Comorbidity and healthcare utilization in osteoarthritis; a primary care survey from Odisha, India[☆]

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A B S T R A C T

Background: The study aimed to explore the pattern of comorbidities among Osteoarthritis (OA) patients attending urban primary care settings and its association with healthcare utilization.
Methods: Age (± 3 years) and sex matched (1:1) case-control study was done among randomly selected 514 people (OA + non-OA) attending primary care settings. Information was collected on 18 comorbidities and healthcare utilization was measured by number of hospital visits in last one year and numbers of medicines taken daily. Multivariate logistic regression was used to examine the association with multimorbidity and linear regression analysis was performed for identifying association between healthcare utilization and comorbidities.
Result: There were 260 radiologically confirmed OA cases and 254 matched controls. The mean age of people with OA was 52.7 years compared to 54.5 years in controls. Mean number of comorbidities among OA was 2.5. Leading comorbidities were acid peptic diseases, chronic back pain, hypertension and diabetes. The adjusted odds of having two or more comorbidities among OA patients was 1.8 [95% CI 1.4–2.2]. The adjusted β coefficient for number of medicines taken was 0.5[95% CI 0.2–0.8] in OA patients with two or more comorbidities compared to non-OA with less than two comorbidities. The hospital visits were 0.7 times less among OA patients with two or more comorbidities compared to non-OA with less than two comorbidities after adjusting for other variables.
Conclusion: Osteoarthritis has significant association with multimorbidity, which increases medicines intake and health care utilization. Comorbidities in OA should be considered for designing integrated care approach.

1. Introduction

Worldwide, Osteoarthritis (OA) has been accepted as one of the major public health problem in non-communicable diseases.[1] It is estimated that, 9.6% of men and 18.0% of women aged 60 years or more have symptomatic OA of the hip or knee.[2] Developing countries too report higher morbidity rate like developed countries. A multi-center based study from India estimated the prevalence of OA among 40 or more age was 28.7% consistent with findings from other large studies where the prevalence varied from 12 to 30%.[2,3] Findings from developed countries rank hip and knee OA high in 'years lived with disability' (YLD) and 'disability adjusted life years' (DALYs), and are experiencing significant economic burden on health system on and individuals because of the pain and mobility restriction.[4,5]

Like other chronic conditions namely, diabetes or hypertension, OA is also associated with comorbidities. Presence of multiple chronic conditions (multimorbidity) has become a norm in elderly and people with OA; are not an exception to it.[6–9] Individuals with co-morbidity have higher mortality rate, increased expenditure towards health, disturbed physical and mental health affecting overall function and quality of life.[10,11] It is assumed, the presence of co-morbidities in OA might have greater impact than isolated OA. In India the prevalence of multimorbidity is found to vary from 25% to 40%[12,13] but the exact distribution of the combination of diseases are not available yet. A recent study done in eastern India among primary care patients described the prevalence of OA to be one of the leading chronic conditions, co-existing with other cardio-vascular and musculoskeletal conditions.[14] Presence of multiple chronic conditions also has got impaired effect on patient outcome and predisposes to the side effects of multiple medications, hospital visits and increased expenditure.[15,16] Studying the

existence of comorbidities in OA patients and its impact on health care utilization would be useful for primary care decision making process. In general, because of pain and stiffness, people with OA used to visit healthcare facilities more often and try different medicines along/besides the modern medicine system.[17,18]

Limited studies are available from developed countries on the magnitude of co-morbidity in OA, whereas, this situation in developing countries is yet to be explored.[19] Also very few researches have assessed the relationship between osteoarthritis, comorbidity pattern and healthcare utilization pattern, which is an absolute necessary for designing a primary care intervention. Keeping the limited evidence available on healthcare utilization pattern among OA patients with comorbidities in primary care settings of India, the study aims to explore the pattern of comorbidities in OA and its association with healthcare utilization among patients attending urban primary care settings in the Eastern India.

2. Materials and methods

This case-control study was carried out from April to June 2017 in two primary health centers in the eastern India. These two urban health centers (UHCs) (out of 17) were randomly selected for data collection. Each UHC provides clinical services to approximately 50,000 people of the urban population managed by one medical officer, one staff nurse and one pharmacist.[20]

2.1. Study subject/study participants

In our study, cases were individual aged 30 years or more having sign and symptoms of knee pain with radiologically confirmed diagnosis of OA (any joint). Following individuals were excluded from the study, 1. history of trauma to lower limb; 2. confirmed case of rheumatoid arthritis and poly arthralgia; 3. severely ill. Controls were selected randomly from the same outpatient register, matched with age (± 3 years) and sex having no sign and symptoms of OA or any joint related diseases with a ratio of 1:1 (OA: Non-OA) and they visited hospitals for other reasons except OA or joint pain.

