Indian J Med Res 156, August 2022, pp 260-268
DOI: 10.4103/ijmr.ijmr_3248_21

Quick Response Code:

Preparedness of primary & secondary care health facilities for the management of non-communicable diseases in tribal population across 12 districts in India

Prabhdeep Kaur[1], P.K. Borah[2], Pooja Gaigaware[1], P.K. Mohapatra[2], Nabajit K.R. Das[2], Pankaj V. Uike[1], Karma Jigme Tobgay[3,#], Aonungdok Tushi[4,#], Zorinsangi[5,#], Gautam Mazumdar[6,#], Bibha Marak[7,#], Dirang Pizi[8,#], Tapas Chakma[9,#], A.P. Sugunan[14,#], P. Vijayachari[14,#], Rakesh R. Bhardwaj[10,#], Probin C. Arambam[11,#], Tridip Kutum[2], Anand Sharma[2], Piyalee Pal[1], P.C. Shanmugapriya[1], Prathab Manivel[1], Neelakandan Kaliyamoorthy[1], Joy Chakma[12], Prashant Mathur[13], R.S. Dhaliwal[12], J. Mahanta[2] & Sanjay M. Mehendale[1]

[1]Division of Non-communicable Diseases, ICMR-National Institute of Epidemiology, Chennai, Tamil Nadu, [2]ICMR-Regional Medical Research Centre, NE Region, Dibrugarh, Assam, [3]Department of Health Care, Human Services & Family Welfare, Government of Sikkim, Gangtok, Sikkim, [4]Department of Health & Family Welfare, Government of Nagaland, Mokokchung, Nagaland, [5]Department of Health & Family Welfare, Government of Mizoram, Aizwal, Mizoram, [6]Regional Cancer Centre, Agartala, Tripura, [7]Department of Health & Family Welfare, Government of Meghalaya, East Garo Hills, Meghalaya, [8]Department of Health & Family Welfare, Government of Arunachal Pradesh, East Kameng, Arunachal Pradesh, [9]Division of Non-communicable Diseases, ICMR- National Institute of Research in Tribal Health, Jabalpur, Madhya Pradesh, [10]Department of Health & Family Welfare, Government of Himachal Pradesh, Shimla, Himachal Pradesh, [11]Directorate of Health Services, Government of Manipur, Imphal, Manipur, [12]Indian Council of Medical Research, New Delhi, [13]ICMR-National Centre for Disease Informatics & Research, Bengaluru, Karnataka & [14]ICMR-Regional Medical Research Centre, Port Blair, Andaman & Nicobar Islands, India

Received November 5, 2021

***Background and objectives*: Non-communicable diseases (NCDs) are highly prevalent in the tribal populations; however, there are limited data regarding health system preparedness to tackle NCDs among these populations. We estimated the availability of human resources, equipment, drugs, services and knowledge of doctors for NCD management in the selected tribal districts in India.**

***Methods*: A cross-sectional survey was conducted in 12 districts (one from each State) with at least 50 per cent tribal population in Andaman and Nicobar Islands, Himachal Pradesh, Madhya Pradesh, Odisha and eight northeastern States. Primary health centres (PHCs), community health centres (CHCs) and district/sub-district hospitals (DHs) were surveyed and data on screening and treatment services, human resources, equipment, drugs and information systems indicators were collected and analysed. The data were presented as proportions.**

[#]Equal contribution

***Results*: In the present study 177 facilities were surveyed, including 156 PHCs/CHCs and 21 DHs. DHs and the majority (82-96%) of the PHCs/CHCs provided outpatient treatment for diabetes and hypertension. Overall, 97 per cent of PHCs/CHCs had doctors, and 78 per cent had staff nurses. The availability of digital blood pressure monitors ranged from 35 to 43 per cent, and drugs were either not available or inadequate. Among 213 doctors, three-fourths knew the correct criteria for hypertension diagnosis, and a few correctly reported diabetes diagnosis criteria.**

***Interpretation & conclusions*: The results of this study suggest that the health system of the studied tribal districts was not adequately prepared to manage NCDs. The key challenges included inadequately trained workforce and a lack of equipment and drugs. It is suggested that capacity building and, procurement and distribution of equipment, drugs and information systems to track NCD patients should be the key focus areas of national programmes.**

Key words Cancers - diabetes - hypertension - indigenous - non-communicable diseases - preparedness - tribal

Non-communicable diseases (NCDs) have emerged as a public health challenge for the poorest billion population[1]. NCDs and injuries accounted for 800,000 deaths among people below 40 yr among the poorest populations globally[1]. India is undergoing an epidemiological transition with the rising burden of NCDs. Although the burden initially increased in more urbanized and developed States, all States have transitioned to higher NCD mortality than infectious and other causes in the past decade[2]. NCDs account for more than half of disability adjusted life years (DALYs) in India[3].

