

Prevalence and Patterns of Coexistence of Multiple Chronic Conditions: A Study from Indian Urban Outpatient Setting

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ABSTRACT

Background: Chronic diseases are a common cause for seeking care in a hospital, however little is known about prevalence and spectrum of multiple chronic conditions (MCC) in Indian context. Estimates for coexistence of MCC range from one-fourth of all primary care attendees in Spain to two-thirds of all medicare attendees in the United States. This study was designed to estimate the similar prevalence and patterns in an Indian outpatient setting. **Materials and Methods:** This study was performed at All India Institute of Medical Sciences Bhopal between May and June 2013, a hospital which had just started outpatient services in this period. All consecutive patients that presented to Medicine, Neurology, and Orthopedics clinics were sought to be included in the study, and information about their current diagnoses was abstracted from their outpatient records. All patients with one or more chronic disease diagnosis were asked about their monthly out-of-pocket expenditure. We performed a descriptive analysis of the demographic, medical diagnoses, and out-of-pocket expenditure variables. **Results:** A total of 785 patients were included in the study, and 286 (36%) of them had one or more chronic disease diagnosis. Of these, 103 (13%) had a single chronic disease, while 183 (23%) had more than one chronic disease diagnosis. Among those with MCCs, chronic vascular diseases in combination, followed by combinations of chronic vascular and immunological diseases were common patterns. There was a significant rising trend in average out-of-pocket expenditure with increasing number of chronic disease diagnoses. **Conclusion:** Co-existence of multiple chronic diseases is common in those who seek hospital-based care. This fact has important implications for education and clinical decision making in primary care.

Keywords: Hospital based, multiple chronic diseases, prevalence

Introduction

Chronic diseases are conditions, which are usually irreversible, persist for a long duration, and require individuals to seek care over a life-time. These conditions include hypertension, diabetes, heart diseases, stroke, chronic respiratory conditions, cancers, autoimmune, degenerative, and endocrine diseases. Chronic diseases are now leading cause of mortality in the world, representing 63% of all deaths. Out of the 36 million people who died from chronic disease in 2008, 9 million were under 60 and 90% of these premature deaths occurred in low- and middle-income countries.^[1]

Increasing awareness, improved health-seeking behaviors, and better use of screening strategies have led to identification of

multiple chronic conditions (MCCs) in the same individual.^[2] MCC is defined as the presence of two or more disease conditions in the same individual.^[3] Existence of MCCs poses various challenges for individuals as well as health systems, such as higher expenditure,^[4] greater clinical and therapeutic complexity,^[5] poor adherence to therapies,^[6] need for greater emotional support,^[7] and potential need for comprehensive care programs, which optimize number of care-providers.^[8] Estimates about the prevalence of MCC in the population are available from some countries such as United States (26%),^[9] Spain (24%),^[10] Taiwan (17%),^[11] and Singapore (16%).^[12] Prevalence is higher in those who seek more health-care, such as Medicare beneficiaries in United States, where prevalence is as high as 68%.^[13] Increasing prevalence of MCC presents with various health system challenges. Health systems traditionally focus on research and treatment of single conditions, and need to be strengthened to take care of complexities of multiple comorbidities.^[14]

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There is paucity of studies that have evaluated either pattern or prevalence of MCCs in a low-and-middle-income country setting. Since various studies have shown increasing prevalence of single chronic diseases (such as diabetes or hypertension)^[15,16] in India, there is a need to understand prevalence or patterns of MCCs as well. The current study is designed to understand proportion and pattern of MCC among adults seeking out-patient care in an urban setting in India.

Materials and Methods

Design

Authors performed a hospital-based cross-sectional study to determine prevalence and patterns of MCCs. Institutional Ethics Committee of All India Institute of Medical Sciences, Bhopal, approved the design and conduct of the study. All participants provided a written informed consent.

Setting

All India Institute of Medical Sciences, Bhopal, a public sector teaching hospital in central India, currently provides ambulatory care services largely to urban population. The current study was performed in medicine, neurology and orthopedics outpatient departments of the institute. All outpatients are electronically registered at the hospital and receive a unique numerical identifier, which is used for all subsequent visits.