2.2. Sample size

Considering the prevalence of comorbidities in OA to be 54.2% in India[21] and assuming 5% error and 1.7 odds ratio of having multimorbidity, the minimum sample required for the study at 95% confidence interval was 458. The sample size was chosen, for feasibility purpose considering the small study duration. Expecting, 15% non-response rate, the required total sample size in both the groups calculated were 539 (270 in each group).

2.2.1. Study instrument/tools

A semi structure questionnaire was developed and validated among 20 non-sample subjects before using for the study purpose. The questionnaire collected information on 5 domains namely: 1. socio-demographic information (age, sex, income, education and literacy level); 2. disease and treatment history; 3. other chronic conditions (physician diagnosed and self-reported) (Appendix 1); 4. healthcare utilization (number of medicines used per day and hospital visit in one year); and 5. disease severity only for OA. The questionnaire was translated by a linguistic expert to local language and back translated to English before using in the final study. During our study, 18 chronic diseases were reported by patients/was extracted from old prescription.

All patients meeting the eligibility criteria were interviewed by researchers (alternative medicine practitioner), immediately after the consultation. The interview was conducted in Odia language at a calm place within the facility. Patients were screened for body mass index

(BMI), hypertension and depression using patient health questionnaire-9.[22] Self-reporting of chronic diseases was validated with the prescriptions. The information on the count of medicine being taken daily and hospital visits were matched with the previous prescriptions, as most of the patients brought their other prescriptions to consult the physician. Information on economic status was validated with the identity card issued by the government for availing free public services.

2.3. Data analysis

Descriptive statistics were calculated across the case and control. The association was tested using chi-square test at the level of p value < 0.05. Multimorbidity was defined as presence of two or more chronic conditions with OA,[6] which was derived using simple count methods. The outcome variable for multivariate logistic regression was '0' – no multimorbidity and '1' – multimorbidity. Study population was grouped into four classes, namely, 1. Non-OA with less than equal to two comorbidities, 2. Non-OA with more than two comorbidities 3. OA with less than equal to two comorbidities and 4. OA with more than two comorbidities. BMI was divided into two groups namely, non-overweight/non-obese and obese/overweight using standard reference cutoff for male and female. Frequencies of the different diseases were calculated in both groups of patients (OA vs Non-OA) across the age groups. Mean score for each healthcare utilization pattern was estimated. Firstly, univariate analysis was done for the association of OA with multimorbidity. Second model, the covariate was adjusted for age, sex, BMI, education, economic status, smoking habit. In the third and final model, it was additionally adjusted for hypertension and diabetes. The purpose of adjusting for these two conditions was to eliminate the confounding, as these systemic diseases are common in multimorbidity. Linear regression model was used to identify the factors responsible for healthcare utilization after adjusting for age, sex, education, marital status, smoking habits, obesity and the comorbidity group. All the analysis was performed using STATA (V.12, STATA Corp, College Station, Texas, USA). [23]

2.4. Ethical consideration

The study obtained approval from the *Institutional Research Ethics Committee.* Prior to the data collection necessary permission was obtained from all relevant persons and urban health center in charge. Before the interview, written consent was obtained from the patients. The collected data was delinked from any identification and was stored in a password protected file having access only to the researchers involved in this study.

3. Results

We approached 540 patients, of which 514 were provided consent for participation. The non-response rate in our study was nearly 4.8% and the demographic characteristics did not differ much among the refuser and study group. In our study, the ratio of non-OA patients to OA patients was nearly 1:1. The distribution of the basic demographic characteristics is given in Table 1. The mean age of the patients was 52.7 years and 54.5 years among OA and non-OA patients respectively. Significant difference in frequency was observed for marital status, education level, smoking habits and comorbidity count (Table 1). Nearly 8% of cases were below the age of 40 years (Appendix 2).

3.1. Comorbidity

The mean number of comorbidities was 2.3, higher in patients with OA (2.5) compared to non-OA (2.1). The count wise distribution of comorbidity across both the groups demonstrates higher reporting of

Table 1
Descriptive characteristics of the study participants.

