护理杂志
Journal of Nursing
Volume 70 Number 10
ISSN: 0047-262X
DOI: 10.5281/zenodo.10099280

Monitoring The Profile of Risk Factors of Noncommunicable Diseases by Modified Steps Approach Among Rural Population: From Chengalpattu District Tamilnadu, India

Geetha K [1] and Dr. C. Kanniammal [2]

[1] Assistant Professor, Community Health Nursing, SRM College of Nursing, SRM Medical College Hospital and Research Centre, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu District, Tamilnadu, India.
[2] Dean, SRM College of Nursing, SRM Medical College Hospital and Research Centre, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu District, Tamilnadu, India.

Abstract

A change in the illness spectrum among communicable to non-communicable diseases (NCDs) is one of the pivotal reasons for this economic revolution. Nowadays this problem of NCDs is becoming more and more serious in India. The World Health Organization (WHO) estimates that NCDs constitute an annual mortality of 41 million or a total fatality rate of 71% across the globe. The possibility of death by NCDs has been increased due to the usage of abusing alcohol, tobacco, and poor diet. This current cross-sectional, analytical study has been carried out from February 2021 to February 2022 in 6 villages (Mamandur, Vadapathy, Meyyur, Kodithandalam, Natarajapuram, and Samathuvapuram) which comprised 240 households in Chengalpattu, Tamil Nadu, India. The modified STEPS approaches were used for studying the profile of NCDs' risk factors among the subjects and it involves three sequential phases. Among 240 subjects, the majority were female (76.25%). Most of the study participants belonged to 41-50 years (29.17%). The present study results demonstrate that 95.83% of the study participants never smoke and 4.16% of the study population smoke. Among the study candidates, 93.33% never consumed alcohol and nearly 16.66% of the study population consumed alcohol. Out of 240 study individuals, the total number of diabetic cases that were diagnosed was 28.3%. Similarly, the total number of hypertensive patients diagnosed was 19.2%. Hence, confirms the necessity to deal with the problem thoroughly in the course of an NCD preventive and management plan by revealing a significant NCD risk factors burden in villages also.

Keywords: *Non-Communicable Diseases, WHO STEPS Approach, Economic Revolution, Risk Factors, NCD Prevention and Control Plan.*

INTRODUCTION

India is a diversified nation, and several of its states are going through an urbanization-driven epidemiological health change [1]. Economic growth brought about by urbanization has resulted in higher food and cigarette consumption as well as a decline in physical activities. A change in the illness spectrum among communicable to non-communicable diseases (NCDs) is one of the results of this economic revolution [2,3]. Nowadays, this problem of non-communicable diseases (NCDs) is becoming more and more serious in India [4]. In October 2010, the government of India launched the National Programme for Prevention and Control of diabetes, cancer, Stroke, and cardiovascular disease. The program's goals include lowering the risk of developing NCDs (diabetes, cardiovascular disease, and stroke), as well as early detection and effective care of these conditions [5].

护理杂志
Journal of Nursing
Volume 70 Number 10
ISSN: 0047-262X
DOI: 10.5281/zenodo.10099280

Metabolism-related risk factors and behavioral (lifestyle/modifiable) risk factors were used to categorize the risk factors for NCDs. Raised blood glucose, elevated blood pressure, obesity, and hyperlipidemia are examples of metabolic risk factors and alcohol, smoking, being inactive physically, and eating poorly are all behavioral risk factors [6,7]. More than 7.2 million people die each year from cigarette usage worldwide, whereas 4.1 million die from eating too much salt or sodium, 3.3 million die from drinking too much alcohol, and 1.6 million die from being inactive [8]. Long-term, expensive treatment for NCDs is linked to higher healthcare expenses for households living in poverty, making them more susceptible to social exclusion [9]. The World Health Organization (WHO) estimates that NCDs constitute an annual mortality of 41 million or a total fatality rate of 71% across the globe. Every year the death rate is increasing by 15 million among a population who are aged 30 to 69 years because of NCD; also 85% of these "premature" deaths occurred in low- and middle-income countries. Most of the NCD fatalities are caused by cardiovascular diseases (17.9 million annually), diabetes (1.5 million), and respiratory illnesses (4.1 million), and malignancies (9.3 million yearly) [10]. The possibility of death by NCDs has been increased due to the usage of abusing alcohol, tobacco, and poor diet [11].