Participants

Out-patient case records of all consecutive patients who visited medicine, neurology and orthopedics out-patient departments during a 1 month period (15th May to 15th June 2013) were included. We excluded children and adolescents (age <18 years). No other exclusions were applied. Since duplicate visits by the same patient in either in the same department or across departments were likely, we used unique numerical identifier to filter such records.

Procedures

Authors identified 18 chronic diseases across five axes: Chronic vascular disease, immunological dysfunction, degenerative articular disease, chronic neurological dysfunction, and miscellaneous. These axes are based on pathophysiological mechanism for included conditions. Included conditions were defined based on standard criteria [Box 1]. Patients were approached for participation at the end of their clinical visit, and consent obtained to record information about demographic (age, gender, years of education), clinical (chronic disease diagnosis, years since diagnosis), and average monthly out-of-pocket medical expenditure by direct interview or from case records.

We included those conditions, which were already known for that individual, at the end of the out-patient visit, and were documented by the treating physicians. No additional screening

Box 1: Chronic disease axis, disease conditions included and basis of diagnosis for the study

Condition/axis	Basis of diagnosis
Chronic vascular disease axis	
Hypertension	Clinical based on JNC7 criteria
Diabetes mellitus	Based on ADA definition, fasting plasma glucose or HbA1c levels
Dyslipidemia	Based on NCEP guidelines
Overweight or obesity	Based on WHO criteria, body mass index ≥ 25 kg/m ²
Ischemic heart disease	Documented AMI/UA/CAD
Stroke	Documented clinical presentation of acute onset neurological deficit.
Congestive cardiac failure	Clinical, based on Framingham's criteria
Chronic kidney disease	Based on NKF guidelines, eGFR <60 ml/min for 3 mo+
Immune dysfunction axis	
Thyroid dysfunction	Documented abnormality in thyroid hormone levels
Rheumatoid arthritis	Based on ARA criteria
Sero-negative spondylo-arthropathy	Chronic inflammatory articular symptoms with negative serology
Collagen vascular diseases	Autoimmune diseases satisfying respective disease criteria
Chronic articular degeneration axis	
Osteoarthritis	Non-inflammatory arthritis, 3 mo+, affecting appendicular skeleton
Degenerative spinal disease	Non-inflammatory arthritis, 3 mo+, affecting axial skeleton
Chronic neurological disease axis	
Chronic neurodegenerative disease	Clinical, chronic progressive neurological disease without any recovery identified as degenerative by the treating doctor (mostly includes dementias, Parkinsonism etc.)
Chronic cephalgia (includes migraine)	Clinical, chronic episodic or non-episodic headache syndrome lasting 3 mo or longer, without an identifiable structural cause, based on ICHD-II criteria
Others	
Cirrhosis of liver	Presence of persistent (>3 mo) hepatocellular dysfunction (low serum albumin or elevated PT or serum bilirubin)
Chronic Lung disease	Presence of persistent or intermittent respiratory symptoms (>3 mo) with documented reduction in FEV1

JNC: Joint national commission, ADA: American Diabetes Association, NCEP: National Cholesterol education Program, WHO: World Health Organization, AMI: Acute myocardial infarction, UA: Unstable angina, CAD: Coronary artery disease, NKF: National Kidney Foundation, eGFR: Estimated glomerular filtration rate, ARA: American Rheumatology Association, PT: Prothrombin time, FEV1: Forced expiratory volume in 1 second

strategies were used for conditions that may have been unknown at the time of out-patient visit.

Statistical analysis and sample size

We enumerated number of chronic disease conditions in all participants, and estimated proportion of individuals with single and MCCs. We estimated means and standard deviation, and proportions as measures of central tendency and dispersion for relevant variables. We estimated 95% CI of proportions as a measure of precision. We used Chi-square and ANOVA tests of trend to determine if proportions with MCCs or out-of-pocket expenditure significantly vary with number of chronic disease diagnoses. All statistical analyses were done using either Microsoft Excel or STATA version 12.0.

Results

A total of 946 new patient-visits were logged in out-patient departments of medicine, orthopedics and neurology during 1 month study period. After excluding the duplicate visits (either in the same department or across departments), and those with in-complete records, a total of 785 unique patients were included in the analysis. Of these, 235, 299 and 251 of them had primarily visited neurology, orthopedics and medicine out-patient departments, respectively. Overall, the participants were middle aged (average age 45.01 (SD 16.01)), and half of them were women (396/785, 50.4%). A total of 286 (36%) participants had at least one chronic disease diagnosis, and 183 (23%) had MCCs.

