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Original Research Article

Magnitude and pattern of multimorbidity among adult patients attending a primary care setting in Delhi, India

Priyanka Pandey*, Anita S. Acharya, Ananya R. Laskar

Department of Community Medicine, LHMC, New Delhi, India

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***Correspondence:**
Dr. Priyanka Pandey,
E-mail: priyankadoctor7@gmai.com

ABSTRACT

Background: Multimorbidity, "the coexistence of two or more chronic diseases", is an upcoming & less addressed public health challenge for low and middle-income countries undergoing rapid demographic and epidemiological transition. This study was done to estimate the burden & pattern of multimorbidity in adults (≥18 years) in a primary care setting.
Methods: This cross-sectional study was carried out from January 2021 to March 2022 at a primary health centre in South Delhi. Data was collected by conducting exit interviews with 510 adult patients using a self-designed, pre-tested interview schedule. Data was analyzed using SPSS and Microsoft Excel.
Results: Out of 510 study subjects interviewed, the overall magnitude of multimorbidity was 160 (31.4%). Almost half of the study subjects with multimorbidity had dyads, one-third had triads, and the rest had quadrads multimorbidity patterns. The leading triad was diabetes mellitus+hypertension+heart disease (12.3%), followed by diabetes mellitus+hypertension+chronic lung disease (10.5%). More than half of the study subjects with multimorbidity, 89 (55.6%), suffered from concordant MM.
Conclusions: The study revealed that 31.4% of subjects had multimorbidity, which was almost equally distributed across the age groups. The burden was significantly higher among those aged 18-39 years. Hypertension and Heart disease were found to be the most frequent and the most concordant multimorbidity, respectively, associated with Diabetes mellitus.

Keywords: Multimorbidity, Dyads, Triads, Quadrads, Delhi, India

INTRODUCTION

With improved living conditions, changing lifestyles and progress in healthcare effectiveness, low-income and middle-income countries face the rapid epidemiological transition from acute infectious diseases to chronic non-communicable diseases. Therefore, the World Health Organization has defined the "coexistence of two or more chronic diseases" as "Multimorbidity" (MM).[1] As far as "chronic diseases" are concerned, these are the diseases that are present for at least three months.[2] A range of factors, including biological, psychological, behavioural, socioeconomic and environmental factors, affect the likelihood of having multimorbidity. Lifestyle factors which may increase the risk of multiple chronic diseases include obesity, poor diet, poor sleep patterns, smoking, air pollution, and alcohol consumption. Lower Socioeconomic status measured by a combination of education, occupation and income parameters proves to have an increased risk of developing multimorbidity.[3] MM is more common among older adults, i.e. >65 years. Their "longer exposure and increased vulnerability" to

risk factors for chronic diseases explains the higher prevalence amongst them. People with multiple health conditions pose a particular challenge to patient safety at all lifecycle stages.[4] Given increasing prevalence of MM in recent decades has led to some describing MM as "the most common chronic condition".[5] Multimorbidity is significantly associated with lower worker productivity, risk of polypharmacy, impaired functioning, frailty, poor quality of life, higher healthcare usage, increased healthcare costs and increased mortality risk.[6-17]

The multimorbidity pattern refers to the specific combinations of chronic health conditions that coexist within an individual. It involves understanding which diseases or medical conditions tend to occur together, their frequency and any underlying factors contributing to these combinations. These coexisting chronic diseases may or may not interact with each other. Their pattern can be identified in commonly occurring combinations, i.e. dyads, triads or quadrads (combination of two, three or four diseases, respectively). "Concordant multimorbidity" refers to co-existing conditions with similar origins or treatments, for example, hypertension and heart disease. "Discordant multimorbidity" is a condition unrelated to each other, for example, diabetes mellitus and tuberculosis.[18] In the bustling urban landscape of South Delhi, India, where the juxtaposition of tradition & modernity is palpable, the multimorbidity pattern presents a unique and complex tapestry of health concerns. This study delves into the intricate web of interconnected health issues South Delhi faces, exploring the magnitude and pattern of multimorbidity in this vibrant and diverse region. As we unravel the intricate threads of multimorbidity patterns, we gain valuable insights into the intersection of healthcare in one of India's most dynamic environments. Our findings give primary care physicians a better clinical and epidemiological understanding of multimorbidity for aligning care management. There has been a dearth of studies that have studied the pattern of multimorbidity in primary care settings of countries with low and middle income, including India. Moreover, most Indian studies on multimorbidity have studied the elderly population (>60 years). Very few studies have been conducted on multimorbidity among adults (age 18-39 years) in a primary care setting, especially in Northern India. Hence, we undertook this study to estimate the burden & pattern of MM in adults (≥18 years) in a primary care setting.