In 21st century, NCDs seriously jeopardize the growth of the majority of nations. The Sustainable Development Objectives (SDGs) were developed in response to the growing NCDs burden in low- and middle-income countries through increased case fatality risk. These objectives and targets were to be accomplished by 2030 [12]. The reduction of premature mortality, improvement of substance abuse prevention and treatment programs, adoption of FCTC (tobacco control laws), and attainment of universal health coverage with access to basic medical supplies are among the NCD-related goals [13]. In order to achieve Sustainable Development Goal 3.4, which includes a target of lowering the likelihood of early death by 1/3rd via prevention and treatment by 2030. [12].

This "STEPS" strategy has been proposed by the WHO for surveillance of common NCD risk factors in order to track changes both within and across nations [14]. As more than two-thirds of the population of India lives in rural areas, very few studies have thoroughly evaluated the STEPS approach's NCD risk factors among that population. Rural people struggle with access issues and the cost of expensive, lifelong treatment for chronic diseases because of their inadequate health care systems [15]. Recently, it is increasingly acknowledged that the rise in risk factor prevalence within residents of rural areas is a public health problem. Furthermore, determining the NCD risk factors will result from organizing efficient interventions for addressing the escalating risk factors of NCDs with the purpose of impending NCDs [16]. Therefore, the main aim of the present investigation was to monitor the profile of risk factors of NCDs by the modified STEPS approach among rural population.

METHODS AND MATERIALS

This current cross-sectional, analytical study has been carried out from February 2021 to February 2022 in 6 villages (Mamandur, Vadapathy, Meyyur, Kodithandalam, Natarajapuram, and Samathuvapuram) which comprised 240 households in Chengalpattu, Tamil Nadu, India. Ethical approval (IEC/1663/2019) has been received from the Institute Ethical Committee (Human Studies). Study participants of age 31 - > 70 years residing in those 6 villages and subject taking hypertensive drugs were also included in the study. were included and study individuals who are severely ill, physically disabled, and pregnant women were excluded from this study. The modified STEPS approaches were used for studying the profile of NCDs' risk factors among the subjects and it involves three sequential phases [17].

护理杂志
Journal of Nursing
Volume 70 Number 10
ISSN: 0047-262X
DOI: 10.5281/zenodo.10099280

Data collection: (STEP 1)

The data was collected from 6 villages through proportionate probability size sampling. One person from 240 households was selected by employing a quantitative approach. An informed consent form was obtained from the study candidates. Subsequently, the selected study participants were interviewed and examined physically. Also, collecting information regarding socio-demographic profile, co-morbid illness, weight, height, waist-hip ratio, hip circumference, waist circumference, BMI, and random blood sugar, three blood pressure measurements were assessed. The reports of study participants regarding the consumption of alcohol, using of tobacco such as cigarettes, bidi or various forms of tobacco, diet plans, physical activities, as well as a history of diabetes mellitus and hypertension have been obtained from the study candidates. Participants will be told about restricting alcohol or beverages that are caffeinated and smoke for 30 minutes preceding measurements.

Physical measurements: (STEP 2)

Physical measurements such as weight, height, waist-hip ratio, hip circumference, waist circumference, BMI, and random blood sugar, three blood pressure measurements have been taken. The height (in cm) of the study participants was measured using inch tape by asking them to stand upright barefoot with their backs against the fence, along with knees and heels together, head in the Frankfurt position with eyes directed forward. The weight of the subjects has been measured with a standard weighing scale (in kilograms) by asking the subject to stand barefoot and the subject wearing light clothes and the weight that was displayed on the screen will be noted [18].