There were a total of 643 disease diagnoses, chronic vascular disease axis being the most common, followed by immunological and degenerative disease axis. About four fifths of individuals with hypertension or diabetes who visited out-patient department had a co-existing disease. About two thirds of all individuals with thyroid dysfunction, and half of all individuals with rheumatoid arthritis had other comorbidity [Table 1, Figure 1].

We evaluated patterns of overlap among various chronic disease axes. Overlap of multiple conditions from within axis 1 (chronic vascular disease axis) was most frequent, comprising 7% of all participants. Overlap between axis 1 and axis 2 (immune dysfunction axis) was next (5% of all cases), followed by overlap between axis 1 and axis 3 (articular degeneration) comprising 4% of all participants. Of 23% of participants who had MCCs, 21% had overlap due to one or more chronic vascular conditions [Table 2].

The proportion of participants with two, or three chronic diseases was 8.7% and 8.8% each. Only 0.5% of all participants had six or more chronic conditions. The monthly out-of-pocket expenditure was progressively higher for individuals with additional chronic condition, and this was statistically significant [Figure 2].

Discussion

The current study demonstrates that about two thirds of all individuals with a chronic disease who visit out-patient department

Table 1: Spectrum of Chronic disease diagnosis amongst study population (n=785)

Index medical condition (s)	Number with condition	Proportion of those with index condition (percentage (95% CI))	Mean age (SD)	Years of awareness of index condition (SD)	No with another coexisting disease	Proportion of coexisting chronic disease diagnosis (%)	Average number of coexisting chronic conditions (SD)
Chronic vascular disease axis							
Hypertension	182	23.18 (20.2-26.1)	58.89 (13.00)	5.20 (6.43)	144	79.12	2.65 (1.21)
Diabetes mellitus	104	13.25 (10.9-15.6)	58.21 (10.71)	4.94 (5.48)	86	82.69	2.83 (1.29)
Obesity	44	5.61 (4.0-7.2)	54.72 (9.42)	9.23 (7.25)	43	97.73	3.25 (1.14)
Dyslipidemia	43	5.48 (3.9-7.1)	54.51 (11.43)	2.84 (4.51)	43	100.00	3.74 (1.04)
Ischemic heart disease	31	3.95 (2.6-5.3)	65.44 (11.06)	4.55 (1.83)	28	90.32	3.29 (1.29)
Stroke	15	1.91 (1.0-2.9)	57 (0)	0.33 (1.29)	15	100.00	3.33 (0.89)
Chronic kidney disease	2	0.25 (0.0-0.6)	50.5 (20.50)	2 (0)	2	100.00	3 (1.41)
Congestive cardiac failure	3	0.38 (0.0-0.8)	61 (0)	1.33 (0)	3	100.00	3.33 (0.57)
Chronic immunologic dysfunction axis							
Thyroid dysfunction	69	8.79 (6.8-10.8)	48.65 (11.05)	4.85 (5.59)	47	68.12	2.53 (1.38)
Rheumatoid arthritis	16	2.04 (1.0-3.0)	49.5 (8.87)	4.86 (10.36)	9	56.25	2.56 (1.54)
Seronegative spondyloarthropathy	9	1.15 (0.4-1.9)	49.62 (18.84)	8.6 (10.36)	6	66.67	2.44 (1.23)
Chronic articular degeneration axis							
Osteoarthritis	39	4.97 (3.4-6.5)	59.89 (9.34)	4.12 (2.31)	34	87.18	2.79 (1.10)
Degenerative spine disease	15	1.91 (1.0-2.9)	65.18 (13.69)	2.84 (4.01)	13	86.67	3 (1.30)
Chronic neurologic condition axis							
Chronic headache and migraine	32	4.08 (2.7-5.5)	36.66 (5.50)	1.06 (2.90)	31	96.88	2.81 (0.91)
Chronic neurodegenerative disease	21	2.68 (1.5-3.8)	65.5 (16.26)	0.04 (0.21)	21	100.00	3.33 (1.11)
Other misc conditions							
Chronic lung disease	10	1.27 (0.5-2.1)	52.62 (11.19)	14.1 (13.78)	7	70.00	2.8 (1.68)
Chronic dermatological lesion	5	0.64 (0.1-1.2)			5	100.00	3.4 (0.54)
Chronic liver disease	3	0.38 (0.0-0.8)	63 (7)	9.33 (5.03)	3	100.00	2.33 (0.57)

