Original Article

A Community-Based Noncommunicable Disease Prevention Intervention in Punjab, India: Baseline Characteristics of 11,322 Adults

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Abstract

Background: Noncommunicable diseases (NCD) are the leading cause of death in India, with cardiovascular diseases (CVD) in particular accounting for nearly 1 in 3 deaths. The prevention of key CVD risk factors – namely, diabetes and hypertension – is a public health priority. **Objectives:** The objective is to describe the results of large-scale, community-based NCD screening using the Government of India's Community Based Assessment Checklist (CBAC) scoring system. **Materials and Methods:** Trained enumerators visited each household in 10 villages in Punjab, India, between September 2019 and March 2020. Standardized methods were used to measure blood pressure, blood glucose, waist circumference, family medical history, and lifestyle behaviors. **Results:** A total of 11,322 adults (52.1% women; mean age 48.3 years) completed the assessment and 14.4% were classified as high-risk (CBAC >4). Those classified as high-risk were significantly more likely to have hypertension (46.0% vs. 20.6% among low-risk, $P < 0.0001$) and diabetes (12.0% vs. 7.7%, $P < 0.0001$). Only 26.8% of those with hypertension were diagnosed and only 14.9% treated. Proportions among those with diabetes were similarly low: 29.2% diagnosed and 16.0% treated. **Conclusions:** To the best of our knowledge, this is the first study to estimate the prevalence of high-risk CBAC scores in a population-based sample. Given that the Government of India aims to undertake population-based screening of all adults >30 years for NCDs, the results of this study are directly translatable.

Keywords: Developing country, diabetes, health services, health survey, hypertension, South Asia

Introduction

Cardiovascular diseases (CVD) account for 28.1% of deaths in India.[1] This represents a 34.3% increase in CVD's contribution to mortality from 1990 to 2016.[1] This increase is not surprising given concurrent increases in two of the leading risk factors for CVD: Hypertension and diabetes.

The most recent national estimates of the prevalence of diabetes and hypertension in India are approximately 6% of men and women have diabetes and 20%–25% have hypertension.[2] The state of Punjab in northern India has the highest prevalence of hypertension and a higher prevalence of diabetes than the national average.[2] A recent evaluation of health system performance for diabetes and hypertension in India found that fewer than half of the patients in rural areas were aware that they had these important CVD risk factors.[3,4] Thus, screening and diagnosis of diabetes and hypertension are important priorities.

As a signatory to the Global Action Plan for the Prevention and Control of Noncommunicable Diseases (NCD), India is now mandated to halt the rise of diabetes by 2025 and reduce the prevalence of hypertension by 25% between 2010 and 2025.[5] To achieve these targets, the Government of India has launched a National Multisectoral Action Plan for the Prevention and Control of NCDs[6] and a dedicated program for the National Prevention

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and Control of Cancer, Diabetes, Cardiovascular Disease and Stroke (NPCDCS).[7] The corporate sector has emerged as an important implementing partner in light of a federal law mandating the investment of 2% of profits into public programs.[8]

Ambuja Cement Foundation (ACF) has been implementing a comprehensive program for the prevention and management of NCDs since 2016–2017. ACF's program follows the Government of India NPCDCS guidelines, including community-based NCD screening using the Community Based Assessment Checklist (CBAC). The program has been running in over 143 villages across India and is now planned to be implemented in 10 villages of Bathinda District of Punjab, India. Working closely with the Bathinda Health Department (Punjab Government), ACF, with evaluation support from Harvard University, completed a study of the current NCD scenario in these villages. To the best of our knowledge, this is the first systematic assessment of the CBAC screening process in a village setting.

Materials and Methods

The ACF NCD Program is an ongoing community-based prevention program that began enrollment in September 2019 and completed enrollment in March 2020. This evaluation included all eligible adults in the 10 villages covered by the program. Eligibility criteria included: Residing in the study area and no plans to move permanently outside the study area in the next 12 months; aged ≥30 years confirmed by directly viewing a government-issued document with the individual's date of birth; non-pregnant through self-report; not bedridden or mentally challenged; and Punjabi, Hindi, or English-speaking. Those with a CBAC score >4 based on the following criteria are classified as "high risk": Age 40–49 years (+1), age ≥50 years (+2); used to smoke or use smokeless tobacco products or sometimes currently use (+1), currently use daily (+2); currently consume alcohol daily (+1); waist circumference 81–90 cm (women)/91–100 cm (men) (+1), >90 cm (women)/>100 cm (men) (+2); physical activity <150 min per week (+1); parent and/or sibling with high blood pressure, diabetes, or heart disease (+2).

