Prevalence and pattern of multimorbidity in Urban Tamilnadu: A cross sectional study

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Abstract:
Background - Several countries are undergoing an epidemiological transition where degenerative diseases are the major cause of mortality and morbidity replacing nutritional and infectious diseases. Non-communicable diseases (NCDs) share common etiological and risk factors. This in turn has increased the prevalence of multi-morbidity. The objective of this study was to estimate the prevalence, patterns and risk factors of multimorbidity above 30 years of age in the southern part of Chennai.
Materials and methods - A cross-sectional study was conducted among NCD patients above 30 years of age attending the Free Community Hospital of a tertiary care centre in Chengalpattu district, Tamil Nadu. Data from 411 participants were collected using a pretested semi-structured questionnaire.
Results - The mean age of the study participant was 59 years and nearly 62.5% were females. 31 % belong to the upper socioeconomic class. The prevalence of multimorbidity was 46.4%. Diabetes and hypertension were the most frequently co-existing conditions. Age, Gender, and occupational status were associated with multimorbidity.
Conclusion: Nearly 50.4 % are with multimorbidity. Diabetes and hypertension were the most frequently co-existing conditions. A better understanding of multi-morbidity patterns and risk factors is crucial for the re-organization of healthcare services to provide integrated care for multiple chronic conditions.

Keywords: Coronary artery disease, Depression, Diabetes mellitus, India, Multimorbidity, Prevalence, Risk factors

1. INTRODUCTION

Several countries are undergoing an epidemiological transition where degenerative diseases are the major cause of mortality and morbidity replacing nutritional and infectious diseases.[1] Tamil Nadu is one of India's three states undergoing epidemiological transition. Ageing, unhealthy diet, lack of physical activity, high blood pressure, high blood sugar, high cholesterol and overweight are the causes of chronic diseases.[2] Non-communicable diseases(NCDs) are those which affect the population over an extended period of time and

share common etiological and risk factors.[3] This in turn has increased the prevalence of multi-morbidity defined as the co-existence of more than one chronic condition in the same individual.[1,4] Multimorbidity patterns are found to affect activities of daily living, increased risk of disability, frailty and mortality.[5,6,7] Furthermore it may result in financial burden, especially in low- and middle-income countries (LMICs).[1] Data from LMICs on multi-morbidity are limited. The prevalence of multimorbidity varies from 4.5 to 83 %.[8] It is important to characterize the multimorbidity pattern in the local population due to wide heterogeneity in its prevalence and patterns. The burden of NCDs in India are on the rise, with the onset of disease at least a decade earlier compared to Western countries. It is highly likely that the prevalence of multimorbidity will be higher in Tamil Nadu. However, there is limited data on the prevalence of multimorbidity in Tamil Nadu. A better understanding of multimorbidity patterns and risk factors is crucial for the re-organization of healthcare services to provide integrated care for multiple chronic conditions.

2. METHODOLOGY

A cross-sectional study among patients attending the Free Community Hospital of a tertiary care centre in Chengalpattu district, Tamil Nadu comprised patients above 30 years of age who were diagnosed case of any of the following chronic diseases namely Diabetes Mellitus, Hypertension, Dyslipidaemia, Coronary artery disease (CAD), Cerebrovascular disease (CVD), Thyroid disorders, Chronic Obstructive Pulmonary Disease (COPD), Chronic Kidney Disease (CKD), Arthritis and Cancer presented to the Free Community Hospital during November 2022 to January 2023. These patients were assessed for the coexistence of depression using the PHQ9 questionnaire.[9]

C and Jeemon et al estimated the prevalence of multi-morbidity to be 45.4% in the age group of 30-69 years.(1) Considering p=45.4, q=55.6 and allowable error, l=5%, the sample size was calculated to be 445 assuming 10% non-response rate. The number of samples required was selected through the judgemental sampling technique.

Data collection:

　　　Necessary data were collected using a pre-tested semi-structured questionnaire. The sociodemographic profile, chronic conditions, and past treatments were all noted. The presence of chronic diseases was further cross verified with the patient's medical records. Socioeconomic status was assessed using Modified B.G Prasad's Socio-economic status scale as our study included both urban and rural populations.[10] The PHQ9 questionnaire was used to screen for depression.