The calculation of Body mass index (BMI) has been done by the subsequent formula: BMI = Weight (in kg)/Height (in meters). As per the WHO classification, BMI has been categorized into further categories: normal - 18.5–24.9, underweight - <18.5, obesity - ≥30, and overweight - 25–29.9 [20]. Waist circumference has been calculated by making the subject stand straight by placing a tape horizontally around the middle of the waist just above the hip bones. The measuring tape has been placed surrounding the waist in such a way that it does not compress the skin. The circumference of the waist has been measured just after exhalation. The circumference of the waist for males with >90 cm and females with >80 cm has been studied as an indicator for obesity of the abdomen. The hip circumference has been calculated towards the widest circumference across greater trochanters. The hip circumference must be measured on standing subjects at the end of a gentle expiration [19].

The blood pressure of the study individuals was measured three times on the same arm at 10-minutes intervals using a digital sphygmomanometer on left arm by following a standard protocol in a sitting position. Subjects were asked to relax in their sitting posture at a minimum of 5 minutes before beginning blood pressure measurements. The respondent's arm was placed at the level of the heart. Then the study individuals has been categorized as hypertensive if systolic blood pressure (SBP) - >140mm Hg or diastolic blood pressure (DBP) - >90mm Hg in accordance with the joint National Committee on Prevention, Detection, Evaluation, and Treatment of High blood pressure. But the subject was sent to the medical officer for confirmation of hypertension. The final reading was determined using the mean of the second and third measurements. [21].

Biochemical measurements: (STEP 3)

The diabetic screening was done by Glucometer. The blood samples were collected by pricking the sterilized third or fourth finger and the very first drop of free-flowing blood will be cleared away with a sterile gauze. Random blood sugar levels were calculated using an accu-check active glucometer having measuring limit of 10-600mg/dl. The study participants who had a random blood sugar of more than 200 mg took an HbA1C test to confirm their diabetic status (>6.5% considered as diabetic) [22].

护理杂志
Journal of Nursing
Volume 70 Number 10
ISSN: 0047-262X
DOI: 10.5281/zenodo.10099280

RESULTS

A total of 240 subjects have participated from 6 villages in the present study conducted from February 2021 to February 2022. Table 1 demonstrates the demographic variable of the 240 study participants in 6 selected villages in Chengalpattu, Tamil Nadu, India. Among them, the majority were female (n=183; 76.25%). The most of the study participants belonged to 41-50 years (29.17%). About 50.83% (n=122) of the subjects had no formal education and 2.50% (n=6) of participants were under-graduated degree holders. The majority of study candidates (n=126; 52.50%) have < Rs. 2000 as their monthly per capita income. Most of the study individuals belong to the nuclear family (n=199; 82.92%). According to the dietary pattern, a maximum of the subjects (n=204; 85%) take non-vegetarian and 3.75% (n=9) of the study population were vegetarians. About, 73.75% (n=177) of the subjects consume vegetables daily and 2.50% (n=6) of them never take vegetables. Also, the majority of the study population rarely takes fruits (n=179; 74.58%) and 5% (n=12) of individuals never take fruits (Table 1). In the current study, personal habitats and physical activities have been tabulated in Table 2, which shows that 95.83% of the study participants (n=230) never smoke and 4.16% (n=10) of the study population smoke daily. Beedi is the form of tobacco that was used mostly by 62.50% (n=5) of the subjects. Among the study candidates, 93.33% (n=224) never consumed alcohol, and gin/brandy/rum/whisky are the type of alcohol that was consumed by most of the study participants (n=12; 80%) and nearly 16.66% (n=16) of the study population consumed alcohol. The study showed that nearly 66.53% (n=159) of the study subjects do household activity for 2-5 hours and external activity (n=119; 66.53%) respectively (Table 2).

Table 3 shows the status of diabetes and hypertension and its family history. Out of the 240-study population, 62.08% of the subjects never do any sort of exercise. The current study results reported that most of the study participants (n=76; 83.52%) had less than 30 minutes of exercise daily. From this study, 83.75% (n=201) of them did not have a family history of diabetes and 90% (n=219) from study candidates were not having any family hypertension history (Table 3). Out of 240 study individuals, the total number of diabetic cases that were diagnosed was 28.3% (n=68). Similarly, the total number of hypertensive patients diagnosed was 19.2% (n=46) and they were referred to nearby hospitals for further management (Figure 1).