The study protocol was approved by the Harvard Institutional Review Board (protocol #: IRB19-1217) and the Joint Ethics Committee of the Narotam Sekhsaria Foundation and Salaam Bombay Foundation (proposal code: JEC/NSF-SBF/2019/07). All participants provided written informed consent.

Data collection was completed after training of enumerators and pilot testing. Systolic and diastolic blood pressure were measured in triplicate using an automatic digital blood pressure machine (Omron 7130, OMRON Automation Pvt. Ltd., Mumbai, Maharashtra, India). The average of the second and third measurements was used in the analysis.[9] Hypertension was defined as systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg.[10] Waist circumference was measured in triplicate to the nearest 0.5 cm and the average of all three was analyzed.

Capillary blood glucose was measured using a point-of-care device (OneTouch VerioIQ, Johnson and Johnson Pvt. Ltd., Mumbai, India). For participants that were classified as low risk (CBAC ≤4), we recorded if they had eaten or had anything to drink in the past 8 h, and then took their blood glucose measurement during the same visit as the surveys. For participants that were classified as high risk, we provided a handout with instructions for fasting and then returned to collect a fasting blood glucose on a subsequent morning. In addition, for these participants, we collected information on dietary intake and clinical history including medication use. Diabetes was defined as a fasting plasma glucose of 7.0 mmol/L (126 mg/dL) or higher; or a random plasma glucose of 11.1 mmol/L (200 mg/dL) or higher.[11]

Statistical analysis

Data analysis was conducted using SAS version 9.4 (SAS Institute, Cary, North Carolina, USA). We tested for differences according to CBAC risk status and gender using Chi-square tests (for binary and categorical variables) and *t*-tests (for continuous variables). $P < 0.05$ was considered statistically significant.

Results

A total of 11,322 adults completed the baseline assessment, of which 14.4% were classified as high risk [Table 1]. High-risk participants were older, had lower incomes, and were more likely to be widowed, have no formal schooling, retired or unemployed, and to cook with unclean fuel.

Overall, the prevalence of tobacco use in this sample population was low: Only 1.8% reported current smoking and 2.7% reported current chewing tobacco use [Table 2]. Alcohol consumption was more common (12.8%). While mean physical activity was 582.0 min per week, it was skewed such that the prevalence of physical inactivity was high: 51.5% of participants reported <150 min of physical activity per week. The prevalence of hypertension was 24.3% and diabetes was 8.3%. Compared to adults that were classified as low risk, those who were classified as high risk were significantly more likely to have a family history of hypertension, diabetes, heart attack, or stroke; more likely to use alcohol; more likely to smoke; and more likely to chew tobacco. They had lower physical activity levels across the domains of work ($P = 0.0006$) and transport ($P = 0.01$), but not recreational ($P = 0.06$). Moreover, they were significantly more likely to have hypertension (46.0% vs. 20.6% among those who were low risk, $P < 0.0001$) and diabetes (12.0% vs. 7.7% among those who were low risk, $P < 0.0001$).

Women were significantly less likely to consume alcohol or use tobacco as compared to men (all $P < 0.0001$, data not shown). They also had lower physical activity from work or transport (both $P < 0.0001$), but not from recreational activities ($P = 0.48$). In terms of the prevalence of hypertension and diabetes, there was not a statistically significant difference between women and men: About 24% of both women and

Table 1: Summary of baseline demographic characteristics of all eligible adults screened in 10 villages of Punjab, India, overall and according to cardiovascular disease risk status