Statistical analysis:

　　　Using version 21 of SPSS, collected data were entered in Microsoft Excel spread sheet and analysed. Qualitative variables are expressed in proportions and quantitative data in mean (SD). Analysis was done using chi-square test considering p value less than 0.05 as significant and the strength of association was estimated by odd's ratio with 95% confidence limits.

Operational definition:

　　　PHQ9 questionnaire is a validated instrument for detecting depression. It is scored on a scale of 0-27. Patients with a score of 15 to 27 were considered to have depression.[9]

Multi-morbidity is defined as the co-existence of more than one chronic condition in the same individual.[1]

Ethical consideration:

Institutional Human Ethical Committee approval was obtained before starting the study. The title of the study, aim, and benefits were clearly explained in their regional language. Participants' privacy was maintained throughout the study. Participants' privacy was maintained at all times. Participants were given the right to refuse to take part in the study at any time.

3. RESULTS

Data were collected from 411 patients with a response rate of 92%. It was found that the mean age and SD were 59.05 years and 11.18 years. More than half of the patients were younger than 60 years (53%, N = 218). The majority of the participants were women, 62.5%, N = 257. Nearly, 46.7% were unemployed and 37.7% were lacking school education. The majority of the study population belonged to the Upper and Upper Middle Income Group, amounting to 59.6% while 6.1% (N = 25) was in the lower income group. Thirty two percent had family history of Non-communicable diseases, 80.8% of the study population were free from tobacco and only nine participants (2.2%) had history of taking alcohol in the present or past. More than half of the study participants (55.2%, N=227) admitted inadequate physical activity. Fifty two percent (N=214) and 48.2% (N=198) had obesity and increased waist-hip ratio respectively.

Table1: General characteristics of the study population (n= 411)

Characteristics	Total	
	N (411)	**%**
Mean age (SD)	59.05 ± 11.18	
Age		
<60 years	218	53
≥60 years	193	47
Gender		
Male	154	37.5
Female	257	62.5
Occupation		
Unemployed	192	46.7
Employed	219	53.3
Education		
Illiterate	155	37.7
Postgraduate	256	62.3
Socioeconomic status		
Lower class	25	6.1
Upper lower class	56	13.6
Lower middle class	85	20.7
Upper middle class	106	25.8
Upper class	139	33.8
Place		
Rural	269	65.5
urban	142	34.5

Family history of NCD		
Yes	124	30.2
No	289	69.8
Tobacco use		
Yes	79	19.2
No	332	80.8
Alcohol use		
Yes	9	2.2
No	402	97.8
Moderate physical activity		
Yes	227	55.2
No	184	44.8
Obesity		
Yes	214	52.1
No	197	47.9
Abdominal fat accumulation		
Yes	198	48.2
No	213	51.8

Morbidity pattern in study population

Table 2: Frequency distribution of NCD

Characteristics	Total	Male	Female
Diabetes mellitus	244 (59.4)	97 (63)	147 (57.2)
Hypertension	209 (50.9)	76 (49.4)	133 (51.8)
Depression	121 (29.4)	33 (21.4)	88 (34.2)
COPD	36 (8.8)	22 (14.3)	14 (5.4)
CAD	36 (8.8)	17 (11)	19 (7.4)
Dyslipidemia	30 (7.3)	16 (10.4)	14 (5.4)
Hypothyroidism	19 (4.6)	3 (1.9)	16 (6.2)
Arthritis	12 (2.9)	2 (1.3)	10 (3.9)
CVA	7 (1.7)	4 (2.6)	3 (1.2)
CKD	2 (0.5)	0	2 (0.8)

Diabetes was the most prevalent morbidity present in 59.4% (n=244) of the study population followed by Hypertension in 50.9% (n=209), depression in 29.4% (n=121), COPD and CAD each affecting 8.8% (n=36), Dyslipidemia, Hypothyroidism, Arthritis, CVA, CKD in 7.3%, 4.6%, 2.9%, 1.7% and 0.5% respectively (n=30, 19, 12, 7 and 2).

Multimorbidity patterns in study population
The prevalence of multimorbidity was found to be 50.4% (207).

