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Community prevalence and dyad disease pattern of multimorbidity in China and India: a systematic review

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ABSTRACT

Background Driven by the increasing life expectancy, China and India, the two most populous countries in the world are experiencing a rising burden of multimorbidity. This study aims to explore community prevalence and dyad patterns of multimorbidity in China and India.

Methods We conducted a systematic review of five English and Chinese electronic databases. Studies involving adults 18 years or older at a community level, which reported multimorbidity prevalence and/or patterns were included. A modified Newcastle-Ottawa Scale was used for quality assessment. Despite large heterogeneity among reported studies, a systematic synthesis of the results was conducted to report the findings.

Results From 13 996 studies retrieved, 59 studies met the inclusion criteria (46 in China, 9 in India and 4 in both). The median prevalence of multimorbidity was 30.7% (IQR 17.1, 49.4), ranging from 1.5% to 90.5%. There was a large difference in multimorbidity prevalence between China and India, with median prevalence being 36.1% (IQR 19.6, 48.8) and 28.3% (IQR 8.9, 56.8), respectively. Among 27 studies that reported age-specific prevalence, 19 studies found multimorbidity prevalence increased with age, while 8 studies observed a paradoxical reduction in the oldest age group. Of the 34 studies that reported sex-specific prevalence, 86% (n=32) observed a higher prevalence in females. The most common multimorbidity patterns from 14 studies included hypertensive diseases combined with diabetes mellitus, arthropathies, heart diseases and metabolic disorders. All included studies were rated as fair or poor quality.

Conclusion Multimorbidity is highly prevalent in China and India with hypertensive diseases and other comorbidities being the most observed patterns. The overall quality of the studies was low and there was a lack of representative samples in most studies. Large epidemiology studies, using a common definition of multimorbidity and national representative samples, with sex disaggregation are needed in both countries.

PROSPERO registration number CRD42020176774.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ People living with multimorbidity have poorer quality of life, physical and mental health functions and experience worse health outcomes.
⇒ The burden of multimorbidity in China and India is growing but limited evidence is available from the current literature.

WHAT THIS STUDY ADDS

⇒ The prevalence and pattern of multimorbidity were affected by multiple factors, which leads to heterogenous definitions of multimorbidity.
⇒ The most important factors include age, number of diseases and method of disease measurement.
⇒ The reported prevalence of multimorbidity in China and India was lower than that in high-income countries but is rising.
⇒ Most studies reported a higher prevalence in females than males.
⇒ The most common patterns of multimorbidity involved hypertensive diseases.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Consensus on a standardised definition for multimorbidity is needed to guide future research.
⇒ Multimorbidity intervention or preventive practice should focus more on the more vulnerable population.
⇒ A priority area for addressing multimorbidity includes hypertensive diseases combined with any of the following disease: diabetes mellitus, arthropathies, heart diseases and metabolic disorders.
⇒ High-quality large-scale studies with representative samples are needed to better understand the growing burden of multimorbidity in China and India.

INTRODUCTION

Globally, over the past few decades, better healthcare and improved living conditions have led to an improvement in life expectancy. However, these improvements have been accompanied by an increased co-occurrence of multiple chronic conditions in an individual, referred to as 'multimorbidity' and 'comorbidity'. Multimorbidity is commonly defined as the presence of more than one

health condition with long duration, each condition is either a physical non-communicable disease, a mental health condition or an infectious disease, within an individual.[1] Compared with comorbidity, multimorbidity co-exists several medical conditions within one person, without focus on one condition above the others (ie, no index condition).[2] Multimorbidity is subject to the interactions or causal relationships among different diseases, and some disease patterns share similar diagnostic factors, which lead to more complex healthcare needs and different aetiological analysis compared with the single disease.[3 4] Irrespectively, multimorbidity is associated with poorer quality of life, worse clinical outcomes, higher levels of disability and premature mortality.[5 6] However, the disease combinations associated with the greatest burden on quality of life remains unclear.[7] Evidence on the prevalence of multimoribidity and the interactions across different disease conditions in the same individual is essential for improving the medical practice for people with multimorbidity.[3 8]

China and India, the two most populated countries, account for about 36% of the world population together.[9] Both countries are subject to substantial global burden of diseases, and multimorbidity is becoming a major concern, especially in the older populations.[10 11] A study from 9 provinces in China with >17000 participants over 45 years old found about 42% of the participants having two or more chronic conditions.[12] While in a study in India, among 9852 participants with age 60 years and above, the number was 30.7%.[13] A number of systematic reviews have examined the prevalence of multimorbidity globally, but only a few studies included data from low-income and middle-income counties (LMICs) and even those were conducted before 2015.[14–18] Moreover, the only one that reported the patterns of multimorbidity was limited to studies from high-income countries (HICs).[17] As such, there is no reliable up-to-date estimates of prevalence and patterns of multimorbidity in China and India. This study aims to bridge the knowledge gap by determining the current prevalence and identifying patterns of multimorbidity at the community levels in both countries.

METHODS

We conducted a systematic review of published studies reporting prevalence and patterns of multimorbidity among adults residing in China and India, in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklist. Details are available in the online supplemental material 1. The study was registered in PROSPERO (CRD42020176774).