According to the 2011 census, the scheduled tribe (ST) population constituted 8.7 per cent of the 104 million in India[4]. The literacy of India was 67 per cent in 2011 compared to 59 per cent among the ST population[4]. ST communities live in about 15 per cent of the country's areas in various ecological and geo-climatic conditions ranging from plains and forests to hills and inaccessible regions[5]. The STs below the poverty line exceed the national average[6]. Furthermore, the health system has poor infrastructure and an inadequate workforce in tribal areas[6].

Health indicators of the ST population were worse than the national average for most indicators, such as infant mortality rate and institutional delivery[6]. In addition to poor reproductive child health and infectious disease burden, evidence also suggests high burden of various risk factors such as tobacco use, alcohol use and hypertension[7-9]. Poor insurance coverage and challenges in seeking healthcare due to difficult geographical terrain and low literacy lead to poor health outcomes[10]. The percentage of individuals (15-49 yr) who visited health facilities/camps in the three months preceding the survey was lower (11.5%) among STs rather than in other castes (23.2%)[11]. The high burden of NCDs might cause complications and mortality among the tribal population due to poor access to healthcare and inadequate healthcare services. Therefore, this study was conducted to describe the availability of various resources in the health system for patients with NCDs.

The Government of India launched the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) intending to prevent and control NCDs through awareness generation, behaviour and lifestyle changes, early diagnosis and treatment of hypertension, diabetes and three cancers[12]. Health systems strengthening at the primary care level are essential to implement NCD interventions among the indigenous populations. The six building blocks of the health system are health services, health workforce, health information system, essential medical products, vaccines and technologies, health financing system, leadership and governance. There are limited data regarding the status of resources required to implement NCD interventions in the tribal areas in India. Therefore, this study was planned to survey healthcare facilities to map the existing resources, identify the gaps to inform policy decisions. The objectives were to describe the infrastructure (drugs, equipment and information systems) and human resources available for screening of five NCDs (hypertension, diabetes, cancer cervix, breast cancer and oral cancer) and treatment of hypertension and diabetes in the primary and secondary care facilities in the selected tribal districts of India. The survey included services which were part of the NPCDCS programme guidelines. We also estimated the knowledge level among the study participants and described the doctors' prescription practices to manage hypertension and diabetes.

Material & Methods

Study design and population: A cross-sectional survey was conducted in a phased manner between 2015 and 2018 after obtaining approval from the Institutional Ethics Committee of ICMR-Regional Medical Research Centre and ICMR-National Institute of Epidemiology, Chennai. A written informed consent was obtained from all participants prior to the start of the survey. The survey was part of a comprehensive study on NCDs in tribal populations with multiple components. The sites were covered in a phased manner, with 2-3 sites surveyed yearly for various aspects of NCDs. The results were shared with the local authorities soon after the survey to initiate the action. Eight northeast States (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura) and four other States (Andaman and Nicobar Islands, Himachal Pradesh, Madhya Pradesh and Orissa) were included in the study (Table I). One district per State was selected for the survey with a 50 per cent or more tribal population. Sikkim is a small State; hence, all facilities in the State were included. Public sector health facilities and doctors working in the surveyed facilities were included in the study.

Sample size and sampling procedure: The study districts were selected to ensure the representation of the various parts of the country. All northeastern States were included due to the high proportion of the tribal population. Within States such as Assam, where all districts are not tribal, a district with at least 50 per cent tribal population was selected. On the mainland, four States were chosen, considering the geographic representation and presence of different tribes. In each State, one district with a tribal population >50 per cent was selected while prioritizing the districts under the NPCDCS national programme for NCDs[12]. At least one doctor was included from each facility, depending on the availability on the survey day. All the doctors assigned to the medicine outpatient (OP) on the survey day, were included in the study. All district, sub-district hospitals and CHCs were included. In a few sites where the number of PHCs was more than 10, 10 PHCs were randomly selected, and in the remaining sites, all PHCs were selected.