Table 3: Frequency distribution of multimorbidity

Multimorbidity	Total, n=411 (%)	Male, n=154 (%)	Female, n=257 (%)
No multimorbidity	204 (49.63)	80 (51.95)	124 (48.25)
2 morbidity	133 (32.4)	39 (25.32)	94 (36.57)
3 morbidity	56 (13.6)	27 (17.53)	29 (11.28)

4 morbidity	11 (2.7)	5 (3.25)	6 (2.33)
5 morbidity	6 (1.5)	2 (1.3)	4 (1.55)
6 morbidity	1 (0.2)	1 (0.6)	0

Overall, 32.4% (133), 13.6% (56), 2.7% (11) of the patients reported to have two, three, four morbidity respectively. 6 patients (1.5%) had five chronic conditions together namely Diabetes, Hypertension, Dyslipidemia, Coronary Artery Disease and Depression or CKD. Only one patient had 6 chronic conditions together namely Diabetes, Hypertension, Dyslipidemia, Hypothyroidism, Coronary Artery Disease and Depression. Dyads were more frequent in females (36.6%, n=94) compared to males (25.3%, n=39) while triads were more frequent in males (17.5%, n=27) compared to females (11.3%,n=29). Diabetes and hypertension was the most frequent dyad in both gender (12.2%), followed by hypertension and depression (6.3%).
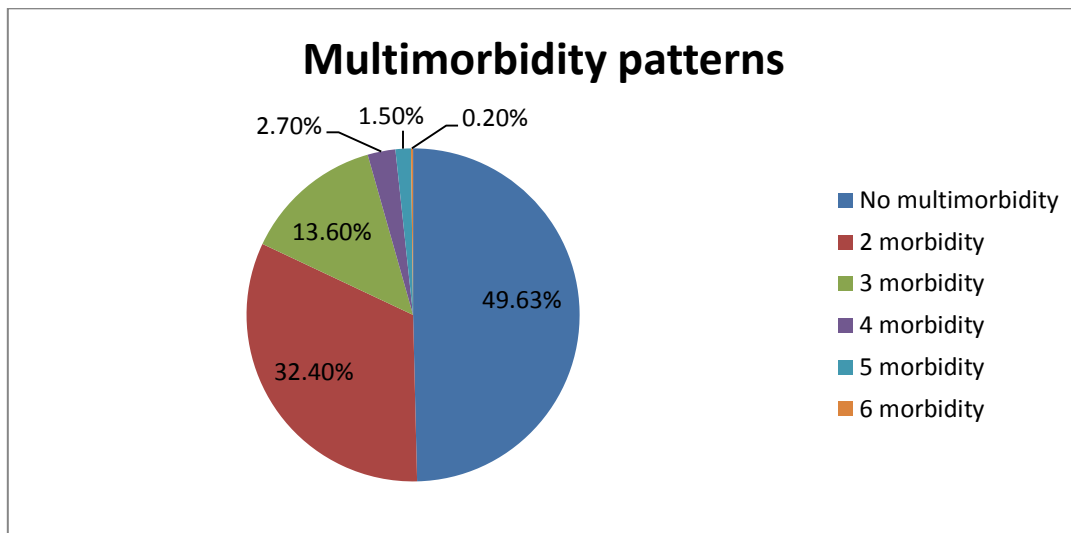

Figure 1: Multimorbidity patterns in the study population
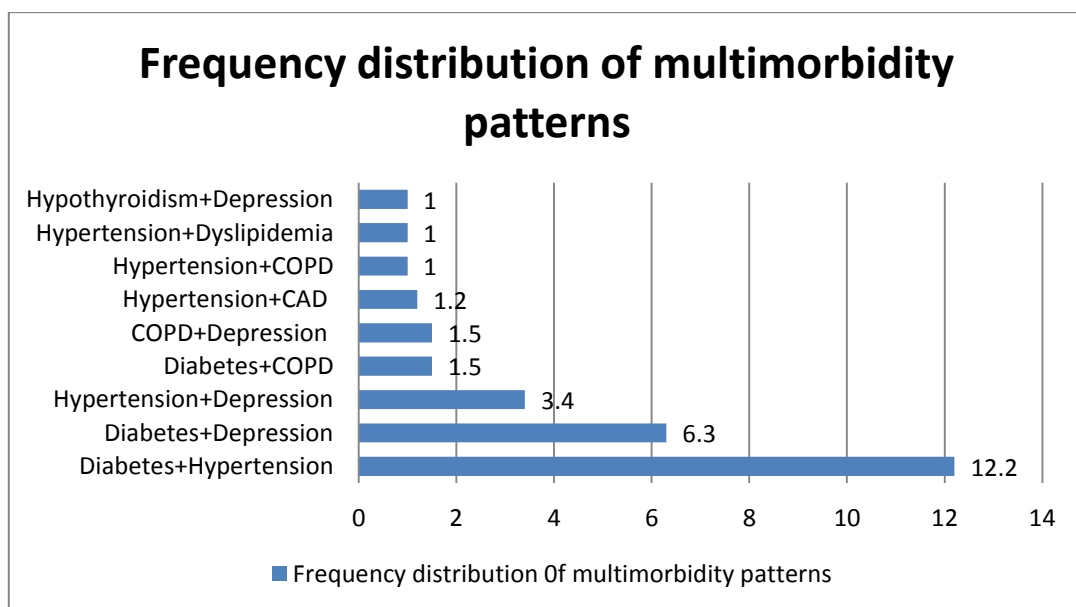