	Total (n=11,322)	Low-risk[a] (n=9696)	High-risk[b] (n=1626)	P*
Gender				
Female	5902 (52.1)	5050 (52.1)	852 (52.4)	0.81
Male	5420 (47.9)	4646 (47.9)	774 (47.6)	
Age (years)				
30-39	3858 (34.1)	3777 (39.0)	81 (5.0)	<0.0001
40-49	2770 (24.5)	2403 (24.8)	367 (22.6)	
50-59	1956 (17.3)	1426 (14.7)	530 (32.6)	
60+	2738 (24.2)	2090 (21.6)	648 (39.9)	
Marital status				
Married	10289 (91.0)	8894 (91.8)	1395 (86.0)	<0.0001
Single/never married	200 (1.8)	182 (1.9)	18 (1.1)	
Widowed/divorced	820 (7.3)	610 (6.3)	210 (12.9)	
Educational attainment				
No formal education	4919 (43.5)	4103 (42.3)	816 (50.2)	<0.0001
Primary and middle school	3257 (28.8)	2779 (28.7)	478 (29.4)	
High school and above	3146 (27.8)	2814 (29.0)	332 (20.4)	
Occupational status				
Employed	4941 (43.6)	4293 (44.3)	648 (39.9)	<0.0001
Housewife	5232 (46.2)	4490 (46.3)	742 (45.6)	
Retired	318 (2.8)	220 (2.3)	98 (6.0)	
Unemployed/student	830 (7.3)	692 (7.1)	138 (8.5)	
Income (INR per month)				
≤10,000	3365 (29.7)	2955 (30.5)	410 (25.2)	<0.0001
10,001-20,000	4366 (38.6)	3781 (39.0)	585 (36.0)	
>20,000	3585 (31.7)	2954 (30.5)	631 (38.8)	
Primary cooking fuel				
Unclean	2667 (23.6)	2202 (22.7)	465 (28.6)	<0.0001
Clean	8655 (76.4)	7494 (77.3)	1161 (71.4)	

(a-b) Low-risk was defined as a CBAC score ≤4 and high-risk as CBAC score >4. *Chi-square test comparing low- and high-risk groups. Values are, *n* (%). CBAC: Community Based Assessment Checklist, INR: Indian rupee

men had hypertension (P = 0.99), and 8.5% of men and 8.0% of women had diabetes (P = 0.37). However, the mean systolic blood pressure (133.4 mmHg versus 129.7 mmHg in men and women, respectively, P < 0.0001), diastolic blood pressure (83.3 mmHg vs. 81.3 mmHg in men and women, respectively, P < 0.0001), and fasting blood glucose (123.6 mg/dl vs. 121.6 mg/dl in men and women, respectively, P = 0.01) was significantly higher among men compared to women, reflecting worse metabolic health among men in this population.

Only 26.8% of those with hypertension were diagnosed and only 14.9% treated. The proportions diagnosed and treated among those with diabetes were similarly low: 29.2% and 16.0%, respectively. Men with hypertension were significantly less likely to be diagnosed or treated as compared to women (P = 0.0002 and P = 0.005, respectively). There was no significant difference in diabetes diagnosis or treatment rates between men and women with diabetes (P = 0.80 and P = 0.94, respectively).

Spending on medications for hypertension and diabetes was, on average, 881 and 1291 INR total over 6 months, respectively [Table 3]. Reported diagnosed comorbidities aligned with reported medications used in the past 12 months with very few reporting medication use (28.8%), most commonly for hypertension and diabetes.

Staple grains, dairy, vegetables, and sugar in tea or coffee were the most commonly consumed foods: Nearly all participants consumed staple grains and sugar in tea or coffee daily [Table 4]. Potatoes and pulses were consumed by most participants on a weekly basis. Nuts, eggs, meat, and fruit juice were rarely consumed. Similarly, fried foods and sweets were only ever consumed by about 40%–50% of participants, and most who did consume these unhealthy foods only consumed them on a monthly basis. Fruit was also consumed infrequently. With regards to differences by gender, women were more likely to consume nuts (P = 0.001) and fruit (P = 0.04), and less likely to consume potatoes (P = 0.009), eggs (P < 0.0001), and meat (P < 0.0001).

Discussion

The most prevalent CVD risk factors in this population of Punjab in northern India are physical inactivity, unhealthy

Table 2: Summary of baseline cardiovascular disease risk factors of all eligible adults screened in 10 villages of Punjab, India, overall and according to cardiovascular disease risk status