Eligibility criteria

Articles were selected based on the following inclusion criteria: (1) original studies reporting prevalence and/or disease patterns of multimorbidity (ie, several medical conditions co-existing within one person with no selection of an index disease condition); (2) studies with participants aged 18 years and above; (3) studies conducted in China (including Mainland China, Hong Kong, Taiwan and Macau) or India; (4) studies conducted at the community level and (5) studies that published in either English or Chinese language, with no limitation on the publication time (from inception to the date of search, 21 April 2020).

Any studies that focused on participants from a specific population group (such as prisoners, miners or earthquake victims), or that began with a preliminary selection of index disease (eg, multimorbidity prevalence among patients with diabetes), or studies conducted in the hospital settings were excluded.

Search strategy

We conducted an online literature search in 'Medline', 'EMBASE', 'Cochrane' and 'Web of Science' for English articles, and 'China National Knowledge Infrastructure' for Chinese articles. We used both Medical Subject Heading (MeSH) terms and keywords to conduct the search in English databases. The MeSH terms included "multimorbidity", "comorbidity" and their variations. The searched keywords included "multimorbidity", "comorbidity", "multiple chronic conditions", "prevalence", "epidemiology", "China" and "India". The detailed search strategy is listed in online supplemental material 2.

Study selection and data extraction

Three independent reviewers (XZ, AP and TW) screened the search results according to the eligibility criteria. Disagreements were resolved through discussion with the senior researchers (DPr and MT), where necessary. A standardised data extraction form was developed (online supplemental material 3) in Excel (Microsoft Excel for Office 365) for entering key study characteristics, including the publication year, study type, study population and sample size, sex and age of participants, data source, study location (urban or rural), number of diseases, prevalence, patterns, all single disease conditions and the top five prevalent single disease conditions (if available). Prior to the formal data collection, two reviewers (XZ and AP) started with a calibration exercise to ensure consistent and reproducible results. During the calibration exercise, we randomly selected 10% of the included articles with each reviewer independently extracting the data. After the calibration exercise, three reviewers (XZ, AP and TW) started to extract the data separately for the rest of the included studies. MT and DPr were consulted if there were any disagreements. All disagreements were resolved by group consensus.

Quality assessment

Study quality was independently assessed by three reviewers (XZ, AP and TW) using the modified Newcastle-Ottawa Scale for cross-sectional studies.[19] The scale consisted of three domains, selection (representativeness of the sample, sample size, non-respondents, ascertainment of the exposure), comparability (comparability of different outcome groups) and outcome (confounding

factors are controlled, assessment of outcome and statistical test). A study is awarded a maximum of one star for each numbered item within the selection and outcome domains. A maximum of two stars is given for comparability domain. Studies awarded seven or eight stars were considered as good quality, five to six stars as fair quality, while four stars or below as poor quality. Score disagreements were resolved by group discussions and consensus. Detailed quality assessment is included in online supplemental material 4.

Data synthesis

We used the International Classification of Diseases-10th revision (ICD-10) coding system to standardise the classification of all listed diseases identified from the review. In this study, the block categories of the ICD-10 coding system was used to synthesise the data, primarily due to two reasons. First, many studies reported a general term of the disease condition, like 'heart disease'. The reported 'heart disease' may refer to 'ischaemic heart disease' or 'other forms of heart diseases'. It is thus unlikely to classify these general terms into a single disease condition. Second, the reporting of the disease conditions of the multimorbidity is heterogenous between the studies. There is a lack of uniformed standard to report multimorbidity disease conditions from the included studies. All disease conditions were coded by an experienced clinician (JY) using Excel (Microsoft Excel for Office 365). Due to inconsistent categorisation for participants' age across the included studies, the following rules were applied for data synthesis: (1) if the prevalence was reported in an age group with lower and upper limits, the mean age was used; (2) if the prevalence was reported for an age group with a lower limit only (eg, participants >85 years), 5 years was added to the lower limit and used; (3) if the prevalence was reported for an age group with an upper limit only (eg, participants younger than 60 years), 5 years was subtracted from the upper limit and used. Multimorbidity patterns were extracted from the studies, but only dyad disease patterns were synthesised in this study because very few studies reported combinations of more than two disease conditions. The prevalence was presented with the median value and IQR. Weighting according to samples size was not considered. In studies reporting sex-specific data, the difference in prevalence between female and male was reported, while the 95% CI for the difference between gender was generated by STATA V.15 (StataCorp, College Station, Texas, USA). Heterogeneity across studies was evaluated using I^2 statistic. Meta-analysis or quantitative pooling was not performed due to the very high heterogeneity (I^2 ≥99%) of the included studies.

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

RESULTS

We identified 13 996 articles from the initial search. After removing the duplicates, 10 860 studies were selected for title and abstract screening. There were 10 685 studies excluded from this screening phase, mainly due to these studies describing the illness co-existed with a particular disease of interest, that is, comorbidity, but not multimorbidity. A total of 175 studies remained for full-text review, with a total of 59 articles included for final analysis and synthesis (figure 1).