Figure 2: Frequency distribution of common multimorbidity patterns

Diabetes, hypertension and depression were coexistent in 8.4% (n=13) of the males and 8.2% (n=21) of the females. Diabetes-hypertension-dyslipidaemia and hypertension-dyslipidaemia-CAD each present in 2.6% (n=4) of the study participants

Risk factors

Table 4: Association between Non-modifiable Risk factors and Multimorbidity by Pearson Chi-square analysis (n=411)

Socio-demographic characteristics	MM N=207	No MM, N=204	Chi-square	P value
Age				
30-39 years	3	31	11.22	0.47
40-49 years	27	55		
50-59 years	62	62		
60-69 years	80	32		
70-79 years	29	10		
80-89 years	6	10		
Gender				
Male	74	80	0.527	0.477
Female	133	124		
Place				
Rural	58	84	6.706	0.010
Urban	146	123		
Education				
Illiterate	84	44	9.526	1.46
Primary school	44	38		
Middle school	32	30		
High school	33	15		
Intermediate/ Diploma	10	5		
Graduate	0	1		
Postgraduate	4	1		
Occupation				
Unemployed	96	39	4.008	0.676
Unskilled worker	45	8		

Semi-skilled worker	14	34		
Skilled worker	30	23		
Clerk/shop/farm	19	3		
Semi professional	1	1		
Professional	2	1		
Socioeconomic status				
Upper class	67	72	0.968	0.915
Upper middle class	53	53		
Lower middle class	44	41		
Upper lower class	32	24		
Lower class	11	14		
Family history				
Yes	52	72	4.211	0.40
No	152	135		

Table 5: Association between modifiable Risk factors and Multimorbidity by Pearson Chi-square analysis (n=411)

Risk Factors	Multimorbidity, N=207	No multimorbidity, N=204	Chi-square	P value
Tobacco use				
Yes	50	29	6.537	0.011
No	157	175		
Smoking habit in the past or present*				
Yes	11	3	4.613	0.032
No	196	201		
Alcohol use in the past or present				
Yes	9	0	9.068	0.003
No	198	204		
Physical inactivity				
Yes	207	133	16.266	0.0001
No	113	71		
Obesity				
Yes	110	104	0.192	0.661
No	97	100		
Abdominal fat accumulation				
Yes	108	90	2.671	0.102
No	99	114		

Table 6: Logistic regression analysis of the non-modifiable risk factors associated with multimorbidity (n=411)

	Multimorbidity, N=207	No multimorbidity, N=204	P value (χ^2)	Crude OR	Adjusted OR
Age					
Mean age	59.633	58.598			
≥60 years	114	104	0.406	0.848 (0.576 − 1.250)	
<60 years	93	100			
Gender					
Male	74	80	0.468	1.16 (0.777 − 1.729)	
Female	133	124			
Place					
Rural	84	58	0.12	1.719 (1.139-2.595)	1.685 (1.110-2.558)
Urban	123	146			
Education					
Illiterate	84	71	0.227	0.782 (0.524 − 1.166)	
Literate	123	133			
Occupation					
Unemployed	96	96	0.890	1.028 (0.698 − 1.514)	
Employed	111	108			
Socioeconomic status					
Lower class	11	14	0.631	1.184 (0.503-2.790)	
Upper lower class	32	24	0.371	0.698 (0.374-1.304)	
Lower middle class	44	41	0.780	0.867 (0.505-1.488)	
Upper middle class	53	53	0.731	0.931 (0.561-1.543)	
Upper class	67	72			