Table 1: Demographic variables

Demographic variables		Number of patients (n=240)	%
AGE GROUP	31-40 years	56	23.33%
	41-50 years	70	29.17%
	51-60 years	58	24.17%
	61-70 years	39	16.25%
	>70 years	17	7.08%
SEX	Male	57	23.75%
	Female	183	76.25%
EDUCATIONAL STATUS	No formal Schooling	122	50.83%
	Primary School	32	13.33%
	Middle School	44	18.33%
	High School	29	12.08%
	Higher Secondary School	7	2.93%
	Under graduate Degree	6	2.50%
	Post Graduate Degree	0	0.00%
MONTHLY PER CAPITA INCOME	< Rs.2000	126	52.50%
	Rs.2001-5000	98	40.83%
	>Rs.5000	16	6.67%
RELIGION	Hindu	226	94.17%
	Muslim	3	1.25%

护理杂志
Journal of Nursing
Volume 70 Number 10
ISSN: 0047-262X
DOI: 10.5281/zenodo.10099280

	Christian	11	4.58%
TYPE OF FAMILY	Nuclear	199	82.92%
	Joint	41	17.08%
	Three generation	0	0.00%
DIETARY PATTERN	Vegetarian	9	3.75%
	Non-Vegetarian	204	85.00%
	Mixed	27	11.25%
VEGETABLE CONSUMPTION	Daily	177	73.75%
	Two or more days in a week	23	9.58%
	Once in a week	5	2.09%
	Rarely	29	12.08%
	Never take	6	2.50%
FRUIT CONSUMPTION	Daily	35	14.58%
	Two or more days in a week	9	3.75%
	Once in a week	5	2.09%
	Rarely	179	74.58%
	Never take	12	5.00%

Table 2: Personal habits and physical activity

Personal habits and physical activity		Number of patients (n=240)	%
SMOKING	Daily	4	1.66%
	≥ times in a week	1	0.42%
	Only one time in a month	1	0.42%
	Not often	4	1.67%
	Non-smokers	230	95.83%
FORM OF TOBOCCO	Cigar (Churuttu)	2	25.00%
	Beedi	5	62.50%
	Pipe	0	0.00%
	Filter Less cigarette	0	0.00%
	Filter cigarette	1	12.50%
ALCOHOL	Daily	5	2.08%
	≥ times in a week	3	1.25%
	Only one time in a week	2	0.83%
	Not often	6	2.92%
	Non-alcoholic	224	93.33%
TYPE OF ALCOHOL	Arrack (Country liquor)	1	6.67%
	Brandy / Gin / Whisky / Rum	12	80.00%
	Fortified wine	0	0.00%
	Beer	2	13.33%
	Teddy	0	0.00%
AMOUNT OF ALCOHOL	More than 390 ml (13 pegs and above)	1	6.67%
	300 ml - 360 ml (10 - 12 pegs)	4	26.67%
	210 ml - 270 ml (7 - 9 pegs)	4	26.67%
	120 ml - 180 ml (4 - 6 pegs)	4	26.67%
	30 ml - 90 ml (1 - 3 pegs)	2	13.33%
HOUSE HOLD ACTIVITY	Never do	36	15.06%
	Less than 2 hours	27	11.30%
	2 - 5 hours	159	66.53%
	6 - 9 hours	15	6.28%
	More than 10 hours	2	0.84%
EXTERNAL ACTIVITY	Never do	58	24.37%
	Less than 2 hours	15	6.30%
	2 - 5 hours	119	66.53%
	6 - 9 hours	38	15.97%
	More than 10 hours	8	3.36%

护理杂志
Journal of Nursing
Volume 70 Number 10
ISSN: 0047-262X
DOI: 10.5281/zenodo.10099280