Study characteristics

The key characteristics of the studies are listed in online supplemental material 3. There are 46 studies conducted in China (43 studies in Mainland China, 1 study in Hong Kong and 2 studies in Taiwan),[12 20–64] 9 studies in India[13 65–72] and 4 studies in both countries.[73–76] The studies reported both countries used the data from WHO study on global ageing and adult health. There were eight studies using data from China Health and Retirement Longitudinal Study but analysis with different age group or data collection time point.[12 35 40 41 43 47 60 62] Most studies (n=46) included participants from both urban and rural areas, while there were four studies specifically in rural areas and nine in urban areas. All included studies were designed as cross-sectional studies, with three studies involving data collection at multiple time points. The age of the participants ranged between 18 years and 113 years. There was one study that enrolled participants from 15 years of age and above, but with no available data to specifically report the prevalence and patterns for the age group between 15 and 18 years.[72] There were 26 studies with study participants >60 years. The number of co-existing disease conditions included in multimorbidity assessment varied from 2 to >40.

Prevalence of multimorbidity

The median prevalence of multimorbidity was found to be 30.7% (IQR 17.1, 49.4), ranging from 1.5% to 90.5% (table 1). Forty-four studies (75%) reported a prevalence <50%, while 15 studies reported a prevalence >50%. Thirty-four studies reported sex-specific data. The median prevalence in females was 34.2% (IQR 14.7, 48.2), and 30.8% (IQR 15.3, 43.1) in males. Of the 46 studies conducted in both urban and rural areas, 12 studies reported urban-specific and rural-specific data in which the median prevalence was 25.0% (IQR 11.1, 33.2) in urban, while 25.5% (IQR 8.3, 28.4) in rural areas. The prevalence of multimorbidity based on primary data collection was 41.6% (IQR 20.8, 56.8), and that of those based on secondary data analysis was 30.1% (IQR 13.5, 44.6). Among the Chinese participants, the median prevalence was 36.1% (IQR 19.6, 48.8), while 28.3% (IQR 8.9, 56.8) for Indian participants. There was no substantial difference in prevalence between studies with representative samples and those without (31.2% vs 30.4%). The prevalence increased with age and the number of