Family history					
Yes	72	52	0.040	0.641 (0.419 − 0.982)	
No	135	152			

Table 7: Logistic regression analysis of the modifiable risk factors associated with multimorbidity (n=411)

	Multimorbidity, N=207	No multimorbidity, N=204	χ^2 (P value)	Crude OR	Adjusted OR
Tobacco use					
Yes	50	29	0.011	0.520 (0.314 - 0.863)	
No	157	175			
Smoking					
Yes	32	16	0.016	0.467 (0.247 - 0.878)	
No	175	188			
Alcohol use					
Yes	9	0	0.003	2.030 (1.839 - 2.242)	
No	198	204			
Inadequate physical activity					
Yes	94	133	0.0001	2.252 (1.514 - 3.350)	2.187 (1.453 − 3.292)
No	113	71			
Obesity					
Yes	110	104	0.661	0.917 (0.623 − 1.351)	
No	97	100			
Abdominal fat accumulation					
Yes	108	90	0.102	0.724 (0.491 − 1.067)	
No	99	114			

The prevalence of multimorbidity was 40.8% (58) in rural and 49.4% (133) in urban population. Pearson's Chi-square test was done where family history of NCD (p=0.040), tobacco use (p=0.011), smoking (p=0.016) and physical inactivity (p=0.0001) had association with multimorbidity. Nine participants had history of alcohol use and all of them were

suffering from two or more chronic conditions which had significant association with multimorbidity established by fischer's exact test, p=0.003.

Logistic regression analysis was done which revealed people with alcohol use had two times increased odds of developing multimorbidity (95% CI: 1.839 - 2.242). People categorized as having physical inactivity was at 2.25 times increased risk of developing multimorbidity (95% CI: 1.514 - 3.350). We found that urban population was at 1.71 times higher odds of developing multimorbidity compared to the rural population. Neither socio-demographic factors nor anthropometric measurements were found to be associated with multimorbidity in the study population. Further multivariate logistic regression analysis was performed where physical inactivity (OR - 2.187; 95% CI: 1.453 – 3.292) was found to have significant association with multimorbidity.

4. DISCUSSION

In India, about 61.8% of deaths in 2016 were due to Non-Communicable Diseases whereas in 1990 NCD deaths accounted to 37.9%. Similar etiological factors contribute to the development of major NCDs namely cardiovascular diseases, cancer, chronic respiratory diseases and diabetes.[11] These factors also cause depression and vice versa.[12,13] Ageing, rapid unplanned urbanization and globalization are major contributions to the increase in NCDs.[14] The prevalence of diabetes and hypertension is high among all socio-demographic groups in India.[15] This in turn is significantly associated with CAD due to synergistic additive interaction.[16] The results of national surveys including the great India blood pressure survey revealed the prevalence of hypertension (15%) higher than diabetes (10%). [15,17] In our study, we found that most multimorbidity patterns had the diabetes or hypertension component. Effectively preventing the development of diabetes and hypertension can reduce the prevalence of multimorbidity thereby restraining from disability and premature deaths. Older age, women, higher educational level, obesity (central obesity) were associated with increased risk of hypertension and diabetes.[16,18,19]

According to Ismail et al, prevalence of multimorbidity was 39.8% with a mean age of 56.7. Factors associated were increasing age, lower educational attainment, overweight or obesity. The most common multimorbidity pattern was diabetes and hypertension (69.1%) which is similar to our study.[20] Jeemon et al found the prevalence of multimorbidity to be 45.4% with a mean age of 53. Most common multimorbidity pattern was hypertension and diabetes (31%) in both males and females. Second and third common pattern was depression along with hypertension and diabetes in females while it was ischemic heart disease along with hypertension and diabetes in males.[1] According to Prenissl Jonas et al household affluence, being a woman, getting married, quitting smoking were linked to higher likelihood of multimorbidity. Multimorbidity was widespread among young and middle-aged persons in India. Further the prevalence of multimorbidity was high in urban areas of Tamilnadu, Telengana and Andhra Pradesh similar to the findings of our study.[21]