Table 3: Status of diabetes and hypertension and its family history

Status of diabetes and hypertension and its family history		Number of patients (n=240)	%
EXCERCISES	Never do	149	62.08%
	Fast walking	76	31.67%
	Fast cycling	15	6.25%
HOURS OF EXCERISES	Less than 30 mts	76	83.52%
	31 mts - 1 hour	12	13.19%
	1.01 hr - 1.30 hrs	3	3.30%
	1.31 hr - 2 hours	0	0.00%
	> 2 hours	0	0.00%
FAMILY HISTORY OF DIABETES	No	201	83.75%
	Paternal	15	6.25%
	Maternal	19	7.92%
	Both	3	1.25%
	Don't know	2	0.83%
FAMILY HISTORY OF HYPERTENSION	No	216	90.00%
	Paternal	7	2.92%
	Maternal	11	4.58%
	Both	2	0.83%
	Dont know	4	1.67%

Prevalence of Diabetes Mellitus and Hypertension n=240					
S. No.	Group	Prevalence of diabetes		Prevalence of hypertension	
		n	%	n	%
1	Already known	60	25.0	33	13.8
3	Newly confirmed subjects	8	47.1	13	27.7
4	Total Cases	68	28.3	46	19.2

Figure 1: Prevalence of Diabetes and Hypertension

The study revealed variations in the prevalence of diabetes and hypertension among different participant groups. Among individuals already known to have diabetes, 60 (25.0%) were found to have diabetes, while 33 (13.8%) had hypertension. In the group of newly confirmed subjects, 8 (47.1%) were diagnosed with diabetes, and 13 (27.7%) had hypertension. Considering the total cases, 68 (28.3%) of the participants had diabetes, and 46 (19.2%) were diagnosed with hypertension. These findings provide insights into the prevalence of these health conditions across various participant groups in the study.

DISCUSSION

Recently, India has gotten through a prompt transition in the healthcare sector together with raising chronic NCDs burden. In compliance with the recent research work, one of the vital leading reasons for the fatality among the rural population in India was NCDs. However, epidemiological studies are very significant because they provide importance not just to enumerating the disease incidence but also assist in gaining insight knowledge towards the disease spectrum that has been brought out incompletely by the hospital data base [24]

The present research work portrays the risk factors of NCD among 6 selected villages in Chengalpattu, Tamil Nadu, India. In this study, the majority were female (76.25%) and most of the study participants belonged to 41-50 years (29.17%). Our study results were correlated with a research work of Srivastav S et al in Uttar Pradesh and their study reports showed that most of the study subjects were female (62.8%) and nearly 27.5% of them belonged to the age category of 41-50 years [25]. About 50.83% of the subjects had no formal education and these reports were found to be

Volume 70 Number 10
ISSN: 0047-262X
DOI: 10.5281/zenodo.10099280

in accordance with the study results of Bhar D et al and estimated 59.3% of them were not educated [26]. The majority of study candidates (52.50%) have < Rs. 2000 as their monthly per capita income and these results were not in accordance with the study findings of Bhar D et al which reported that 15.1% of the study individuals has got a monthly per capita income of < Rs. 4000 and 24.4% of them got monthly per capita income of > Rs. 7000 respectively [26].

According to the dietary pattern, a maximum of the subjects (85%) take non-vegetarian, and 3.75% of the study population were vegetarians. On the contrary, the study reports of Rizzo N et al suggests that 32.5% of the study participants were non-vegetarian and a maximum of them were vegetarians (64.5%). About, 73.75% of the subjects consume vegetables daily and 2.50% of them never take vegetables [27]. Also, the majority of the study population rarely takes fruits (74.58%) and 5% of individuals never take fruits. This can be ascribed to the poor socioeconomic conditions among study individuals and their unknowingness with respect to advantages in consumption of fruits and vegetables. Likewise, 95.8% of males as well as 97.1% of females had consumed fewer vegetables and fruits as reported by Bhagyalaxmi et al in their research work done in Gujarat among villagers which was in concordance with the present study findings [15].