SD: Standard deviation

Table 2: Overlap of Chronic diseases category axis (n=785)

Disease category axis	Number	Proportion of those with disease category (95% CI)	Women (%)	Age(SD)	Years education (SD)	Average no of coexisting chronic conditions (SD)
No chronic disease	499	63.5 (60.2-66.9)	47.90	40.36 (15.04)	12.15 (4.49)	0
Chronic disease occurring alone	103	13.12 (10.8-15.5)	65.00	50.7 (13.43)	12.03 (4.44)	1
Chronic vascular disease (axis 1)	60	7.64 (5.8-9.5)	48.33	54.88 (13.98)	12.29 (3.94)	1
Immune dysfunction (axis 2)	32	4.08 (2.7-5.5)	93.75	42.68 (10.36)	11.25 (5.07)	1
Articular degeneration (axis 3)	7	0.89 (0.2-1.5)	71.43	57.85 (4.59)	10.1 (5.77)	1
Misc conditions	4	0.51 (0.0-1.0)	75.00	46.25 (4.42)	15 (3.37)	1
Multiple chronic conditions	183	23.31 (20.4-26.3)	49.00	58.6 (11.9)	12.03 (4.81)	2.95 (0.93)
More than one condition form axis 1	56	7.13 (5.3-8.9)	35.71	59.07 (11.83)	12.52 (5.07)	2.69 (0.80)
Axis 1 and axis 2	43	7.13 (3.9-7.1)	79.07	54.05 (10.90)	12.06 (4.38)	3.13 (0.83)
Axis 1 and axis 3	33	4.20 (2.8-5.6)	51.52	62.83 (12.03)	11.92 (4.95)	3.06 (0.93)
Axis 1 and neurological conditions	34	4.33 (2.9-5.8)	26.47	68.5 (10.08)	15 (2.34)	3.05 (1.01)
Axis 1 and axis 2 and/or axis 3	10	1.27 (0.5-2.1)	60.00	55.28 (12.00)	8.83 (4.91)	3.4 (1.50)
Axis 2 and axis 3 and/or misc condition	7	0.89 (0.2-1.5)	57.14	62 (6)	11.66 (6.11)	2.14 (0.37)
Overall	785		50.45	45.01 (16.02)	12.10 (4.56)	0.81 (1.30)

SD: Standard deviation

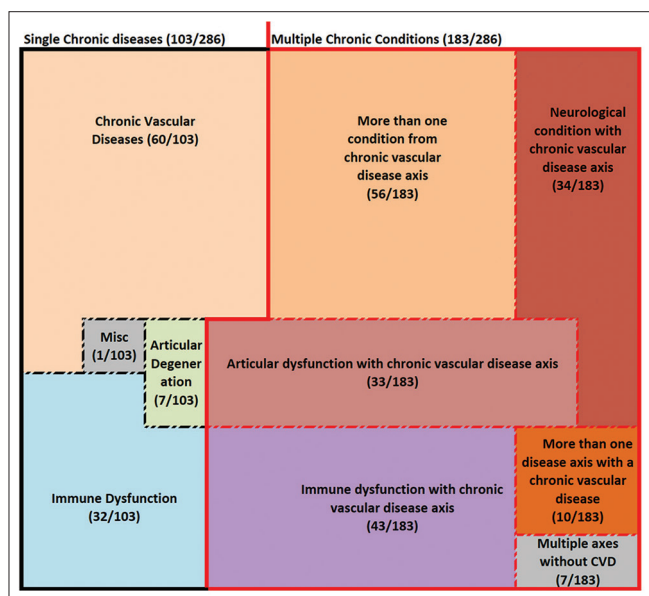


Figure 1: The billion-pound-o-gram depicting chronic disease spectrum. Area of each shape in this billion-pound-o-gram is proportional to the prevalence of disease condition in the current study

have MCCs. Most overlap is due to one or more chronic vascular disease. Individuals with more chronic conditions have significantly more average out-of-pocket expenditure for medical supplies. This study, to our knowledge, is a first documented estimate of MCCs from India. We sampled consecutive patients from three out-patient departments to collect information about chronic disease diagnoses based on standard diagnostic criteria.