METHODS

We carried out an observational, descriptive cross-sectional study among adult patients (≥18 years) attending South Delhi municipal corporation (SDMC) Polyclinic Mehrauli during January 2021 to June 2022. All patients aged ≥18 years across genders were approached for participating in the study. However, pregnant females and those with acute medical and psychiatric conditions who were unable to comprehend the interview schedule were excluded. Assuming 30.7% of adults have multimorbidity. 95% confidence interval, and 16% relative error, the sample size calculated was 339 subjects.[19] Sample size calculation for the same is depicted as follows:

$$N= (Z_{1-\alpha/2})^2 \times p \times q/E^2$$

Where $(Z_{1-\alpha/2})=1.96$ (95% confidence interval), p=0.307, E=0.0491 (Relative error=16% of p). Thus, sample size was calculated to be 339.02.

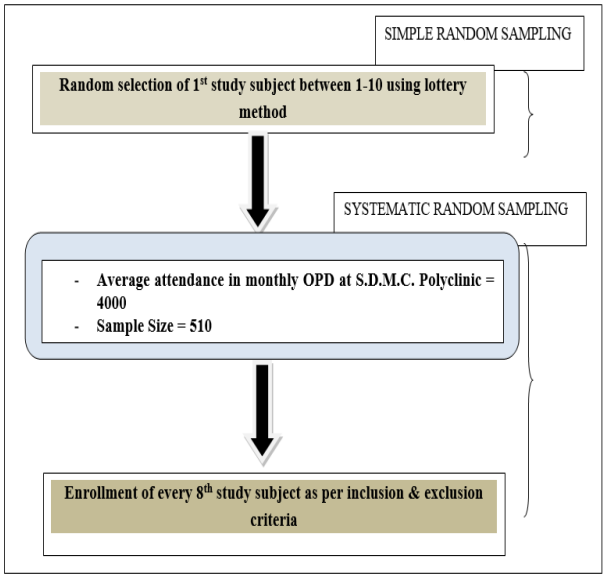

Figure 1: Flowchart showing sampling methodology.

Subsequently, the design effect of 1.5 was applied, and the final sample size calculated was 509, rounded off to 510.Data was collected from the patients attending S.D.M.C. Polyclinic Mehrauli, and exit interviews were conducted for them. The first study subject exiting OPD of S.D.M.C. Polyclinic was selected by simple random sampling, and subsequent study subjects were selected by systematic random sampling (Fig-1). Considering inclusion & exclusion criteria, 510 study subjects were enrolled. Rapport was built with the eligible subjects, and the study's purpose and methodology were explained. The interview was initiated after obtaining the written consent, and relevant treatment records were sought. As per MAQ-PC (Multimorbidity Assessment Questionnaire for Primary Care), physicians diagnosed two or more than two chronic diseases were assessed, and PHQ-9 guidelines were used for analysing depression. Data collected was coded and entered in SPSS (Statistical Package for the Social Sciences) version 16.[19,20] For descriptive statistics, all quantitative variables were analysed in terms of mean and standard deviation.

RESULTS

A total of 642 patients from primary care settings were approached, of which 510 agreed to participate and were finally enrolled & interviewed, comprising 58.4% males

and 41.6% females, with the mean age of the study subjects being 40.80±16.23 years (Range 18-78 years). The sociodemographic characteristics of the study participants are depicted in (Table 1). The mean age in males was 43.22±16.76 years, and in females, it was 37.39±14.84 years. Nearly one-third of the participants were 18-29 years (31.8%). Almost half of the study subjects (50.6%) had completed their education at least high school and above, which included 55.0% males & 44.4% females. The majority of the study subjects (83.5%) belonged to the upper middle class of socioeconomic status as per the Modified Kuppuswamy Scale (CPI 2022).[21]

Out of 510 interviewed study subjects, nearly one-third, i.e. 160 (31.4%), were found to be suffering from multimorbidity, as shown in (Table 2). The mean number of morbidities of chronic conditions across ages indicates that there is an increasing number of morbidities with age. The study subjects with MM and mean number of morbidity across ages were found to be strongly positively correlated r (158)=0.85, p value<0.00001.