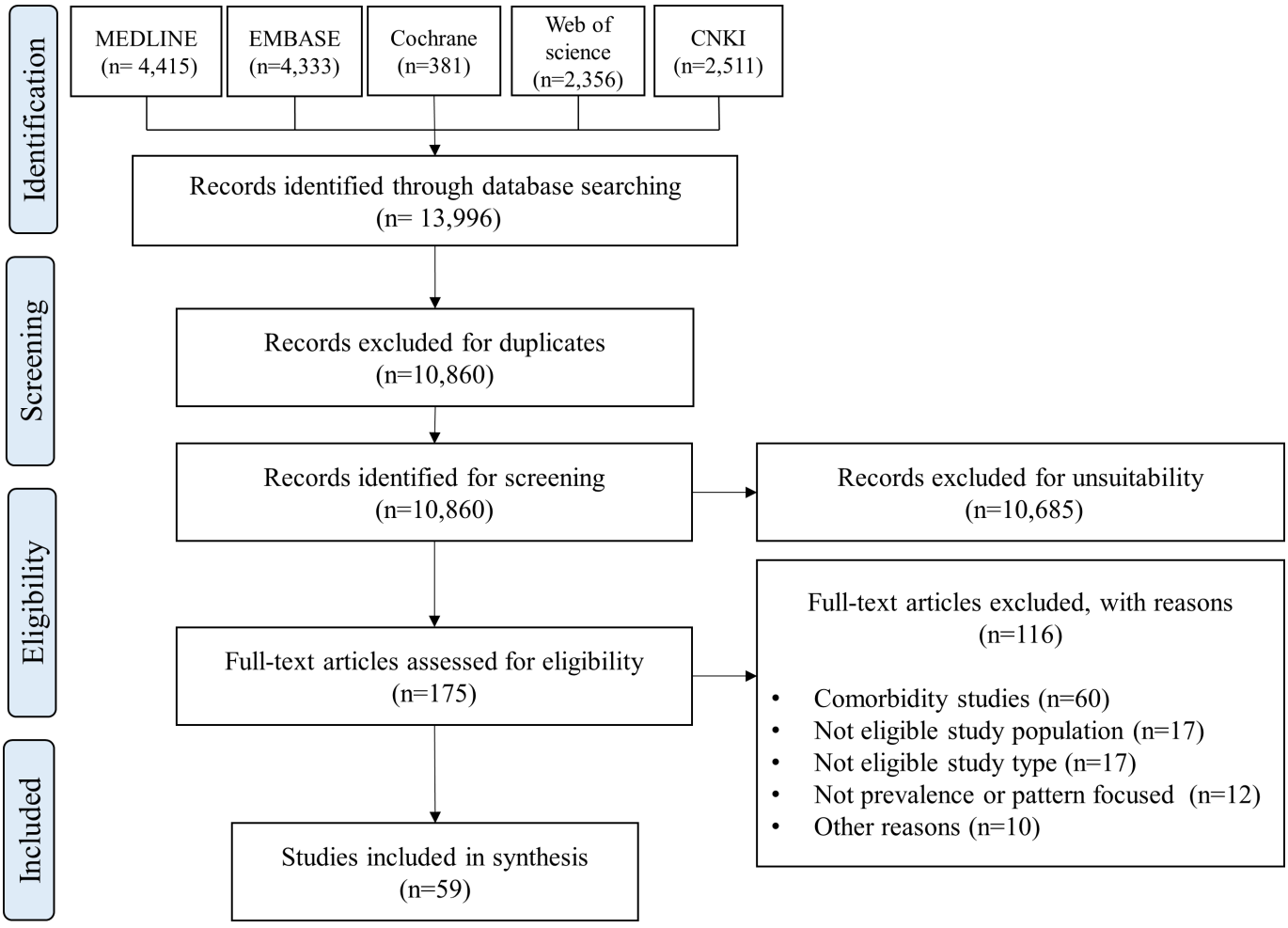

Figure 1 Study flow chart. CNKI, China National Knowledge Infrastructure.

co-existing disease conditions, whereas decreased with the sample size (table 1).

Prevalence of multimorbidity by sex and age

Out of the 59 studies, 34 studies reported 37 datasets for sex-specific analysis (one study contained three datasets, and one study contained one dataset from China and one from India). Figure 2 shows the differences in prevalence between female and male. Among the 37 datasets, 86% (n=32) reported females had a higher prevalence than males, with only 5 studies showing otherwise.

Out of the 59 studies, only 27 studies reported the prevalence of multimorbidity by age group (21 from China and 6 from India) (figure 3). In general, the prevalence of multimorbidity increased with age, prior to the age of 60 years, but this pattern changed for age groups >60 years. Of note, there were eight studies that saw a reduction in the middle-old or oldest-old age groups (>75 years old). More than half of these studies used country-level representative datasets, and all eight studies enrolled participants aged 45 years and above.[12 34 47 59 61–63 67] Among the 27 studies, the highest prevalence was 90.8% for an age group >70 years old,[58] while the lowest was 1.6% for an age group between 18 and 24 years old.[23]

Patterns of multimorbidity

Seventeen datasets from 14 studies (1 study reported patterns in 4 datasets) reported the pattern of multimorbidity. Figure 4 shows the prevalence of dyad disease patterns identified in each study. The top four frequently occurring dyad disease patterns were hypertensive diseases and diabetes mellitus (n=9; median prevalence: 10.1%, IQR: 6.6, 15.8), hypertensive diseases and arthropathies (n=8; median prevalence: 11.6%, IQR: 3.6, 17.9), hypertensive diseases and heart diseases (n=7; median prevalence: 7.5%, IQR: 4.9, 23.3) and hypertensive diseases and metabolic disorders (n=6; median prevalence: 10.7%, IQR: 9.5, 19.4). The dyad disease pattern with highest prevalence was hypertensive diseases and diseases of oesophagus, stomach and duodenum (56.6%), while the lowest prevalence was other diseases of the respiratory system and arthropathies (1.1%). Hypertensive diseases were the most frequent disease condition in all dyad disease patterns, followed by arthropathies and diabetes mellitus.

Single disease conditions

The number of single disease conditions identified from the included 59 studies varied from 2 to >40. The most

Table 1 Prevalence of multimorbidity by age

The youngest age of enrolled participants	18–34 years		35–59 years		60 years and above		All studies	
	No. of studies	Prevalence of multimorbidity (%, IQR)	No. of studies	Prevalence of multimorbidity (%, IQR)	No. of studies	Prevalence of multimorbidity (%, IQR)	No. of studies	Prevalence of multimorbidity (%, IQR)
Overall	15	15.5 (9.1, 24.7)	18	30.9 (22.1, 43.1)	26	49.0 (41.6, 68.5)	59	30.7 (17.1, 49.4)
Sex								
Female	11	11.3 (9.2, 15.1)	10	38.3 (31.5, 45.2)	13	53.3 (43.0, 63.4)	34	34.2 (14.7, 48.2)
Male	11	9.2 (8.8, 15.4)	10	35.5 (27.4, 41.8)	13	45.5 (40.1, 50.3)	34	30.8 (15.3, 43.1)
Area								
Urban	6	11.1 (10.7, 16.9)	4	32.6 (30.3, 35.8)	2	44.7 (42.9, 46.6)	12	25.0 (11.1, 33.2)
Rural	6	8.3 (7.6, 16.9)	4	27.2 (22.8, 31.6)	2	45.9 (44.6, 47.3)	12	25.5 (8.3, 28.4)
Data source								
Primary data	6	13.3 (8.9, 25.1)	8	35.8 (27.0, 45.3)	15	51.0 (33.0, 66.9)	29	41.6 (20.8, 56.8)
Secondary data	9	17.1 (9.4, 23.4)	10	30.2 (13.1, 42.1)	11	44.5 (42.7, 77.2)	30	30.1 (13.5, 44.6)
No. of diseases								
≤10	8	9.0 (8.4, 18.6)	9	29.7 (27.3, 40.5)	6	33.1 (19.6, 48.7)	23	24.5 (9.1, 40.5)
11–15	3	16.3 (14.0, 38.1)	6	31.4 (8.8, 42.1)	9	48.6 (43.7, 57.0)	18	43.0 (20.6, 51.2)
≥16	4	24.7 (20.1, 28.3)	3	45.4 (33.1, 66.7)	11	68.7 (43.5, 81.5)	18	54.1 (26.8, 78.5)
Region								
India	7	8.9 (8.6, 25.2)	3	31.0 (20.0, 45.1)	3	56.8 (43.8, 61.3)	13	28.3 (8.9, 56.8)
China	11	16.3 (11.7, 23.6)	16	30.7 (23.5, 42.9)	23	48.6 (41.7, 71.0)	50	36.1 (19.6, 48.8)
Population range								
≤10 000	4	20.9 (12.2, 33.8)	8	40.5 (31.0, 45.4)	20	50.2 (38.8, 68.2)	32	44.5 (29.0, 59.1)
10 001–49 999	7	17.9 (9.0, 24.0)	8	26.1 (7.4, 35.9)	6	46.1 (43.6, 72.9)	21	24.7 (9.0, 43.6)
≥50 000	4	13.5 (10.4, 18.6)	2	39.2 (33.3, 45.2)	0		6	17.1 (11.1, 27.3)
Representative data								
Yes	5	14.7 (8.9, 27.8)	10	31.8 (28.5, 43.9)	5	43.7 (43.6, 44.5)	20	31.2 (21.6, 44.6)
No	10	15.5 (11.1, 24.7)	8	29.0 (7.4, 41.9)	21	56.8 (41.6, 73.3)	39	30.4 (16.1, 56.8)