Data collection: Data on the health facilities and providers were collected using structured questionnaires. The field investigators were trained at the selected study districts. The field staff was graduates and hired locally through an advertisement as per the State rules. The field supervisor monitored data collection. The data in the medical OP were collected in context to the provider survey in addition to those pertaining to services, human resources, equipment and drugs from doctors, nurses, laboratory technicians and pharmacists. The data collection tool included components which were part of the NPCDCS programme.

Data was also collected on the knowledge of doctors about diagnosis guidelines and treatment practices for hypertension and diabetes, various categories of human resources and their level of training related to managing NCDs, information on screening five diseases (hypertension, diabetes, breast cancer, cervical cancer and oral cancer), hypertension and diabetes treatment services and documentation practices. In each facility, equipment such as blood pressure (BP) monitors, glucometer, height scale, glucometer strips and semi-autoanalyzers were assessed. The availability of medications prescribed for NCDs at the pharmacy on the day of the survey was also evaluated.

Operational definitions of terms describing diseases type or study centres are provided as Supplementary material.

Data analysis: The proportions for various indicators were analyzed using MS Excel 16.0 and Epi Info software 7.2.4. The critical indicators for different health system pillars, namely; service delivery, human resources, health information systems, equipment and drugs were analyzed. The indicators included the proportion of facilities with protocols, the proportion providing screening and OP services, the proportion with various cadres of staff, and the proportion with the availability of equipment, laboratory services and drugs to treat hypertension and diabetes. Sikkim was considered as one district for analysis. The key indicators were stratified into two categories, northeastern and other districts. Northeastern districts included Sikkim, East Kameng, Dhemaji, Senapati, East Garo Hills, Lunglei, Mokokchung and Dhalai. The other districts included Nicobar, Kinnaur, Mandla and Koraput. The indicators were also stratified based on two types of facilities. District and sub-district/taluk hospitals were combined in one category as secondary care facilities and PHCs and CHCs were combined in another category as primary care facilities consistent with the norms in the State health departments. The knowledge indicators included the proportion

Table I. Number of facilities included in the survey in 12 tribal districts, India

State	Study district	Population (2011 census[13])	Percentage scheduled caste (ST) population	PHC/ CHC	Sub-district and district hospitals	Number of facilities
Andaman and Nicobar Islands	Nicobar	36,842	64	5	1	6
Arunachal Pradesh	East Kameng	78,690	92	10	1	11
Assam	Dhemaji	686,133	47	19	1	20
Himachal Pradesh	Kinnaur	84,121	58	25	1	26
Madhya Pradesh	Mandla	1,054,905	58	14	1	15
Manipur	Senapati	479,148	87	9	1	10
Meghalaya	East Garo Hills	317,917	96	12	1	13
Mizoram	Lunglei	161,428	95	11	3	14
Nagaland	Mokokchung	194,622	92	14	1	15
Odisha	Koraput	1,379,647	51	14	2	16
Sikkim	All districts	610,577	34	10	4	14
Tripura	Dhalai	378,230	56	13	4	17
Total				156	21	177

ST, scheduled tribes; PHC, primary health centre; CHC, community health centre

of doctors who correctly reported the cut off for diagnosing hypertension/diabetes and respective prescription practices.

Results

Screening and treatment services: NPCDCS was operational at all the study sites. State- and district-level nodal officers provided an overview of the programme-related activities. The programme envisaged screening and management of the major NCDs such as diabetes/hypertension at the CHC level and management of cardiovascular diseases at the district hospitals. The programme primarily provided funding for awareness-related activities, additional human resources, training, drugs and consumables at CHCs and district hospitals.

Twelve districts were included in the study with ST population above 50 per cent (except Sikkim)[13]. Of the 177 facilities surveyed across the 12 districts (Table I), 156 PHCs/CHCs and 21 district/sub-district hospitals were included in this study. Most of the facilities were functioning in government-owned buildings and had electricity connections. Among 14 CHCs, two CHCs did not have drinking water facilities for patients. There was an AYUSH clinic located at 14 CHCs. Overall, one-third of the PHCs conducted screening for hypertension or diabetes. In the northeastern districts, less than one in five PHCs conducted screening compared to nearly half of the facilities in other districts. The screening for three cancers was operational in less than one in 10 primary care health facilities across all districts (Table II). Only 17 per cent of the PHCs had treatment protocols for the diagnosis and treatment of hypertension, and three per cent for diabetes. The district-level facilities and the majority (96%) of the primary care facilities provided OP treatment for hypertension. A large proportion (82%) of PHCs/CHCs and hospitals had outpatient department services for diabetes (Table II).