Table 1: Sociodemographic characteristics of the study subjects (n=510).

Socio-demographic characteristics	Gender		
	Males	Females	Total
	N (%)	N (%)	N (%)
Total subjects	298 (58.4)	212 (41.6)	510 (100)
Age (years)			
18-29	82 (27.5)	80 (37.6)	162 (31.8)
30-39	61 (20.5)	57 (26.9)	118 (23.1)
40-49	38 (12.8)	26 (12.3)	64 (12.5)
50-59	59 (19.8)	15 (7.1)	74 (14.5)
60-69	35 (11.7)	29 (13.7)	64 (12.6)
≥70	23 (7.7)	05 (2.4)	28 (5.5)
Education			
Illiterate	16 (5.4)	13 (6.1)	29 (5.7)
Primary school	42 (14.1)	42 (19.8)	84 (16.4)
Middle school	76 (25.5)	63 (29.7)	139 (27.3)
High school	105 (35.3)	59 (27.8)	164 (32.1)
Intermediate/Diploma	52 (17.4)	33 (15.6)	85 (16.7)
Graduate	07 (2.3)	01 (0.5)	08 (1.6)
Professional degree	00 (0.0)	01 (0.5)	01 (0.2)
Socioeconomic status*			
Upper middle	249 (83.6)	177 (83.5)	426 (83.5)
Lower middle	45 (15.1)	31 (14.6)	76 (14.9)
Upper	04 (1.3)	04 (1.9)	08 (1.6)

*as per the Modified Kuppuswami Scale (CPI 2022).

Table 2: Prevalence of multimorbidity and mean morbidity score across age groups.

Age group (years)	Total (n=510)	MM present (n=160)	%	Weighted % (95% CI)	Mean number of morbidities
18-29	162	24	14.8	3.6 (0.7-6.5)	0.35
30-39	118	32	27.1	6.4 (2.6-10.2)	0.63
40-49	64	21	32.8	2.7 (0.2-5.3)	0.81
50-59	74	30	40.5	5.7 (2.1-9.3)	1.00
60-69	64	35	54.7	7.7 (3.6-11.8)	1.48
≥70	28	18	64.3	1.9 (0.2-4.1)	1.79

r(158) =0.85, p<0.00001

As shown in (Figure 2), 160 study subjects suffering from MM were found to be almost equally distributed across the three age groups, and males contributed to almost two-thirds (64.4%) of the burden of MM. The (Table 3) depicts that almost half of the study subjects with MM had dyads, one-third had triads, and the rest of them had quadrads patterns of multimorbidity. Out of the total 91 study subjects with dyads (56.9%), nearly two-thirds (65.9%) of males & one-third of females (34.1%) had dyad patterns of multimorbidity. A similar observation was noticed for the triad pattern of multimorbidity (66.7% males and 33.3% females). Out of 12 (7.5%) study

subjects with quadrad pattern of MM, one-fourth belonged to the 18-39 years.

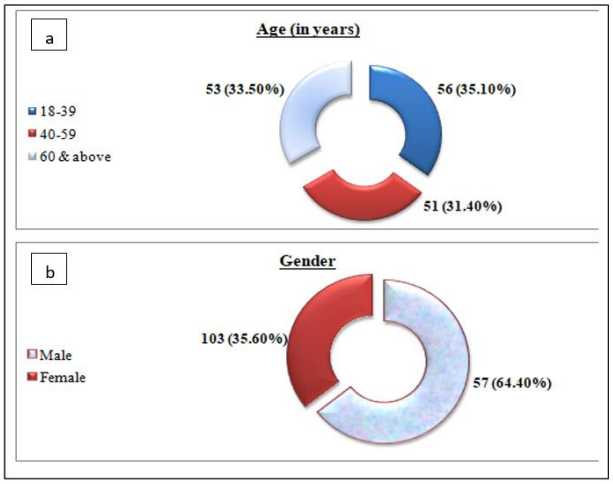

Figure 2: (a) Age-wise, (b) gender wise distribution of MM (n=160).