The present study results demonstrate that 95.83% of the study participants never smoke and 4.16% of the study population smoke. In an investigation carried out by Srivastav S et al in Uttar Pradesh admist rural population, about 87.43% of the study subjects never smoke, and 12.5% of them do smoke [25]. Among the study candidates, 93.33% never consumed alcohol and nearly 16.66% of the study population consumed alcohol. Likewise, the study reports of Srivastav S et al suggest that nearly 6.28% of the study population consumed alcohol and 93.72% of them never consumed alcohol and these results were in accordance with the present study reports [25]. Additionally, the arduous lifestyle of the subjects can impart to increased alcohol consumption because it happens to be a root cause of easing their physical exhaustion which provided a impermanent relief. The current study showed that 62.08% of the subjects never do any sort of exercise and most of the study participants (83.52%) had less than 30 minutes of exercise daily [28]. However, the present study results were not associated with the study findings of Srivastav S et al as they demonstrate that a low number of study individuals (45.89%) do physical activity than the present study results [25]. Also, low physical activity (38.9%) was reported by the study participants in an investigation conducted by Bhagyalakshmi et al [15].

In the present research work, 83.75% of them did not have a family history of diabetes and 90% of the study subjects were not having a history of hypertension from their families. Similar investigation reports were identified from the research work of Adegbite BR et al, which showed that 93.7% of the study participants had a family history of diabetes, as well as 90% of them, had a family history of hypertension [29]. The total number of diabetic cases that were diagnosed was 28.3% and the total number of hypertensive patients diagnosed was 19.2% respectively. Also, the present study results were in accordance with the study findings of Ramani V K et al which demonstrated that about 21.5% of the study population were diagnosed with diabetes and hypertension was diagnosed among 13.8% of the total study participants respectively [30].

To develop population-specific and individually-tailored therapies, it is essential to undertake state- and region-specific NCD surveys because of the diversity in NCD prevalence [31]. States find it challenging to evaluate the success of the treatments used in the NPCDCS program due to the absence of baseline data across states. In order to institutionalize NCD surveillance efforts throughout all of the states, this asks for a necessary drive on the policy front [32]. Multiple departments other than the health remain to be insensitive to its part in NCD prevention, which presents a significant obstacle in approaching the rise in NCDs and their risk factors [33]. Therefore, enhancing multi-

Volume 70 Number 10
ISSN: 0047-262X
DOI: 10.5281/zenodo.10099280

sectoral partnerships and carrying out joint prevention initiatives in accordance with national multi-sectoral action plans may significantly contribute to precluding the emergence of NCD risk factors among populace [34].

CONCLUSION

The study confirms the necessity to deal with the problem thoroughly in the course of an NCD preventive and management plan by revealing a significant NCD risk factors burden in villages also. Risk factors, such as smoking, using smokeless tobacco, and eating insufficient amounts of fruits and vegetables are topics of concern in the current study for the rural area. Interventions including tobacco control, the manufacture and distribution of nutritious meals, the regulation of unhealthy foods, and urban design to encourage physical activity need to be put into place in order to lower the modifiable risk factors. Rural residents who participated in the study were aware that they needed to minimize risk factors from emerging, but they were unable to adopt good eating habits since there were no nutritious foods available to them because of poverty and low income. Instead of rationing, the government should develop such agreements that would promote access to nutrient-dense foods by collaborating with some self-help organizations. Therefore, the increased frequency of these risk factors makes Tamilnadu's district an ideal location for population-based health promotion interventions, which are essential for the efficient prevention and management of NCDs.

Acknowledgment

Conflict of Interest:

The authors declare that there is no conflict of interest.

Authors Contribution

All authors hold significant and sincere participation in this research work and have accepted it for publishing.

Funding

Nil.

Data Availability

Not applicable.

Ethical Statement

The study is accepted by the Institutional ethical committee of SRM Medical College Hospital and Research Centre (IEC/1663/2019).

References:

1) 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(10111):2437-2460. doi:10.1016/S0140-6736(17)32804-0.
2) Casari S, Di Paola M, Banci E, et al. Changing Dietary Habits: The Impact of Urbanization and Rising Socio-Economic Status in Families from Burkina Faso in Sub-Saharan Africa. *Nutrients*. 2022;14(9):1782. Published 2022 Apr 24. doi:10.3390/nu14091782.
3) Rijal A, Adhikari TB, Khan JAM, Berg-Beckhoff G. The economic impact of non-communicable diseases among households in South Asia and their coping strategy: A

Volume 70 Number 10
ISSN: 0047-262X
DOI: 10.5281/zenodo.10099280

systematic review [published correction appears in PLoS One. 2019 Jan 25;14(1):e0211588]. *PLoS One*. 2018;13(11):e0205745. doi: 10.1371/journal.pone.0205745.