	Total (*n*=11,322)	Low-risk[a] (*n*=9696)	High-risk[b] (*n*=1626)	*P**
Family clinical history, percentage yes				
Hypertension	1432 (12.7)	889 (9.2)	543 (33.4)	<0.0001
Diabetes	1156 (10.2)	596 (6.2)	560 (34.4)	<0.0001
Heart attack	502 (4.4)	251 (2.6)	251 (15.4)	<0.0001
Stroke	340 (3.0)	171 (1.8)	169 (10.4)	<0.0001
Alcohol consumption				
No	9874 (87.2)	8652 (89.2)	1222 (75.2)	<0.0001
Yes	1448 (12.8)	1044 (10.8)	404 (24.9)	
Smoking				
Never	11001 (97.2)	9517 (98.2)	1484 (91.3)	<0.0001
Past	121 (1.1)	91 (0.9)	30 (1.9)	
Current	200 (1.8)	88 (0.9)	112 (6.9)	
Chewing tobacco				
Never	10,903 (96.3)	9476 (97.7)	1427 (87.8)	<0.0001
Past	110 (1.0)	80 (0.8)	30 (1.9)	
Current	309 (2.7)	140 (1.4)	169 (10.4)	
Physical activity (min/week)				
Work	428.7±757.2	438.8±766.7	368.7±695.2	0.0006
Transport	120.9±342.8	124.2±348.8	101.5±303.4	0.01
Recreational	32.4±186.3	33.7±194.1	24.5±130.6	0.07
Total	582.0±982.3	596.6±997.7	494.7±880.4	0.0001
Physical activity <150 (min/week)	5829 (51.5)	4998 (51.6)	831 (51.1)	0.74
Waist circumference (cm)	85.0±12.9	83.1±10.7	96.2±18.0	<0.0001
Systolic blood pressure (mmHg)	131.5±16.4	130.2±15.4	139.6±19.4	<0.0001
Diastolic blood pressure (mmHg)	82.2±9.6	81.5±9.1	86.5±11.3	<0.0001
Hypertension[†]	2741 (24.3)	1996 (20.6)	745 (46.0)	<0.0001
Fasting blood glucose (mg/dl)	122.5±42.2	124.9±42.3	107.3±37.9	<0.0001
Diabetes[‡]	923 (8.3)	744 (7.7)	170 (12.0)	<0.0001

(a-b) Low-risk was defined as a CBAC score ≤4 and high-risk as CBAC score >4. *Chi-square test comparing low-and high-risk groups for categorical variables, and *t*-test for continuous variables. [†]Defined as systolic blood pressure ≥140 or diastolic blood pressure ≥90. [‡]Defined as fasting blood glucose ≥126 mg/dl or random blood glucose ≥200 mg/dl. Values are, *n* (%) or mean±SD. CBAC: Community Based Assessment Checklist, SD: Standard deviation

diets, and hypertension. The prevalence of tobacco use in this population was low (<3%), and while alcohol use was more common, it was still <15% and both tobacco and alcohol use were almost entirely restricted to men. While enumerators were carefully selected from the villages surveyed, and trained in standardized survey administration, under-reporting of these taboo behaviors is likely. This under-reporting may explain why only 14.4% of participants were classified as high risk. Moving forward, it may be important to consider the fact that five of the six NCD risk factors included in the CBAC score are self-reported, and under-reporting of tobacco, alcohol, and family history of disease is common. Moreover, the one objective measurement included in the CBAC score – waist circumference – may be considered invasive by some participants, particularly if the tape is placed over bare skin, which is recommended for accurate, precise measurements.[12] Additional, less invasive objective measurements, such as blood pressure, could be implemented at relatively low cost and improve the identification of adults at risk of developing CVD.

The overall prevalence of hypertension in this sample was 24.3% and diabetes was 8.3%. The estimate for hypertension is lower than that estimated for Punjab using National Family Health Survey data: 35.5% in rural areas.[2] This could relate to differences in the definitions of hypertension: The national study included the use of medications in the definition. This broader definition could explain the higher prevalence. The estimate for diabetes, on the other hand, was slightly higher than this representative state sample, which estimated a prevalence of 6.8% in rural areas.[2] Generally speaking, however, our objective assessments of blood pressure and glucose align with previous studies; lending further support to integrating these measurements into future programs.

We could not identify previous studies of CBAC scores in population-based samples. One previous study, in Jammu and Kashmir, screened 266 patients attending an urban outpatient department in 2019 and reported a prevalence of high-risk CBAC score of 28%.[13] In that study, a similar prevalence of tobacco and alcohol use was reported as compared to our study, but a higher prevalence of family history of cardiometabolic diseases.[13] A second study, in Delhi, screened 50 adults attending a medical camp in 2019 and reported a prevalence of high-risk CBAC score of 22%.[14] Similar overall rates of

Table 3: Summary of clinical history of all high-risk adults identified in 10 villages of Punjab, India, overall and according to gender