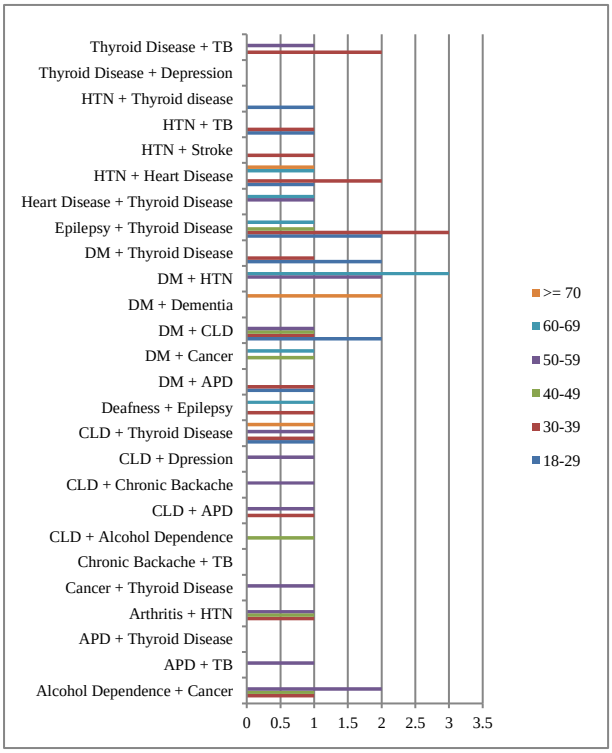

Figure 3: Pattern of dyad among males (n=60) (APD-Acid peptic disease, CLD-Chronic lung disease, DM-Diabetes mellitus, HTN-Hypertension, TB-Tuberculosis).

The most frequently occurring dyad was diabetes mellitus+hypertension (16.5%), followed by epilepsy+thyroid disease and hypertension+heart disease/ stroke/arthritis (10.9%), as shown in (Figure 3-4, Table 4) portrays that the leading triad was found to be diabetes mellitus+hypertension+heart disease (12.3%), followed by diabetes mellitus+hypertension+chronic lung disease (10.5%), and a total of 12 quadrads (7.5%) were detected among the study subjects with multimorbidity. Findings are suggestive of the fact that either Diabetes mellitus or Hypertension or both were the most frequently involved chronic disease among all the patterns of multimorbidity.

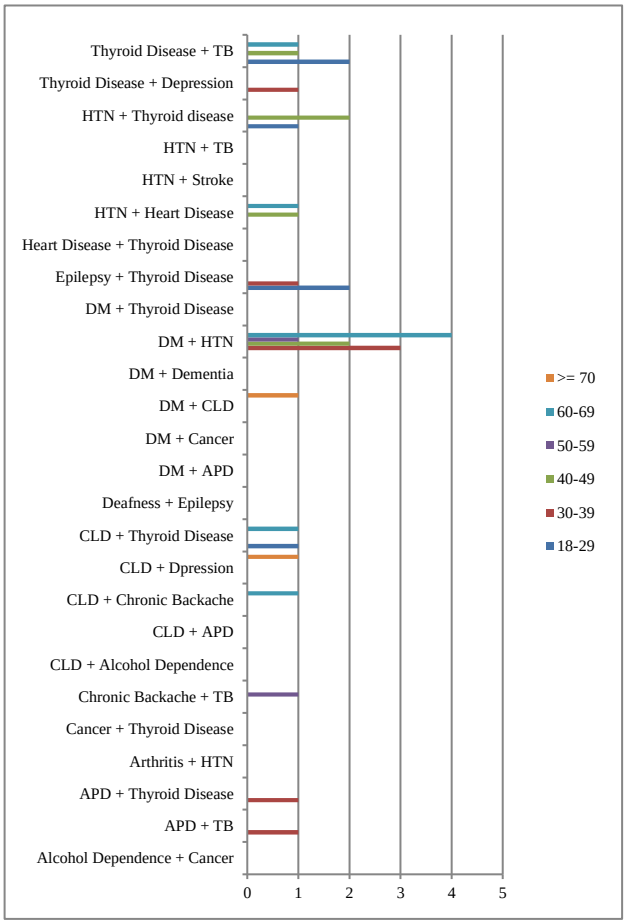

Figure 4: Pattern of dyads among females (n=31).