Human resource: Overall, 151/156 (97%) of the primary care facilities had doctors, and 78 per cent had staff nurses. Three fourths of the primary care facilities had pharmacists and laboratory technicians (Table III). Most hospitals had doctors, nurses, pharmacists and laboratory technicians. However, nurses were assigned various duties in addition to NCD related clinical responsibilities such as screening and follow up. Most facilities did not have a clearly defined task-sharing between different types of staff. Counsellors were appointed under NPCDCS in half of the hospitals in northeastern districts and 20 per cent in other districts. Only a few, about six per cent of the primary care facilities had counsellors and only a few staff in every category were trained for NCD-related activities (Table III).

Equipment and drugs: Sphygmomanometer for blood pressure measurement was available in most

Table II. Availability of protocols, screening services and outpatient services in the health facilities in 12 tribal districts, India

Protocols and services	Overall (n=177)		Northeastern districts (n=114)		Other districts (n=63)	
	PHC/CHC (n=156), n (%)	DH (n=21), n (%)	PHC/CHC (n=98), n (%)	DH (n=16), n (%)	PHC/CHC (n=58), n (%)	DH (n=5), n (%)
Diagnosis/treatment protocols						
Hypertension	26 (17)	8 (38)	13 (13)	4 (25)	16 (28)	4 (80)
Diabetes	5 (3)	6 (29)	10 (10)	3 (19)	18 (31)	3 (60)
Cervical cancer	5 (3)	3 (14)	5 (5)	2 (13)	1 (2)	1 (20)
Breast cancer	49 (31)	1 (5)	5 (5)	0	1 (2)	1 (20)
Oral cancer	28 (18)	2 (10)	5 (5)	1 (6)	1 (2)	1 (20)
Screening services						
Hypertension	52 (33)	11 (52)	21 (21)	7 (44)	31 (53)	4 (80)
Diabetes	50 (32)	9 (43)	16 (16)	5 (31)	34 (59)	3 (60)
Cervical cancer	9 (6)	5 (24)	7 (7)	4 (25)	2 (3)	2 (40)
Breast cancer	8 (5)	4 (19)	6 (6)	2 (13)	2 (3)	2 (40)
Oral cancer	9 (6)	4 (19)	7 (7)	3 (19)	2 (3)	1 (20)
Outpatient treatment services						
Hypertension	149 (96)	21 (100)	93 (95)	16 (100)	56 (97)	5 (100)
Diabetes	128 (82)	20 (95)	76 (78)	15 (94)	52 (90)	5 (100)

Table III. Availability of human resources for screening and management of non-communicable diseases in 12 tribal districts, India

Human Resources	Overall (n=177)		Northeastern districts (n=114)		Other districts (n=63)	
	PHC/CHC (n=156), n (%)	DH (n=21), n (%)	PHC/CHC (n=98), n (%)	DH (n=16), n (%)	PHC/CHC (n=58), n (%)	DH (n=5), n (%)
Doctor	151 (97)	19 (90)	94 (96)	14 (88)	57 (98)	5 (100)
Staff nurse	122 (78)	19 (90)	88 (90)	14 (88)	34 (59)	5 (100)
Pharmacist	112 (72)	18 (86)	76 (78)	14 (88)	36 (62)	4 (80)
Counsellor (under NPCDCS programme)	9 (6)	10 (48)	8 (8)	9 (56)	1 (2)	1 (20)
Physiotherapist (under NPCDCS programme)	10 (6)	14 (67)	3 (3)	10 (63)	7 (12)	4 (80)
Laboratory technician	117 (75)	18 (86)	86 (88)	13 (81)	31 (53)	5 (100)

NPCDCS, National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke

health facilities, but the availability of automated digital BP monitors ranged from 35 to 43 per cent in various facilities (Table IV). Only one in 10 PHCs and one-fourth of the hospitals had automated digital BP monitors in the surveyed northeastern districts. A weighing scale was available in most (96%) PHCs/CHCs and 86 per cent of the district hospitals. Glucometer was available in all except three hospitals and 83 per cent of the PHCs/CHCs. Three-fourths of the primary care facilities had glucometers in the northeastern districts compared to 97 per cent in the other four districts. Semi-autoanalyzer was available in 24 per cent and 90 per cent of PHCs and secondary care hospitals. Electrocardiogram was available in 20 per cent of the PHCs/CHCs and 17/21 hospitals.