4) Upadhyay RP. An overview of the burden of non-communicable diseases in India. *Iran J Public Health*. 2012;41(3):1-8.

5) Noncommunicable Diseases: National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular diseases and Stroke (NPCDCS); 2013. 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. [Last accessed on 2023 May 2].

6) Budreviciute A, Damiati S, Sabir DK, et al. Management and Prevention Strategies for Non-communicable Diseases (NCDs) and Their Risk Factors. *Front Public Health*. 2020;8:574111. Published 2020 Nov 26. doi:10.3389/fpubh.2020.574111.

7) Esmailnasab N, Moradi G, Delaveri A. Risk factors of non-communicable diseases and metabolic syndrome. *Iran J Public Health*. 2012;41(7):77-85.

8) Tobacco. World Health Organization (WHO); 2023. Available from: https://www.who.int/news-room/fact-sheets/detail/tobacco. [Last accessed on 2023 May 2].

9) Kazibwe J, Tran PB, Annerstedt KS. The household financial burden of non-communicable diseases in low- and middle-income countries: a systematic review. *Health Res Policy Syst*. 2021;19(1):96. doi:10.1186/s12961-021-00732-y.

10) Noncommunicable disease: Mortality. World Health Organization (WHO); 2023. Available from: https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/ncd-mortality. [Last accessed on 2023 May 2].

11) Noncommunicable disease. Pan American Health Organization (PAHO); 2023 Available from: https://www.paho.org/en/topics/noncommunicable-diseases. [Last accessed on 2023 May 2].

12) SDG Target 3.4 Non-communicable diseases and mental health. World Health Organization (WHO); 2023. Available from: https://www.who.int/data/gho/data/themes/topics/sdg-target-3_4-noncommunicable-diseases-and-mental-health. [Last accessed on 2023 May 2].

13) Magnusson RS. Framework legislation for non-communicable diseases: and for the Sustainable Development Goals?. *BMJ Glob Health*. 2017;2(3):e000385. doi:10.1136/bmjgh-2017-000385.

14) WHO STEPS Surveillance Manual. World Health Organization (WHO); 2023. Available from: https://www.who.int/docs/default-source/ncds/ncd-surveillance/steps/steps-manual.pdf?sfvrsn=c281673d_5. [Last accessed on 2023 May 2].

15) Bhagyalaxmi A, Atul T, Shikha J. Prevalence of risk factors of non-communicable diseases in a District of Gujarat, India. *J Health Popul Nutr*. 2013;31(1):78-85. doi:10.3329/jhpn.v31i1.14752.

16) Sarveswaran G, Kulothungan V, Mathur P. Clustering of noncommunicable disease risk factors among adults (18-69 years) in rural population, South-India. *Diabetes Metab Syndr*. 2020;14(5):1005-1014. doi:10.1016/j.dsx.2020.05.042.

Volume 70 Number 10
ISSN: 0047-262X
DOI: 10.5281/zenodo.10099280

17) World Health Organization. Guide to Physical Measurements (Step 2). WHO STEPS Surveillance. Geneva: World Health Organization; 2008.

18) World Health Organization. Waist Circumference and Waist-Hip Ratio: Report of a WHO Expert Consultation. Geneva: World Health Organization; 2011.

19) Lim SS, Vos T, Flaxman AD, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010 [published correction appears in Lancet. 2013 Apr 13;381(9874):1276] [published correction appears in Lancet. 2013 Feb 23;381(9867):628. AlMazroa, Mohammad A [added]; Memish, Ziad A [added]]. *Lancet*. 2012;380(9859):2224-2260. doi:10.1016/S0140-6736(12)61766-8.

20) STEPS Country Reports. World Health Organization (WHO). Available from: http://www.who.int/chp/steps/reports/en/ index.html. [Last accessed on 2023 May 2].