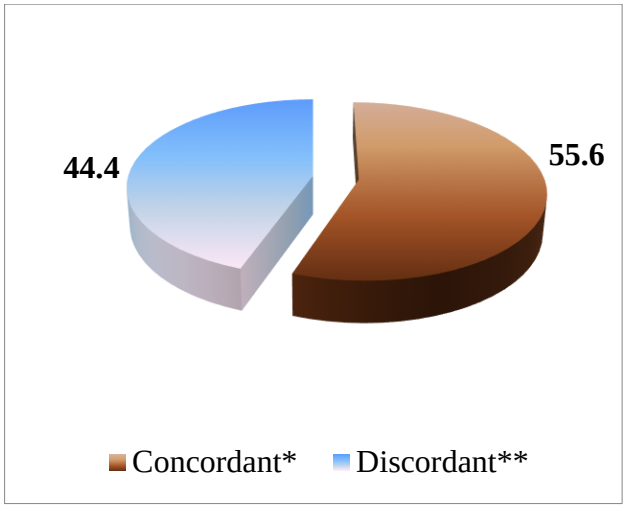

Figure 5: Pattern of multimorbidity based on the systems involved (n=160) (*Co-existing conditions with similar origins or treatments, **Conditions which are unrelated to each other).

Table 3: Pattern of multimorbidity according to age & gender of the study subjects (n=160).

Age (years)	Dyads* (n=91; 56.9%)		Triads** (n=57; 35.6%)		Quadrads*** (n=12; 7.5%)	
	Males	Females	Males	Females	Males	Females
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
18-39	28 (46.7)	13 (41.9)	11 (28.9)	01(5.3)	01 (20.0)	02 (28.6)
40-59	20 (33.3)	08 (25.8)	14 (36.9)	08 (42.1)	00 (0.0)	01 (14.3)
≥60	12 (20.0)	10 (32.3)	13 (34.2)	10 (52.6)	04 (80.0)	04 (57.1)
Total	60 (65.9)	31 (34.1)	38 (66.7)	19 (33.3)	05 (41.7)	07 (58.3)

*Combination of two chronic diseases, **Combination of three chronic diseases, ***Combination of four chronic diseases

More than half of the study subjects (55.6%) had a concordant pattern of MM, whereas the discordant pattern was found in 44.4 % of study subjects (Table 5). Hypertension and Heart disease were the most frequent concordant multimorbidity, respectively, associated with diabetes mellitus. Thyroid disease, acid peptic disease and depression, respectively, were the significant contributors to the discordant multimorbidity related to diabetes mellitus.

Table 4: Pattern of triads and quadrads among study subjects having multimorbidity.

Parameters	N (%)
Pattern of Triads (N=57)	
DM+HTN+TD/APD/AD/CKD/EP/BL/CA/DP	17 (29.8)
DM+HTN+HD	07 (12.3)
DM+HTN+CLD	06 (10.4)
HTN+ST+HD/TD	06 (10.4)
DM+CKD+ST/CA	05 (8.8)
CLD+DP+HTN/DE	05 (8.8)
HTN+HD+DP/TD	03 (5.3)
HD+ST+DP	03 (5.3)
DM+TB+TD	02 (3.5)
HTN+CLD+APD	01 (1.8)
HTN+AD+DP	01 (1.8)
AT+CLD+DP	01 (1.8)
Pattern of Quadrads (N=12)	
DM+HTN+TD+DP/TB/CA	07(58.3)
HTN+CLD+APD+ST	02 (16.7)
DM+HTN+DP+APD/CLD	02 (16.7)
EP+TD+TB+DP	01 (8.3)

AD-Alcohol dependence, AT-Arthritis, BL-Blindness, CA-Cancer, CBA-Chronic backache, CKD-Chronic kidney disease, DE-Dementia, DN- Deafness, DP- Depression, EP- Epilepsy, HD- Heart disease, HTN-Hypertension, ST-Stroke, TB-Tuberculosis.

DISCUSSION

Studying the multimorbidity pattern in primary healthcare facilities is crucial for providing more efficient and patient-centred care, optimising resource allocation, reducing healthcare costs and improving the overall health and well-being of individuals with complex health needs. It has wide-ranging implications for both individual patient care and healthcare system management. Out of 510 study subjects interviewed, the overall magnitude of multimorbidity was found in 160 (31.4%) study subjects. Multimorbidity was found to be almost equally distributed across the three age groups. Similar findings were found in Pati S et al (28.3%)[19] and Lee Y et al (34.8%).[22] The magnitude of multimorbidity was found to differ in other studies due to population characteristics, including age range.[23-26] Multimorbidity was present in a relatively young & productive age group (18-39 years), which is an alarming finding. This finding is indicative of a direful transition in future with respect to the coexistence of chronic diseases across various age groups, including young adults. Nearly two-thirds of males (64.4%) and one-third of females (35.6%) were found to be suffering from multimorbidity. Similar findings were found in Pati et al, Banjare et al and Lee et al.[19,22,25] This finding may be attributed to the fact that males are more forthcoming in seeking healthcare services for their diseases as compared to either housewives or working females.