The pharmacy registers were reviewed for the availability of commonly used hypertension and diabetes drugs. Among antihypertensives, amlodipine was available in three-fourths and atenolol in one third of the health facilities (Table IV). Among diabetes drugs, metformin was available in nearly half and glimepiride in at least one-fourth of the health facilities. The availability of drugs such as amlodipine was lower in northeastern districts compared to other districts

Table IV. Availability of drugs, equipment and laboratory services for hypertension and diabetes management in 12 tribal districts, India

Equipment, laboratory services and drugs	PHC/CHC (n=156), n (%)	DH (n=21), n (%)	PHC/CHC (n=98), n (%)	DH (n=16), n (%)	PHC/CHC (n=58), n (%)	DH (n=5), n (%)
Equipment and laboratory services						
Sphygmomanometer	151 (97)	19 (90)	95 (97)	14 (88)	56 (97)	5 (100)
Automated digital BP apparatus	55 (35)	9 (43)	11 (11)	4 (25)	44 (76)	5 (100)
Height scale	86 (55)	16 (76)	38 (39)	12 (75)	48 (83)	4 (80)
Weighing scale	150 (96)	18 (86)	95 (97)	13 (81)	55 (95)	5 (100)
Semi autoanalyzer	38 (24)	19 (90)	20 (20)	14 (88)	18 (31)	5 (100)
Glucometer	130 (83)	18 (86)	74 (76)	13 (81)	56 (97)	5 (100)
ECG	31 (20)	17 (81)	14 (14)	12 (75)	17 (29)	5 (100)
Drugs						
Hypertension						
Amlodipine	122 (78)	15 (71)	66 (67)	15 (71)	56 (97)	5 (100)
Atenolol	99 (63)	13 (62)	58 (59)	13 (62)	41 (71)	4 (100)
Nifedipine	34 (22)	4 (19)	16 (16)	4 (19)	18 (31)	2 (40)
Diabetes						
Metformin	72 (46)	9 (43)	27 (28)	5 (31)	45 (78)	5 (100)
Glimepiride	40 (26)	7 (33)	18 (18)	4 (25)	22 (38)	3 (60)
Glipizide	17 (11)	5 (24)	2 (2)	2 (13)	15 (26)	2 (40)
Glibenclamide	14 (9)	5 (24)	2 (2)	2 (13)	12 (21)	2 (40)

BP, blood pressure; PHC, primary health centre; ECG, electrocardiogram

(67 *vs.* 97% at the PHC level). Pharmacists were not trained to estimate the requirement of drugs and reported interruptions in the supply of drugs, including stock-outs.

Health information systems: NCD patients were seen in the OP departments, and the screening register was maintained in only 60/177 health facilities. Only 40 per cent (71/177) of the facilities prepared and submitted monthly reports. Less than one-fifth (28/177) of the facilities maintained separate registers for follow up patients with diabetes or hypertension. Of the facilities which maintained follow up registers for NCD, 13/28 (46%) facilities were from northeastern states. Most health facilities did not maintain the line list of NCD patients under care. Hence, it was difficult to assess the patient load.

Knowledge and practices of providers: A total of 213 doctors were surveyed, of these 149 (70%) were below 40 yr of age, and 157 (74%) were males. Only 15 were AYUSH doctors, and 14 doctors had post-graduate (MD) qualifications. Most of the doctors were treating patients for hypertension, and 167 doctors also treated patients for diabetes.

Three-fourths of the doctors were aware of the correct cut-off for the diagnosis of hypertension, and only 18-39 per cent knew the cut-off for fasting or postprandial glucose for diagnosis of diabetes. One-third of the doctors routinely did anthropometry for patients with hypertension or diabetes. Nearly 60 per cent of the patients were referred for laboratory investigations such as creatinine, lipid and urine albumin. Almost three-fourths (70%) reported amlodipine as the most commonly prescribed drug for hypertension. Other commonly prescribed drugs were ACEI/ARB (44%; angiotensin converting enzyme inhibitor/angiotensin receptor blockers), atenolol or other beta-blockers (41%). Metformin (59%) was the most widely prescribed drug, followed by various sulfonylureas (49%) for diabetes treatment.

Discussion

The present study documents the preparedness of health facilities to manage hypertension and diabetes

predominantly in the tribal districts of India. There were significant gaps in the availability of a trained workforce, drugs for hypertension and diabetes, laboratory services and lack of clinical protocols for service delivery as envisaged under NPCDCS. The programme's implementation was in its early phases at all sites. However, there was variation in the availability of resources based on the States' initiatives for NCDs. Most facilities had at least one doctor; however, there were gaps in the availability of paramedical personnel. Doctors were inadequately trained to manage these diseases in the primary care setting. The lack of information systems limited our understanding of service demand and the extent of follow up among patients on treatment.