	Total (*n*=1626)	Female (*n*=853)	Male (*n*=776)	*P**
Ever diagnosed with (percentage yes)				
Hypertension	338 (20.8)	212 (24.9)	126 (16.3)	<0.0001
Diabetes	161 (9.9)	103 (12.1)	58 (7.5)	0.002
Pain (arthritis, joint pain, etc.)	19 (1.2)	16 (1.9)	3 (0.4)	-
High blood cholesterol	14 (0.9)	11 (1.3)	3 (0.4)	-
Heart disease	13 (0.8)	8 (0.9)	5 (0.7)	0.51
Asthma	12 (0.7)	8 (0.9)	4 (0.5)	-
Stroke	5 (0.3)	4 (0.5)	1 (0.1)	-
Cancer	5 (0.3)	5 (0.6)	0	-
Allergies	2 (0.1)	2 (0.2)	0	-
Other†	25 (1.5)	22 (2.6)	3 (0.4)	-
Medication use in past 12 months (percentage yes)	420 (28.8)	275 (33.5)	145 (22.7)	<0.0001
Hypertension	215 (13.2)	137 (16.1)	78 (10.1)	0.0004
Diabetes	84 (5.2)	54 (6.3)	30 (3.9)	0.03
Cardiovascular disease	8 (0.5)	5 (0.6)	3 (0.4)	-
Traditional medicine use (percentage yes)	15 (1.0)	9 (1.1)	6 (0.9)	0.78
Medication spending in past 6 months (INR)				
Hypertension	881.0±1938.6	983.2±2335.1	667.5±430.5	0.31
Diabetes	1290.8±1871.4	1167.7±1045.9	1636.9±3260.0	0.39

*Chi-square test comparing males and females for categorical variables, and *t*-test for continuous variables. †Other diagnosed conditions included: Depression; headaches; eye problem; skin problem; goiter; liver disease; thyroid disease; hypotension; and paralysis. Values are *n* (%) or mean±SD.
SD: Standard deviation, INR: Indian rupee

Table 4: Summary of baseline dietary intake of all high-risk adults identified in 10 villages of Punjab, India, overall and according to gender

	Total (*n*=1626)	Female (*n*=853)	Male (*n*=776)	*P**
Staple grains (times/day)	2.6±0.6	2.6±0.6	2.6±0.5	0.43
Potatoes				
Never or <1 time/month	42 (2.8)	25 (3.0)	17 (2.6)	0.009
Monthly	101 (6.8)	65 (7.8)	36 (5.5)	
Weekly	1296 (87.3)	728 (87.3)	568 (87.3)	
Daily	46 (3.1)	16 (1.9)	30 (4.6)	
Pulses				
Never or <1 time/month	456 (30.7)	262 (31.4)	194 (29.8)	0.88
Monthly	208 (14.0)	116 (13.9)	92 (14.1)	
Weekly	806 (54.2)	448 (53.7)	358 (54.9)	
Daily	16 (1.1)	8 (1.0)	8 (1.2)	
Nuts				
Never or <1 time/month	1046 (70.4)	587 (70.4)	459 (70.4)	0.001
Monthly	236 (15.9)	112 (13.4)	124 (19.0)	
Weekly	168 (11.3)	112 (13.4)	56 (8.6)	
Daily	36 (2.4)	23 (2.8)	13 (2.0)	
Vegetables (times/day)	0.9±0.9	0.9±0.9	0.9±0.9	0.62
Vegetables				
Never or <1 time/month	44 (3.0)	28 (3.4)	16 (2.5)	0.37
Monthly	29 (2.0)	14 (1.7)	15 (2.3)	
Weekly	1049 (70.6)	598 (71.7)	451 (69.3)	
Daily	363 (24.4)	194 (23.3)	169 (26.0)	
Fruits				
Never or <1 time/month	626 (42.1)	335 (40.2)	291 (44.6)	0.04
Monthly	315 (21.2)	167 (20.0)	148 (22.7)	
Weekly	471 (31.7)	284 (34.1)	187 (28.7)	
Daily	74 (5.0)	48 (5.8)	26 (4.0)	

Contd...

Table 4: Contd...