Dyad was the most common multimorbidity pattern in more than half of the study subjects (56.9%), which included 65.9% males & 34.1% females. Similar findings were found in Pati et al, Lee et al and King et al.[19,22,27] The most frequently occurring dyad in the present study was diabetes mellitus+hypertension (16.5%), followed by epilepsy+thyroid disease and hypertension+heart disease/stroke/arthritis (10.9%). Similar findings were found in Zhang et al, Lee et al and Lay et al.[22,28,29] Diabetes mellitus was the most prevalent disease overall among males as well as females. Therefore, it becomes even more necessary to view the pattern of diabetes mellitus with other chronic diseases from the perspective of non-random association of health problems. More than one-third of study subjects with multimorbidity (35.6%) had a pattern of triads with 66.7% males & 33.3% females. The leading triad was found to be diabetes mellitus+hypertension+heart disease (12.3%), followed by diabetes mellitus+ hypertension+chronic lung disease (10.5%). Similar findings emanated from the studies done by Pati et al, Zhang et al, Lee et al, Lay et al and King et al.[19,22,27,28] Associated comorbidities may arise due to the therapeutic impacts or due to the index disease. In our study, hypertension was predominantly coexistent with diabetes mellitus.

There were 12 subjects (7.5%) with a quadrad pattern of multimorbidity. Similar findings were found by Lee et al.[22] There were three study subjects in the 18-39 years age group who had a quadrant pattern of multimorbidity. Either Diabetes mellitus or Hypertension or both were the most frequently involved chronic diseases among all the patterns of multimorbidity. More than half of the study subjects (55.6%) suffered from concordant multimorbidity; a discordant multimorbidity pattern was found in 44.4% of study subjects. Hypertension and heart disease were the most frequent concordant multimorbidity, respectively, associated with diabetes mellitus. Thyroid disease, acid peptic disease and depression, respectively, were the significant contributors to the discordant multimorbidity related to diabetes mellitus. Nearly similar findings were found in Soji et al.[23] The most common systems involved among study subjects with multimorbidity were the cardiovascular system (28.1%), followed by the respiratory system and endocrine system in 13.8% and 13.1% of subjects, respectively. More than half of the study subjects (55%) had cardiovascular/respiratory/endocrine disorder(s) symptoms. Similar findings were found in Pati et al, Lee et al and King et al.[19,22,27]

Strengths and limitations

This study exhibits multimorbidity patterns in the context of a primary health centre setting. Results arising from this study signify the importance of improved clinical guidelines, resource allocation, reduced healthcare costs and better patient care. Multimorbidity has been studied extensively amongst people aged ≥40 years, but very few studies have focused on multimorbidity in adults of less than 40 years of age. This study has considered a more comprehensive age range of 18 years & above. Besides, our study was conducted in a robust sample size of 510 adults of both genders. MAQ PC was used to assess the magnitude of multimorbidity based on previously diagnosed chronic diseases. In addition, all the study subjects were screened for hypertension and obesity, which are important risk factors for non-communicable diseases included in MAQ PC. Wherever deemed necessary, further referrals to higher centres were initiated promptly. Limitations were; this health facility-based cross-sectional study was conducted in an urban setting in Delhi. Therefore, the generalization of results will be limited to urban settings. Sociodemographic characteristics reflected in the study may not represent the population at the state or national level as it was a facility-based study. The study design being cross-sectional had a limitation in assessing the trend of evolving multimorbidity or its risk factors. The study included only those cases that were already diagnosed by a physician.

CONCLUSION

This study sheds light on the substantial burden of multimorbidity among adult patients seeking care in primary care settings in Delhi, India. The prevalence of multimorbidity is high, with patterns reflecting a diverse array of chronic conditions. Understanding the magnitude and patterns of multimorbidity is crucial for healthcare planning, resource allocation, and the development of effective interventions tailored to the needs of this population. Our findings underscore the necessity of integrated, patient-centered approaches to primary care that address the complex healthcare needs of individuals with multiple chronic conditions. Moreover, further research is warranted to explore the determinants and consequences of multimorbidity in diverse populations, with the ultimate goal of improving health outcomes and enhancing the quality of care for individuals living with multimorbidity. By addressing multimorbidity comprehensively within primary care settings, healthcare systems can strive towards achieving equitable and sustainable healthcare for all.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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