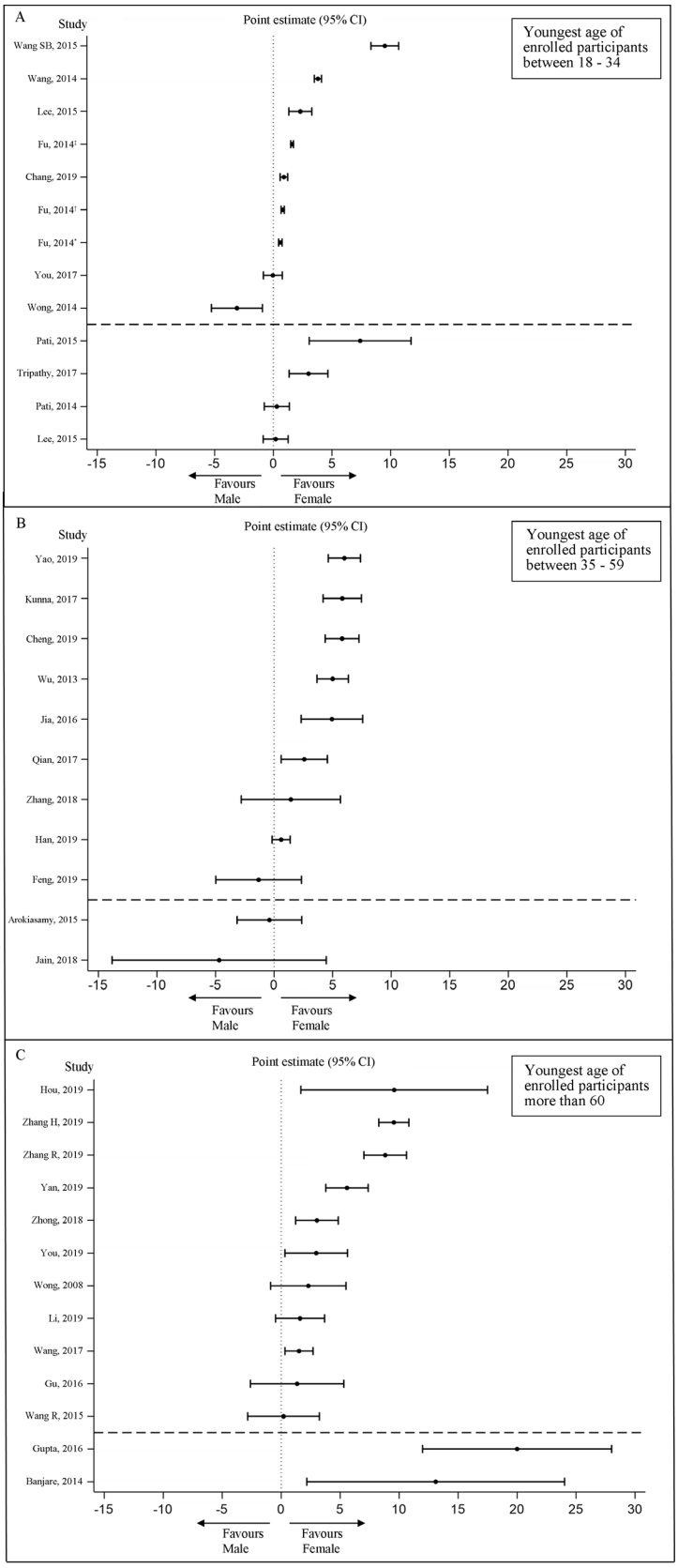

Figure 2 Multimorbidity prevalence between female and male. *The 2010 dataset of Fu, 2014. †The 2005 dataset of Fu, 2014. ‡The 2000 dataset of Fu, 2014. Panel A: forest plot showing multimorbidity prevalence difference between female and male in studies with youngest age of enrolled participants between 18 and 34 years. Panel B: forest plot showing multimorbidity prevalence difference between female and male in studies with youngest age of enrolled participants between 35 and 59 years. Panel C: forest plot showing multimorbidity prevalence difference between female and male in studies with youngest age of enrolled participants >60 years.