Compared to high-income countries such as United States, the prevalence of MCCs in our hospital-based study is low (68% vs 23%). This is likely due to a true lower prevalence or disease unawareness in our population. As developing nations try to bridge “unscreened-gap” in chronic diseases, we are likely to observe a greater prevalence of MCCs. This will have huge implications for low- and middle-income countries, as MCCs make clinical care algorithms more complex.^[14]

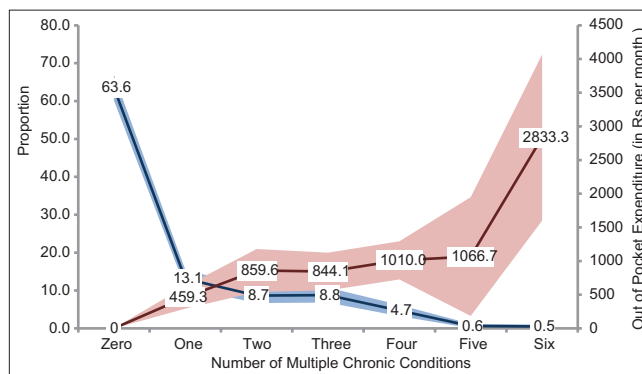


Figure 2: Prevalence and out-of-pocket expenditure for one or more chronic coexisting conditions. Proportion of multiple chronic conditions (blue line) and its 95% confidence interval (blue shaded area) shows a decreasing trend (Chi-square goodness of fit test (chi square 1609.6, df 6, $P < 0.0001$). Increasing trend for out-of-pocket expenditure in rupees (red line) and its 95% confidence interval was statistically significant (ANOVA $P < 0.001$)

There is a need to develop mechanisms so that fragile health systems can also deal with this complexity. First step in this direction is to understand prevalence and patterns of MCCs.

In MCCs spectrum, most overlap is contributed by chronic vascular disease axis,^[9,11] and results of our study are similar in this regard. Vascular diseases such as diabetes and hypertension are considered as entry points of cardiovascular disease control,^[17] and these may as well be entry points for entire chronic disease spectrum. Prevalent patterns of MCCs suggest that multiple vascular conditions occurring together are common. Thus, there is a need to move from disease specific to a disease axis guideline, which encompasses conditions such as hypertension, diabetes, dyslipidemia, obesity, and even secondary prevention of secondary complications under a single umbrella. Similarly we need to take into account chronic vascular conditions when we are managing immunological conditions (such as thyroid dysfunction or SLE), or degenerative conditions (such as osteoarthritis or osteoporosis). These paradigms are required, as current chronic disease

guidelines focus on individual conditions, and mostly do-not take into account multiple co-morbidities.^[18] We need to take patterns of MCCs into account, as there are potential interactions between disease conditions, prescribed medications,^[14] and potential fragmentation of care due to multiplicity of providers.^[19]

Our study has certain limitations. First, this is a hospital-based study and this selection bias is likely to overestimate the prevalence more than that truly existing in the populations. Secondly, we did not perform any biochemical tests to screen individuals for additional chronic disease diagnoses. Thus, our prevalence reflects only those conditions which patients and physicians were aware of. This information bias is likely to result in underestimation of the true prevalence. Thirdly, we limited diagnostic possibilities to most common multiple chronic disease diagnoses. We did not include cancers, mental health conditions, and skin conditions that may also require long-term therapies. A wider chronic disease spectrum is likely to result in higher prevalence of MCCs. Despite these limitations, these results indicate that a significant proportion of individuals with a chronic disease diagnosis are likely to have MCCs.

Conclusion

MCCs are an emerging problem in low-and-middle income countries as shown in our study. There is a need to incorporate MCCs in medical teaching, research needs, as well as in service delivery. There are many unmet research needs, especially about defining outcomes that we need to achieve while managing MCCs.^[20,21] For effective service delivery, we need to move from disease specific to group specific management of disease conditions. We also need to empower primary care providers so that appropriate screenings and therapies are introduced in a timely manner among those with MCCs. In this context, it is imperative to introduce mechanisms that ensure continuity of care, since co-existence of multiple chronic diseases is common in those who seek hospital-based care. This fact has important implications for education and clinical decision making in Primary care.

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