Marengoni et al studied the development of disability in patients with multimorbidity above 60 years of age. At the end of six years follow up 21% of the participants developed limitations of at least one ADL (Activities of Daily Living) and 15% of them developed limitations of at least one IADL (Instrumental Activities of Daily Living).[5] Positive association between multimorbidity and mortality was proven, with risk of death 1.73 (95% CI: 1.41; 2.13) times and 2.72 (95% CI: 1.81; 4.08) times higher in individuals with two and three co-existing morbidities respectively compared with individuals with less than one chronic disease.[6]

The number of diabetics are projected to be 100 million by the year 2030.[25] It is estimated that only about 12% of the hypertensive and 15.7% of diabetics had good control of the blood pressure and sugar respectively.[21,26,27] Due to the continuous increase in the number of NCD cases sharing common etiological factors, early age of onset and the synergistic effect of metabolic diseases, the prevalence of multimorbidity is also on the rise. Hypertension and diabetes being the two most common NCDs among Indian population must be prevented at all the levels of health care. Screening patients with any NCD for the co-existence of other NCDs will aid in early detection of multimorbidity. Collaborating geriatric clinics with super specialities will benefit through secondary and tertiary prevention.

5. CONCLUSION

A better understanding of multi-morbidity patterns and risk factors is crucial for re-organization of health care services to provide integrated care for multiple chronic conditions. Adopting healthier lifestyle through balanced and wholesome diet, adequate physical activity, community participation in IEC Activities,

Conflicts of interest:
No conflicts of interest

List of Abbreviation:

Abbreviation	Definition
ADL	Activities of Daily Living
AOR	Adjusted odd's ratio
CAD	Coronary Artery Disease
CI	Confidence Interval
CKD	Chronic Kidney Disease
COPD	Chronic Obstructive Pulmonary Disease
CVA	Cerebrovascular Accidents
IADL	Instrumental Activities of Daily Living
IEC	Information, Education and Communication
MM	Multimorbidity
NCD	Non-Communicable Disease
OR	Odd's ratio
PHQ 9	Patient Health Questionnaire 9
SD	Standard Deviation

6. REFERENCES

1. C R, Jeemon P. Prevalence and patterns of multi-morbidity in the productive age group of 30-69 years: A cross-sectional study in Pathanamthitta District, Kerala. Wellcome Open Res. 2020 Dec 15;5:233.
2. Non-Communicable Diseases (NCDS) In India [Internet]. [cited 2022 Oct 15]. Available from: https://pib.gov.in/pib.gov.in/Pressreleaseshare.aspx?PRID=1576626
3. Shang X, Peng W, Hill E, Szoeke C, He M, Zhang L. Incidence, Progression, and Patterns of Multimorbidity in Community-Dwelling Middle-Aged Men and Women. Front Public Health. 2020 Aug 18;8:404.
4. World Health Organization. Multimorbidity [Internet]. Geneva: World Health Organization; 2016 [cited 2022 Oct 15]. 28 p. (Technical Series on Safer Primary Care). Available from: https://apps.who.int/iris/handle/10665/252275

5. Marengoni A, Akugizibwe R, Vetrano DL, Roso-Llorach A, Onder G, Welmer AK, et al. Patterns of multimorbidity and risk of disability in community-dwelling older persons. Aging Clin Exp Res. 2021;33(2):457–62.

6. Multimorbidity and mortality in older adults: A systematic review and meta-analysis - ScienceDirect [Internet]. [cited 2023 Mar 12]. Available from: https://www.sciencedirect.com/science/article/abs/pii/S0167494316301388

7. St John PD, Tyas SL, Menec V, Tate R. Multimorbidity, disability, and mortality in community-dwelling older adults. Can Fam Physician. 2014 May;60(5):e272–80.

8. S P, S S, Ma H, M van den A, J M, Ja K, et al. Prevalence and outcomes of multimorbidity in South Asia: a systematic review. BMJ Open [Internet]. 2015 Oct 7 [cited 2023 Mar 20];5(10). Available from: https://pubmed.ncbi.nlm.nih.gov/26446164/

9. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001 Sep;16(9):606–13.