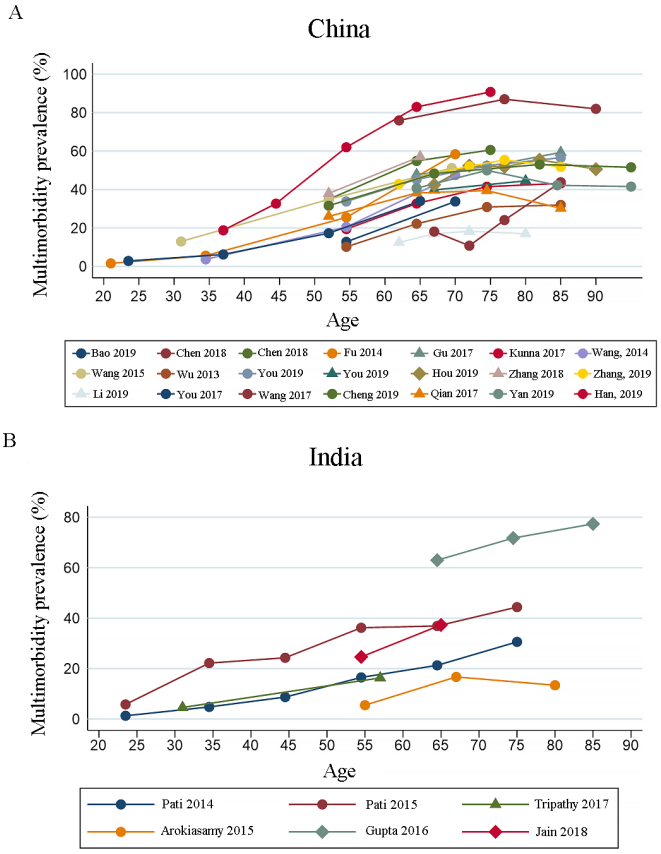

Figure 3 Age-specific prevalence of multimorbidity. ♦: Sample size <1000; ▲: Sample size between 1000 and 10 000; ●: Sample size >10 000. Panel A: prevalence of multimorbidity by age group in China. Panel B: prevalence of multimorbidity by age group in India.

frequent single disease conditions were hypertensive diseases (n=58), diabetes mellitus (n=57), cerebrovascular diseases (n=48), heart diseases (n=47), arthropathies (n=43) and chronic lower respiratory diseases (n=41).

The prevalence of each single disease condition was reported in most of the studies (n=44). The most prevalent single disease conditions were hypertensive diseases (median: 30.2%, IQR 20.9, 46.5), arthropathies (median: 21.2%, IQR 13.5, 32.7), diseases of oesophagus, stomach and duodenum (median: 20.3%, IQR 11.4, 24.5), metabolic disorders (median: 13.9%, IQR 5.6, 34.2) and heart diseases (median: 13.0%, IQR 6.5, 15.4).

Sample size of the included studies

The sample size varied widely from <100 to >2 million. There were only three studies with >1 million participants, one from India and two from Taiwan, China.[23 38 72] All these studies were secondary analysis from the routinely collected data, such as national health survey or health insurance database, whereas studies with fewer than 1000 participants were primary data collected from the community surveys.[51 53 59 65 69 71]

Quality assessment

All included studies were cross-sectional studies and none of them were rated as good quality (7–8 stars). Thirty-nine studies were rated as fair quality (5–6 stars), while 20 were rated as poor quality (4 stars or below) (online supplemental material 4).