21) American Diabetes Association. Standards of Medical Care in Diabetes; 2013. Available from: http://www.care.diabetesjournals.org/content/36/Supplement_1/S11. full. [Last accessed on 2023 May 2].

22) Misra PJ, Mini GK, Thankappan KR. Risk factor profile for non-communicable diseases among Mishing tribes in Assam, India: results from a WHO STEPs survey. *Indian J Med Res*. 2014;140(3):370-378.

23) Yadav S, Arokiasamy P. Understanding epidemiological transition in India. *Glob Health Action*. 2014;7:23248. Published 2014 May 15. doi:10.3402/gha.v7.23248.

24) Nethan S, Sinha D, Mehrotra R. Non Communicable Disease Risk Factors and their Trends in India. *Asian Pac J Cancer Prev*. 2017;18(7):2005-2010. Published 2017 Jul 27. doi:10.22034/APJCP.2017.18.7.2005.

25) Srivastav S, Mahajan H, Goel S, Mukherjee S. Prevalence of risk factors of noncommunicable diseases in a rural population of district Gautam-Budh Nagar, Uttar Pradesh using the World Health Organization STEPS approach. *J Family Med Prim Care*. 2017;6(3):491-497. doi:10.4103/2249-4863.222027.

26) Bhar D, Bhattacherjee S, Das DK. Behavioral and biological risk factors of noncommunicable diseases among tribal adults of rural siliguri in Darjeeling District, West Bengal: A cross-sectional study. *Indian J Public Health*. 2019;63(2):119-127. doi:10.4103/ijph.IJPH_326_18.

27) Rizzo NS, Jaceldo-Siegl K, Sabate J, Fraser GE. Nutrient profiles of vegetarian and nonvegetarian dietary patterns. *J Acad Nutr Diet*. 2013;113(12):1610-1619. doi:10.1016/j.jand.2013.06.349.

28) M, R., & Dongre, A. (2019). Risk factors for non-communicable diseases in villages of Tamil Nadu - A survey. *International Journal of Medical Science and Public Health*, *8*(4), 1. https://doi.org/10.5455/ijmsph.2019.0204705032019

29) Adegbite BR, Edoa JR, Agbo Achimi Abdul J, et al. Non-communicable disease co-morbidity and associated factors in tuberculosis patients: A cross-sectional study in Gabon. *EClinicalMedicine*. 2022;45:101316. doi:10.1016/j.eclinm.2022.101316.

30) Ramani VK, Suresh KP. Prevalence of hypertension and diabetes morbidity among adults in a few urban slums of Bangalore city, determinants of its risk factors and opportunities for control - A cross-sectional study. *J Family Med Prim Care*. 2020;9(7):3264-3271. doi:10.4103/jfmpc.jfmpc_234_20.

Volume 70 Number 10
ISSN: 0047-262X
DOI: 10.5281/zenodo.10099280

31) Sivanantham P, Sahoo J, Lakshminarayanan S, Bobby Z, Kar SS. Profile of risk factors for Non-Communicable Diseases (NCDs) in a highly urbanized district of India: Findings from Puducherry district-wide STEPS Survey, 2019-20. *PLoS One*. 2021;16(1):e0245254. doi:10.1371/journal.pone.0245254.

32) Thakur JS, Paika R, Singh S. Burden of noncommunicable diseases and implementation challenges of National NCD Programmes in India. *Med J Armed Forces India*. 2020;76(3):261-267. doi:10.1016/j.mjafi.2020.03.002.

33) Hadian M, Mozafari MR, Mazaheri E, Jabbari A. Challenges of the Health System in Preventing Non-Communicable Diseases; Systematized Review. *Int J Prev Med*. 2021;12:71. doi:10.4103/ijpvm.IJPVM_487_20.

34) Juma PA, Mapa-Tassou C, Mohamed SF, et al. Multi-sectoral action in non-communicable disease prevention policy development in five African countries. *BMC Public Health*. 2018;18(Suppl 1):953. doi:10.1186/s12889-018-5826-6.