The present study documented the gaps in programme implementation in tribal areas, but given the poor emphasis on NCDs, the health system preparedness is inadequate in the non-tribal areas as well[14]. The National NCD Survey[14] during 2017-2018 highlighted the gaps in public and private sector facilities. A small proportion of the rural primary care facilities were fully equipped with drugs, diagnostics and other required resources[14]. Our data suggest that an intensified focused mission mode approach will be required to accelerate the health system strengthening for NCD management in tribal areas. In the past, most health programmes in these populations prioritized maternal and child health and infectious diseases[6]. Given the investments in maternal health, child health and infectious diseases, there has been an improvement in the health indicators in the tribal population in the past decades. However, the pace of progress was slower compared to non-tribal populations[6]. In recent years, attention was drawn to the growing numbers of NCDs among tribal regions of India, as several studies reported a high burden of hypertension, tobacco use, alcohol use and cancers[7-9,15]. The interventions and models from non-tribal areas may not be replicable and scalable for the tribal populations due to geographical constraints, health-seeking behaviours and availability of limited resources. The linkages between the health system and community are essential to generate awareness and maintain a continuum of care. Hence, one may need to learn to address the burden of NCDs in India and elsewhere from ongoing community-centric initiatives in tribal areas.

A randomized control trial[16] is ongoing in a tribal district of Gadchiroli, India, to estimate the effectiveness of community-based interventions for screening and managing cardiovascular diseases. The model is proposed to reduce stroke mortality in rural areas where access to healthcare is difficult[16]. *Jan Swasthya Sahyog*, an NGO based in Chhattisgarh that caters to tribal districts in the region, is also working on several community-based interventions for NCDs. One such initiative encompassed formation of peer support groups for various chronic diseases, and this improved the adherence to treatment[17]. The models from these initiatives can be analyzed, and best practices can be scaled.

The findings of the present study suggest that, doctors were inadequately trained, and non-physician health workers did not play a significant role in the NCD interventions. Similar challenges have been reported in studies from India and other low- and middle-income countries (LMICs)[18]. A survey from Tanzania reported a lack of trained workforce, proper reporting and data management systems[18]. Tribal districts are poorly connected; hence, travelling to distant places may not be feasible except for serious illness. Provision of healthcare closer to home involving non-physician health workers would thus be the most viable strategy to enhance the utilization of services. Systematic reviews have documented the effectiveness of non-physician healthcare worker interventions to improve hypertension and diabetes control. A nurse-led intervention led to a mean decline of −5.23 mmHg systolic and −2.92 mmHg diastolic BP, respectively[19]. Similarly, non-physician health workers' interventions led to an average reduction of −36.26 mg/dl (−52.60 to −19.92, I^2 = 78%) in the fasting blood sugar[20]. In the South-East Asian Region, Bhutan documented the feasibility of engaging non-physician health workers to detect and manage diabetes in remote hilly areas[21]. In 2016, the WHO developed the HEARTS package[22], which recommends task-sharing involving all health workers in managing hypertension and diabetes. The Government of India's health and wellness centres initiative for every 5000 populations involving a community health officer (a specially trained nurse) will facilitate scaling NCD services closer to home, especially in remote areas[23]. In addition to the inadequate workforce, lack of simplified treatment protocol and training were the other barriers to good quality care. The WHO HEARTS guidelines recommend a simple treatment protocol that can make it easier for doctors to manage patients in primary healthcare settings[22]. The availability of an adequately

trained workforce is essential to improving NCD care in the tribal districts.

The present study documented inadequate availability of drugs and equipment. A multi-country study conducted in eight LMICs reported a similar scenario. Automated BP monitors were available in only 10 per cent of the facilities, and low-cost antihypertensives and diabetes medications were unavailable in all primary care facilities[24]. Antihypertensive drugs are cheap and readily available in India[25]. However, forecasting, budgeting and appropriate distribution are required to ensure adequate availability in most peripheral health facilities[26]. High-quality professional BP monitors should be procured and available up to the PHC level. The WHO has issued a technical specification for BP monitors, which the states and districts can use to plan procurements[27]. The national programme NPCDCS provides a budget for drugs and consumables for NCDs[12]. The training of district- and state-level managers in programme planning and management is a must to improve the overall functioning of the NCD programme.

The present study was not without its limitations. The information system in most districts did not capture the NCD patient visits fully; therefore, the adequacy of drugs and human resources could not be assessed. The second limitation was that we could not interview all cadres of healthcare workers.