	Total (*n*=1626)	Female (*n*=853)	Male (*n*=776)	*P**
Eggs				
Never or <1 time/month	1255 (84.6)	763 (91.7)	492 (75.5)	<0.0001
Monthly	103 (6.9)	33 (4.0)	70 (10.7)	
Weekly	112 (7.6)	33 (4.0)	79 (12.1)	
Daily	14 (0.9)	3 (0.4)	11 (1.7)	
Dairy (times/day)	0.9±0.6	0.9±0.7	0.9±0.6	0.71
Dairy				
Never or <1 time/month	311 (21.0)	177 (21.3)	134 (20.7)	0.89
Monthly	19 (1.3)	12 (1.4)	7 (1.1)	
Weekly	98 (6.6)	53 (6.4)	45 (6.9)	
Daily	1053 (71.1)	590 (70.9)	463 (71.3)	
Meat				
Never or<1 time/month	1270 (85.6)	775 (93.0)	495 (76.0)	<0.0001
Monthly	194 (13.1)	50 (6.0)	144 (22.1)	
Weekly	19 (1.3)	8 (1.0)	11 (1.7)	
Daily	1 (0.1)	0	1 (0.2)	
Fried food				
Never or <1 time/month	905 (60.9)	525 (63.0)	380 (58.3)	0.16
Monthly	461 (31.0)	248 (29.7)	213 (32.7)	
Weekly	120 (8.1)	61 (7.3)	59 (9.1)	
Sweets				
Never or <1 time/month	804 (54.2)	449 (54.0)	355 (54.5)	0.99
Monthly	570 (38.4)	322 (38.7)	248 (38.0)	
Weekly	105 (7.1)	58 (7.0)	47 (7.2)	
Daily	5 (0.3)	3 (0.4)	2 (0.3)	
Fruit juice				
Never or <1 time/month	1280 (86.2)	712 (85.5)	568 (87.1)	-
Monthly	123 (8.3)	74 (8.9)	49 (7.5)	
Weekly	80 (5.4)	45 (5.4)	35 (5.4)	
Daily	2 (0.1)	2 (0.2)	0	
Sugar in tea or coffee (times/day)	3.0±1.1	3.0±1.1	3.1±1.0	0.70
Sugar in tea or coffee				
Never or <1 time/month	63 (4.3)	45 (5.4)	18 (2.8)	-
Monthly	1 (0.1)	1 (0.1)	0	
Weekly	5 (0.3)	3 (0.4)	2 (0.3)	
Daily	1415 (95.4)	784 (94.1)	631 (96.9)	

*Chi-square test comparing males and females for categorical variables, and *t*-test for continuous variables. Values are, *n* (%) or mean±SD. SD: Standard deviation

alcohol use were reported in that study as compared to our study, but a much higher prevalence of family history of disease and smoking.[14] Another explanation for the higher rates of high-risk CBAC scores in these two previous studies is that they were conducted in health care-seeking populations, which are likely to have a higher prevalence of disease.

Only 26.8% of those with hypertension were diagnosed and only 14.9% treated. The proportions diagnosed and treated among those with diabetes were similarly low: 29.2% and 16.0%, respectively. These proportions are substantially lower than those reported at the national level in India: 44.7% diagnosed and 13.3% treated for hypertension,[4] and 52.5% diagnosed and 40.5% treated for diabetes.[3] These findings therefore support planned intervention activities, particularly the involvement of the local health department, which has agreed to help ensure testing, diagnosis, and availability of medicines in the local health system.

Spending on medications for hypertension and diabetes was, on average, 881 and 1291 INR total over 6 months, respectively. This estimate is lower than previous estimates for out-of-pocket spending on NCD care in India.[15,16] A survey of 166 patients attending a tertiary hospital in Punjab, conducted in 2010, found that the average out-of-pocket cost of every doctor visit for hypertension was 167 INR and for diabetes was 166 INR.[17] Ensuring that medications for these conditions are both accessible and affordable is critical for treatment compliance.

The overall dietary diversity of this sample population is low: Only staple grains, sugar in tea or coffee, and dairy were

consumed daily by a majority of participants. Behavior change communication should therefore focus on increasing vegetable and fruit intake; increasing pulse intake; and reducing sugar in tea or coffee. Unlike other settings, the consumption of sugary beverages, fruit juice, fried foods, and sweets was low in this population, and so messaging may not need to focus on these.

Conclusions

Findings of this baseline assessment in northern India suggest that hypertension and diabetes are relatively common among adults. Yet, diagnosis and treatment rates for these conditions are low. In order to prevent and control hypertension and diabetes key behavioral risk factors to be targeted include physical inactivity and unhealthy diets among men and women, as well as alcohol intake among men. Results will inform national efforts to tackle NCDs.

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Conflicts of interest

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