10. Bashar MA. Modified BG prasad socioeconomic status scale: Updated for the year 2022. Indian Pediatrics. 2022;59(10):816–.

11. Status of Non-Communicable Diseases (NCDs) in India [Internet]. [cited 2023 Mar 15]. Available from: https://pib.gov.in/pib.gov.in/Pressreleaseshare.aspx?PRID=1796435

12. Mental Health and Neurological Disorders [Internet]. NCD Alliance. 2015 [cited 2023 Mar 19]. Available from: https://ncdalliance.org/why-ncds/ncds/mental-health-and-neurological-disorders

13. Alsharbati W. prevalence of depression among NCD patients. 2020 Apr 8;

14. Noncommunicable diseases [Internet]. [cited 2023 Mar 15]. Available from: https://www.who.int/india/health-topics/noncommunicable-diseases

15. Geldsetzer P, Manne-Goehler J, Theilmann M, Davies JI, Awasthi A, Vollmer S, et al. Diabetes and Hypertension in India: A Nationally Representative Study of 1.3 Million Adults. JAMA Intern Med. 2018 Mar 1;178(3):363–72.

16. Wang Z, Yang T, Fu H. Prevalence of diabetes and hypertension and their interaction effects on cardio-cerebrovascular diseases: a cross-sectional study. BMC Public Health. 2021 Jun 25;21(1):1224.

17. Ramakrishnan S, Zachariah G, Gupta K, Shivkumar Rao J, Mohanan PP, Venugopal K, et al. Prevalence of hypertension among Indian adults: Results from the great India blood pressure survey. Indian Heart J. 2019 Jul 1;71(4):309–13.

18. Petrie JR, Guzik TJ, Touyz RM. Diabetes, Hypertension, and Cardiovascular Disease: Clinical Insights and Vascular Mechanisms. Can J Cardiol. 2018 May;34(5):575.

19. Sowers JR, Epstein M, Frohlich ED. Diabetes, Hypertension, and Cardiovascular Disease. Hypertension. 2001 Apr;37(4):1053–9.

20. Ismail S, Stanley A, Jeemon P. Prevalence of multimorbidity and associated treatment burden in primary care settings in Kerala: a cross-sectional study in Malappuram District, Kerala, India [Internet]. Wellcome Open Research; 2022 [cited 2022 Oct 14]. Available from: https://wellcomeopenresearch.org/articles/7-67

21. Prenissl J, Manne-Goehler J, Jaacks LM, Prabhakaran D, Awasthi A, Bischops AC, et al. Hypertension screening, awareness, treatment, and control in India: A nationally representative cross-sectional study among individuals aged 15 to 49 years. PLOS Med. 2019 May 3;16(5):e1002801.

22. Lu J, Wang Y, Hou L, Zuo Z, Zhang N, Wei A. Multimorbidity patterns in old adults and their associated multi-layered factors: a cross-sectional study. BMC Geriatr. 2021 Jun 19;21(1):372.

23. Khanam MA, Streatfield PK, Kabir ZN, Qiu C, Cornelius C, Wahlin Å. Prevalence and Patterns of Multimorbidity among Elderly People in Rural Bangladesh: A Cross-sectional Study. J Health Popul Nutr. 2011 Aug;29(4):406–14.

24. Kshatri JS, Palo SK, Bhoi T, Barik SR, Pati S. Prevalence and Patterns of Multimorbidity Among Rural Elderly: Findings of the AHSETS Study. Front Public Health. 2020;8:582663.

25. Rinnenburger D. The Epidemiological Shift from Acute to Chronic in India. In: Rinnenburger D, editor. Chronicity: Treating and coping [Internet]. Cham: Springer International Publishing; 2021 [cited 2023 Mar 12]. p. 51–8. Available from: https://doi.org/10.1007/978-3-030-66873-0_8

26. India Hypertension Control Initiative, a high impact and low-cost solution [Internet]. [cited 2023 Mar 15]. Available from: https://www.who.int/india/news/detail/02-06-2022-india-hypertension-control-initiative--a-high-impact-and-low-cost-solution

27. Mathur P, Leburu S, Kulothungan V. Prevalence, Awareness, Treatment and Control of Diabetes in India From the Countrywide National NCD Monitoring Survey. Front Public Health. 2022;10:748157.