Overall, the present survey will serve as a baseline to measure the progress in the NCD services delivered in the healthcare system over time under the NPCDCS programme. The challenge of inadequate human resources can be addressed by adding a health workforce at all levels. Furthermore, strategies such as task-sharing and team-based care approaches can help overcome the workforce related challenges. All categories of staff should be trained to detect and manage NCDs and the doctors should be provided with standard treatment protocols. The information system should be streamlined to track the patients, procurement and distribution of drugs and devices should be strengthened, and adequate uninterrupted supply should be ensured.

***Acknowledgment*:** Authors acknowledge the cooperation extended by all the district and State officials during data collection, Dr Sudhanshu Sahu, VCRC Field Station, Koraput, for support in fieldwork at Koraput. Prof Rajesh Kumar and all members of the task force for the technical support. The hard work of field staff in all the sites who collected the data in difficult geographical terrains with poor connectivity is also acknowledged.

***Financial support & sponsorship*:** The study was funded by extramural grant of the Indian Council of Medical Research, New Delhi, India (Grant No. 58/1/4/Tribal Health/2016/Ph-II-NCD-II).

***Conflicts of Interest*:** None.

References

1. Bukhman G, Mocumbi AO, Atun R, Becker AE, Bhutta Z, Binagwaho A, *et al.* The Lancet NCDI Poverty Commission: Bridging a gap in universal health coverage for the poorest billion. *Lancet* 2020; *396* : 991-1044.
2. India State-Level Disease Burden Initiative Collaborators. Nations within a nation: Variations in epidemiological transition across the states of India, 1990-2016 in the Global Burden of Disease Study. *Lancet* 2017; *390* : 2437-60.
3. Vos T, Lim SS, Abbafati C, Abba KM, Abbasi M, Abbasifard M, *et al*. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: A systematic analysis for the Global Burden of Disease Study 2019. *Lancet* 2020; *396* : 1204-22.
4. Narain JP. Health of tribal populations in India: How long can we afford to neglect? *Indian J Med Res* 2019; *149* : 313-6.
5. Planning Commission, Government of India. *Report of the committee to study development in hill states arising from management of forest lands with special focus on creation of infrastructure, livelihood and human development*. New Delhi: Planning Commission; 2013. p. 105.
6. Ministry of Health and Family Welfare. Ministry of Tribal Affairs, Government of India. *Report of expert committee on Tribal Health-Tribal Health in India: Bridging the gap and a roadmap for the future*.. Available from: *http://tribalhealthreport.in/executive-summary/,* accessed on June 17, 2022.
7. Tushi A, Rao SR, Pattabi K, Kaur P. Prevalence of risk factors for non-communicable diseases in a rural tribal population of Mokokchung, Nagaland, India. *Natl Med J India* 2018; *31* : 11-4.
8. Rizwan SA, Kumar R, Singh AK, Kusuma YS, Yadav K, Pandav CS. Prevalence of hypertension in Indian tribes: A systematic review and meta-analysis of observational studies. *PLoS One* 2014; *9* : e95896.
9. Negi PC, Chauhan R, Rana V, Vidyasagar, Lal K. Epidemiological study of non-communicable diseases (NCD) risk factors in tribal district of Kinnaur, HP: A cross-sectional study. *Indian Heart J* 2016; *68* : 655-62.
10. Sridharan VS, Anil C, Balasubramaniam R, Balasubramanya MA, Seetharaman MR, Seetharaman S, *et al*. Report of the Study to Understand the Health Status and Healthcare Systems in Selected Tribal Areas of India; June, 2009. Available from: *https://hsrii.org/wp-content/uploads/2014/07/Health_Systems_Development_Study_to_understand_the_Health_Status_and_Healthcare_Systems_in_selected_tribal_areas_of_India_Abridge_report.pdf*, accessed on October 20, 2021.