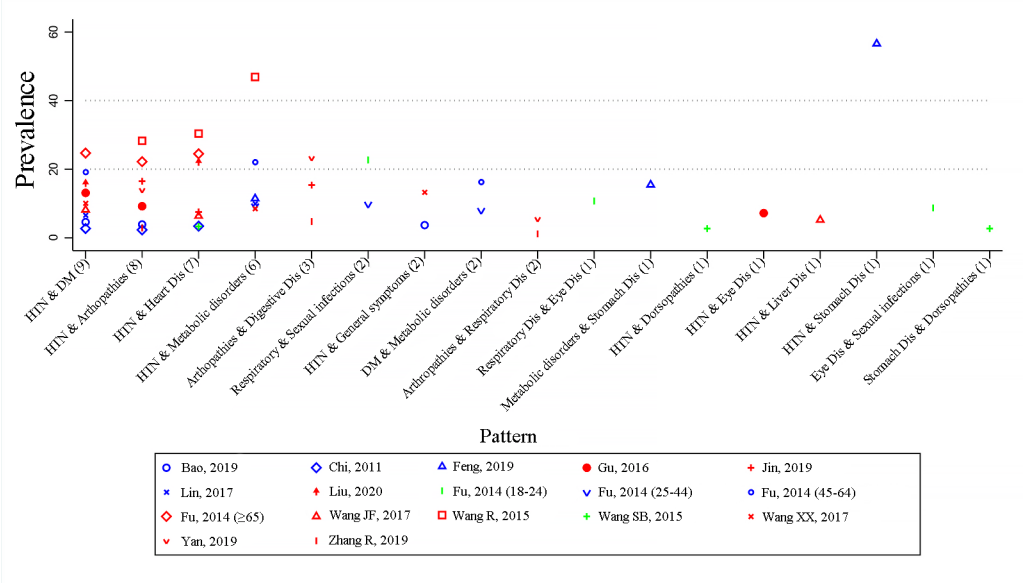

Figure 4 The prevalence of different dyads patterns of multimorbidity in included studies. The numbers in brackets represent the frequency of pattern in the studies. Colours in green: studies with youngest age of enrolled participants between 18 and 34 years; colours in blue: studies with youngest age of enrolled participants between 35 and 59 years; colours in red: studies with youngest age of enrolled participants >60 years. Digestive Dis, Oother diseases of the digestive system; DM, Diabetes mellitus; Eye Dis, Diseases of the eye and adnexa; General symptoms, General symptoms and signs; HTN, hypertensive Diseases; Liver Dis, Diseases of liver; Respiratory Dis, Other diseases of the respiratory system; Sexual infections, Iinfections with a predominantly sexual mode of transmission; Stomach Dis, Diseases of esophagus, stomach and duodenum.

DISCUSSION

This review found that the prevalence of multimorbidity varies widely across the studies and is largely affected by the study participants' age and sex. In addition, the patterns of multimorbidity are associated with the most prevalent single disease conditions, such as hypertensive diseases, diabetes mellitus, arthropathies, heart diseases and metabolic disorders.

In most studies, the prevalence of multimorbidity increased with age. In contrast, a previous review found an S-shaped relationship between age and prevalence, with <20% before 40 years old and >70% between the age of 40 and 70 years, remaining plateaued after the age of 70 years.[77] This might be explained by the wide age range of the study participants, spanning from 10 years and below to 80 years and above in one single study. Whereas in this review, the widest age range was from 18 years to 70 years and above. Nevertheless, the middle-age group (from 35 years to 64 years) seems to be the most vulnerable population to multimorbidity, which is similar to the pattern identified as the previous studies.[15 17 77] The plateaued or decreased pattern in the oldest age group may be due to the bias in multimorbidity assessment, such as the potential under-reporting of mental health diseases or self-reported disease outcomes.[78 79] This may also be attributable to potential survival bias, where people who suffered from multimorbidity died prematurely in the very old age group. This explanation is supported by a previous study that found people with more co-existing disease condition having higher mortality risk.[80]

Moreover, our study also found that the prevalence of multimorbidity increased with the number of diseases that are included in the analysis. This finding is consistent with previous studies that found the number of diseases considered in the analysis largely affected the estimated prevalence of multimorbidity.[81 82] For example, a previous study that included 335 disease conditions in the multimorbidity analysis found the prevalence of multimorbidity increased with the number of observed diseases.[1] Although there is no uniform standard for the number of disease types to be included in the multimorbidity analysis, the number and type of disease conditions should be determined according to the prevalent single disease condition in the study population.[77 82]

In our study, we found the prevalence of multimorbidity was higher in females than males, which is consistent with the previous review.[15] A large population-based study in West Asia addressed the importance to increase awareness about multimorbidity risk factors among females.[83] Despite the fact that average life expectancy of females are higher than males,[11 84] females experience greater challenges in health and quality of life.[85]Although such findings may portrait females as more vulnerable to multimorbidity, two factors should be considered. First, sex-wise comparison can be highly affected by the sex-specific disease conditions that were included in the multimorbidity analysis. For example, one study investigated disorders of breast and pelvic inflammatory disease in the multimorbidity assessment, which only applied to females with zero prevalence in males.[27] Likewise, this also applied to males due to male-specific diseases such as prostate issues. Second, higher detection rates of multimorbidity among females may be due to higher utilisation of health services, such as health screening during pregnancy.[86] This highlights the need to conduct high-quality studies to control confounders and gender-specific disease conditions to provide robust evidence on sex-specific multimorbidity prevalence.

