, in a study conducted in Bangalore about 35.5% of them were hypertensive [15]. This enormous difference in the burden of Hypertension to our study might be because of the further rapid urbanization of metro cities. Nevertheless, hypertension burden was identical in both urban and rural residents of our study depicting hypertension is no more solely a disease of the urbanised cities but we are also witnessing an alarming rise in the rural areas too.

About 10.5% were diabetic (≥200 mg/dl) in this study whereas in NFHS-5, 13.6% of women and 16.5% of men had high blood glucose levels (>140mg/dl) [8]. The discrepancies in the burden might be owed to the difference in definitions or methodology of measuring diabetes in the respective surveys. However, only 40% have ever measured their blood glucose levels and amongst the individuals with diabetes, though 83.3% of them were aware of the status, only 68% of them were on medication for diabetes, mandating the need for awareness generation among at-risk individuals.

As for the preventable risk factors of NCDs, 62% of them used any form of tobacco which was higher when compared to studies conducted in Northern India [17,18]. The higher usage of tobacco, especially smokeless tobacco, might be due to higher level of cultural acceptability of tobacco use and lower levels of stigma for tobacco usage among females in north eastern states in comparison to rest of the states in India. Only third of smokers and 6.6% of tobacco chewers reported quitting of tobacco products, this directs the necessity for behaviour change interventions at both individual and community level and to adopt environmental tobacco use prevention interventions. There is also a need for ensuring easy accessibility to de-addiction centres and tobacco replacement therapies through the state national program for Tobacco control.

Ours is the first study to estimate the 10 year cardiovascular risk in Manipur, wherein more than two-thirds (37.6%) of them had a 10% and above risk of developing CVD in the next ten years. This obligates the need for implementation of CVD risk assessment of all at risk individuals at the primary health settings using WHO/ISH charts to further prevent fatal and non-fatal cardiovascular complications. Health care workers at all levels need to be mandatorily trained in assessing the CVD risk of every individual aged 40 and above attending the health centre.

Nonetheless, our study is not devoid of any limitations. The estimates of burden of NCDs in this study are limited only to the valley districts of Manipur. Considering the fact that the risk behaviours and lifestyle patterns drastically vary between the hilly and valley districts, and additionally primary health care facilities are and NCD services are usually hard-to-reach or deficient in hilly districts, it is imperative to enumerate the burden even in the hilly regions. WHO/ISH also recommends the usage of cholesterol levels in CVD risk estimation which would yield a more precise risk, which unfortunately was not included in our study. Our data also relied on self-report for certain lifestyle risk factors, hence the

possibility social desirability bias cannot be ruled out. Measurement of fasting blood glucose levels rather than random glucose levels might yield precise estimates of burden of Diabetes and additionally single time estimation of blood pressure readings might overestimate the burden of Hypertension due to a variety of variations.

Therefore, our estimates not only highlights the probable areas for interventions to help lower the burden of NCDs but also stresses on the need for implementation of WHO Package of essential non-communicable diseases (PEN) in low resource settings.

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