11. International Institute for Population Sciences and International Classification of Functioning, Disability and Health. *National family health survey (NFHS-4), 2015-16*. Mumbai: IIPS and ICF; 2017.
12. Ministry of Health and Family Welfare. *National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS)*. Available from: *https://main.mohfw.gov.in/Major-Programmes/non-communicable-diseases-injury-trauma/Non-Communicable-Disease-II/National-Programme-for-Prevention-and-Control-of-Cancer-Diabetes-Cardiovascular-diseases-and-Stroke-NPCDCS,* accessed on August 19, 2020.
13. Office of the Registrar General and Census Commissioner, India. *Population finder 2011*. Available from: *https://censusindia.gov.in/census.website/data/population-finder*, accessed on November 3, 2021.
14. Krishnan A, Mathur P, Kulothungan V, Salve HR, Leburu S, Amarchand R, *et al.* Preparedness of primary and secondary health facilities in India to address major noncommunicable diseases: Results of a National Noncommunicable Disease Monitoring Survey (NNMS). *BMC Health Serv Res* 2021; *21* : 757.
15. Indian Council of Medical Research-National Centre for Disease Informatics and Research . *A Report on cancer burden in North Eastern States of India*. Bengaluru: ICMR-NCDIR; 2017. p. 75.
16. Kalkonde Y, Deshmukh M, Nila S, Jadhao S, Bang A. Effect of a community-based intervention for cardiovascular risk factor control on stroke mortality in rural Gadchiroli, India: Study protocol for a cluster randomised controlled trial. *Trials* 2019; *20* : 764.
17. Jain Y, Jain P. Communitisation of healthcare: Peer support groups for chronic disease care in rural India. *BMJ* 2018; *360* : k85.
18. Peck R, Mghamba J, Vanobberghen F, Kavishe B, Rugarabamu V, Smeeth L, *et al.* Preparedness of Tanzanian health facilities for outpatient primary care of hypertension and diabetes: A cross-sectional survey. *Lancet Glob Health* 2014; *2* : e285-92.
19. Anand TN, Joseph LM, Geetha AV, Prabhakaran D, Jeemon P. Task sharing with non-physician health-care workers for management of blood pressure in low-income and middle-income countries: A systematic review and meta-analysis. *Lancet Glob Health* 2019; *7* : e761-71.
20. Maria JL, Anand TN, Dona B, Prinu J, Prabhakaran D, Jeemon P. Task-sharing interventions for improving control of diabetes in low-income and middle-income countries: A systematic review and meta-analysis. *Lancet Glob Health* 2021; *9* : e170-80.
21. Dorji T, Yangchen P, Dorji C, Nidup T, Zam K. An approach to diabetes prevention and management: The Bhutan experience. *WHO South East Asia J Public Health* 2016; *5* : 44-7.
22. World Health Organisation. *Cardiovascular disease-HEARTS technical package*. Geneva: WHO; 2020.
23. Ministry of Health and Family Welfare, Government of India. *Ayushman Bharat – Health and Wellness Centre*. Available from: *https://ab-hwc.nhp.gov.in/home/aboutus*, accessed on March 29, 2021.
24. Mendis S, Al Bashir I, Dissanayake L, Varghese C, Fadhil I, Marhe E, *et al.* Gaps in capacity in primary care in low-resource settings for implementation of essential noncommunicable disease interventions. *Int J Hypertens* 2012; *2012* : 584041.
25. Negi S, Neupane D, Sahoo SK, Mahajan T, Swaroop K, Moran AE, *et al.* Prices of combination medicines and single-molecule antihypertensive medicines in India's private health care sector. *J Clin Hypertens (Greenwich)* 2021; *23* : 738-43.
26. Kaur P, Kunwar A, Sharma M, Mitra J, Das C, Swasticharan L, *et al.* India hypertension control initiative-hypertension treatment and blood pressure control in a cohort in 24 sentinel site clinics. *J Clin Hypertens (Greenwich)* 2021; *23* : 720-9.
27. World Health Organisation. *WHO technical specifications for automated non-invasive blood pressure measuring devices with cuff*. Available from: *https://apps.who.int/iris/handle/10665/331749,* accessed on October 14, 2021.

For correspondence: Dr Prabhdeep Kaur, ICMR-National Institute of Epidemiology, Ayapakkam, Chennai 600 077, Tamil Nadu, India
e-mail: kprabhdeep@gmail.com

Supplementary File

Operational Definitions

(*i*) NCDs: NCDs included in the study were hypertension, diabetes and screening for three cancers, oral, cervix and breast, included in the NPCDCS.[12]

(*ii*) Sub-centre: 1/5000 population in general areas and 1/3000 in difficult/tribal and hilly regions.[13]

(*iii*) Primary health centres: 1/30,000 population in general areas and 1/20,000 in difficult/tribal and hilly regions.[13]

(*iv*) Community health centres: 1/1,20,000 population in general areas and 1/80,000 in difficult/tribal and hilly regions.[13]

(*v*) District/sub-district hospital: A hospital at the secondary referral level responsible for a district of a defined geographical area containing a defined population.[13]