The overall prevalence of multimorbidity is found to be higher in China than in India. One likely reason might be that Indian studies included in this review had wider age range than the Chinese studies, which led to a reduced overall prevalence because the prevalence of multimorbidity is lower in younger age groups. Moreover, the number of disease conditions included in the Indian datasets were smaller than the Chinese datasets, which may have reduced the overall prevalence. In addition, the prevalence of the most prevalent single disease conditions was higher in Chinese studies compared with Indian studies.[11 87] In addition, we found far more Chinese studies than Indian studies in this review. The reasons to explain this are threefolds. First, Chinese language database is available whereas India does not have such database in local language apart from English. Second, there are multiple studies (n=8) from China that used one single database from China Health and Retirement Longitudinal Study. Third, all regions in Greater China are included in this review. Besides Mainland China, Hong Kong, Macau and Taiwan were included as well. We also found the overall prevalence reported in our review to be much lower than those reported in studies conducted in HICs. For example, a systematic review and meta-analysis that included 31 HICs reported the pooled prevalence of multimorbidity at the community settings in HICs to be 37.9% (95% CI: 32.5 to 43.4),[15] while another review covering 52 articles from 30 HICs, with >60 million older adults reported the overall prevalence of multimorbidity to be 66.1% (IQR: 54.4, 76.6).[18] One potential reason to explain for this difference, in addition to the likely lower reporting rates in LMICs than that in HICs, could be the premature deaths occurring in LMICs from non-communicable diseases and multimorbidity.[88] With improvement in health prevention and management, people in China and India can be expected to live longer with multimorbidity.

In our study, the most frequent and prevalent disease condition is hypertensive disease. This finding aligns with the epidemiological studies in China and India. The prevalence of hypertension is 23.2% in China (adults over 18 years between 2012 and 2015),[89] while 25.3% in India (adults over 18 years between 2012 and 2014),[87] making it as the leading health problem in both countries. This finding is also consistent with the studies from HICs that found hypertension to be the most prevalent disease condition in multimorbidity analyses.[17 18] Nonetheless, in this review, diseases such as dementia,

depression and anxiety were not reported as prevalent or frequent diseases compared with other studies,[82 90] which may be due to the under-reporting or underdiagnosis of the non-symptoms-based conditions.[78] Last but not least, HIV infection, which is widely considered as a chronic condition because of its life-long disease duration and antiretroviral therapy,[91 92] was not mentioned in any of the currently included studies. Patients with HIV, however, are more vulnerable to chronic diseases such as diabetes mellitus and kidney diseases, in addition to HIV-associated complications.[93 94] Therefore, if the included studies considered HIV infection in their multimorbidity analyses, the prevalence and patterns of multimorbidity may have been presented differently.

The common patterns of multimorbidity identified from this review are hypertensive diseases combined with diabetes mellitus, arthropathies, heart disease and metabolic disorders, which is different compared with the previous studies.[17 75 95] One possible explanation for the various patterns across the studies is the non-unified classification of the diseases compared with previous studies. In this review, the block category of ICD-10 coding system was used to code all disease conditions. For example, one of the most commonly reported multimorbidity pattern in another study involved hyperlipidaemia,[92] but that was coded into its block category as metabolic disease in this study. This highlights the need to standardise disease classification for multimorbidity assessment.

In our review, only three studies used routinely collected data, with large sample size, to conduct multimorbidity assessment, spanning ages 18 to >65 years. Despite routinely collected data, such as health insurance claims or electronic health records, been applied in many aspects,[96 97] its use in multimorbidity assessment remains limited. This may be due to the concerns about the accessibility, accuracy and reliability of the routinely collected data.[98] Routinely collected data can serve as a promising tool to better understand the epidemiology of multimorbidity due to its volume and representativeness, but still depending on the quality and completeness of the data. For example, mental health assessment or dietary patterns may not be collected routinely. It might be necessary to establish an integrated health information system of integrating the existing routinely collected data systems,[99] maximising the use of such data, to comprehensively and timely understand the burden of multimorbidity.

Strengths and limitations

To our knowledge, our study is the first systematic review examining the prevalence and patterns of multimorbidity in both Chinese and Indian population. There are a few limitations that we acknowledge. First, we did not include grey literatures or unpublished papers in the data synthesis, despite a rigorous search from the major English and Chinese databases. Second, we used ICD-10 coding system to code the disease conditions, but the outcomes may differ if we used other coding systems. Third, we only analysed the dyad patterns of multimorbidity in this study due to limited studies reporting disease patterns with more than two disease conditions. Moreover, our study is limited by the large heterogeneity among the included studies in their sample sizes, data collection methods and numbers of diseases included in the multimorbidity analyses. Meta-analysis was therefore not possible to be performed to estimate the overall pooled prevalence of multimorbidity. Lastly, this review was restricted to studies that involved participants only from China and India, which may limit the generalisability of the findings to a broader population in LMICs.

Nonetheless, this review represents an updated and comprehensive synthesis of evidence about multimorbidity prevalence and patterns in Chinese and Indian community settings. The findings should support researchers and clinical practices to conduct future studies to further explore the prevention and management of multimorbidity.

CONCLUSION

With rapid ageing and improvements in living standards and health services, multimorbidity is likely to become a growing health problem among Chinese and Indian people. To date, China and India have begun to realise the impact of multimorbidity. More studies have tended to report the prevalence and patterns of multimorbidity in the past 5 years, but the results varied across different studies. This may in part be due to a lack of standardised definition of multimorbidity and methodological issues in conducting these studies. It is therefore important to apply common definition of multimorbidity, use routinely collected data as disruptive technology, to conduct robust large-scale research to determine the prevalence and patterns of multimorbidity in China and India, and other LMICs, among people of different age groups, to provide further evidence for the development of effective interventions for multimorbidity management.

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