Variables	Categories	Total (N = 514)	Non-OA (N = 260) 95% CI	OA (N = 254) 95% CI	P value (chi square test)
Sex	Female	50.2[45.8–54.5]	51.6[45.4–57.7]	48.8[42.7–54.9]	
Marital status	Single	7.4[5.1–9.7]	8.7[5.2–12.1]	6.1[3.2–9.1]	0.003[a]
	Married	80.5[77.1–84.0]	74.8[69.4–80.2]	86.1[81.9–90.4]	
	Widow/er	12.1[9.2–14.9]	16.5[11.9–21.1]	7.8[4.4–10.9]	
Ethnicity	Schedule Caste/Tribe	27.2[23.4–31.1]	27.6[22.1–33.1]	26.9[21.5–32.3]	0.871
	Others	72.8[68.9–76.6]	72.4[66.9–77.9]	73.1[67.7–78.5]	
Education	Illiterate	9.7[7.1–12.3]	15.7[11.2–20.2]	3.9[1.5–6.2]	< 0.001[a]
	Primary and secondary	36.0[31.8–40.1]	31.5[25.7–37.2]	40.4[34.4–46.4]	
	High school and higher secondary	44.8[40.4–49.1]	45.7[39.5–51.8]	43.8[37.8–49.9]	
	Graduation and above	9.5[7.0–12.1]	7.1[3.9–10.2]	11.9[7.6–15.9]	
Economy status	Above poverty line	79.8[76.3–83.2]	79.2[74.3–84.2]	80.3[75.4–85.2]	0.760
	Below poverty line	20.2[16.7–23.7]	20.8[15.8–25.7]	19.7[14.8–24.6]	
Smoking habit	Yes	19.1[15.6–22.5]	23.5[18.3–28.6]	14.6[10.2–18.9]	0.010[a]
Body mass index	Non-overweight/Obese	51.9[47.6–56.3]	51.1[45.1–57.2]	52.8[46.6–58.9]	0.716
	Overweight/Obese	48.1[43.7–52.4]	48.9[42.7–55.0]	47.2[41.1–53.4]	
Comorbidity count	None	4.1[2.4–5.8]	5.1[2.4–7.8]	3.0[1.0–5.2]	0.040[a]
	One	18.9[15.5–22.3]	22.8[17.6–28.1]	15.0[10.6–19.3]	
	Two	37.7[33.5–41.9]	37.0[31.1–43.0]	38.5[32.5–44.4]	
	Three or more	39.3[35.1–43.5]	35.1[29.1–40.9]	43.5[37.4–49.5]	

[a] P value significant at < 0.05.

two or less comorbidities in non-OA group, whereas, comorbidities count of three or more are being frequently reported among OA patients with significant p value < 0.05 (Table 1). Of the 18 diseases extracted, leading chronic conditions were acid peptic disease, chronic back pain, hypertension and diabetes, which varied across the groups (Appendix 1). Top three chronic conditions reported among OA patients were acid peptic disease (73.8%), chronic back pain (65.4%) and hypertension (38.9%), whereas, among non-OA patients, acid peptic disease (59.4%), chronic back pain (31.5%), hypertension (27.6%) and diabetes (25.6%) were frequently reported (Appendix 1). The age wise distribution of the chronic conditions in both groups has been depicted in Figure 1. Among OA patients, acid peptic disease, hypertension, chronic back pain and diabetes, were seen to be increasingly reported among elderly (≥71 years) (Figure 1). Our multivariate logistic regression model shows, the odds of having two or more chronic conditions was 1.8 times higher among OA patients (OR 1.8: 95% CI 1.4–2.2) compared to non-OA after adjusting for sex, age, education, marital status, smoking habits, BMI, hypertension and diabetes (Table 2).

3.2. Health care utilization

Among patients with OA, the mean number of medicines taken per day and hospital visits in one month was found to be 2.9 and 2.8 compared to 2.9 and 2.5 in non-OA patients respectively. Figure 2a represents the distribution of mean number of medicines taken across different comorbidity groups in both the sex. The mean number of medicine use per day increases steadily with increase in number of comorbidities with highest seen among OA patients with two or more comorbidities and among females. The number of outpatient visits per year was seen to be decreasing with increase in comorbidities and was lowest (mean 2.24) among female arthritis patients with two or more comorbidities (Figure 2b).
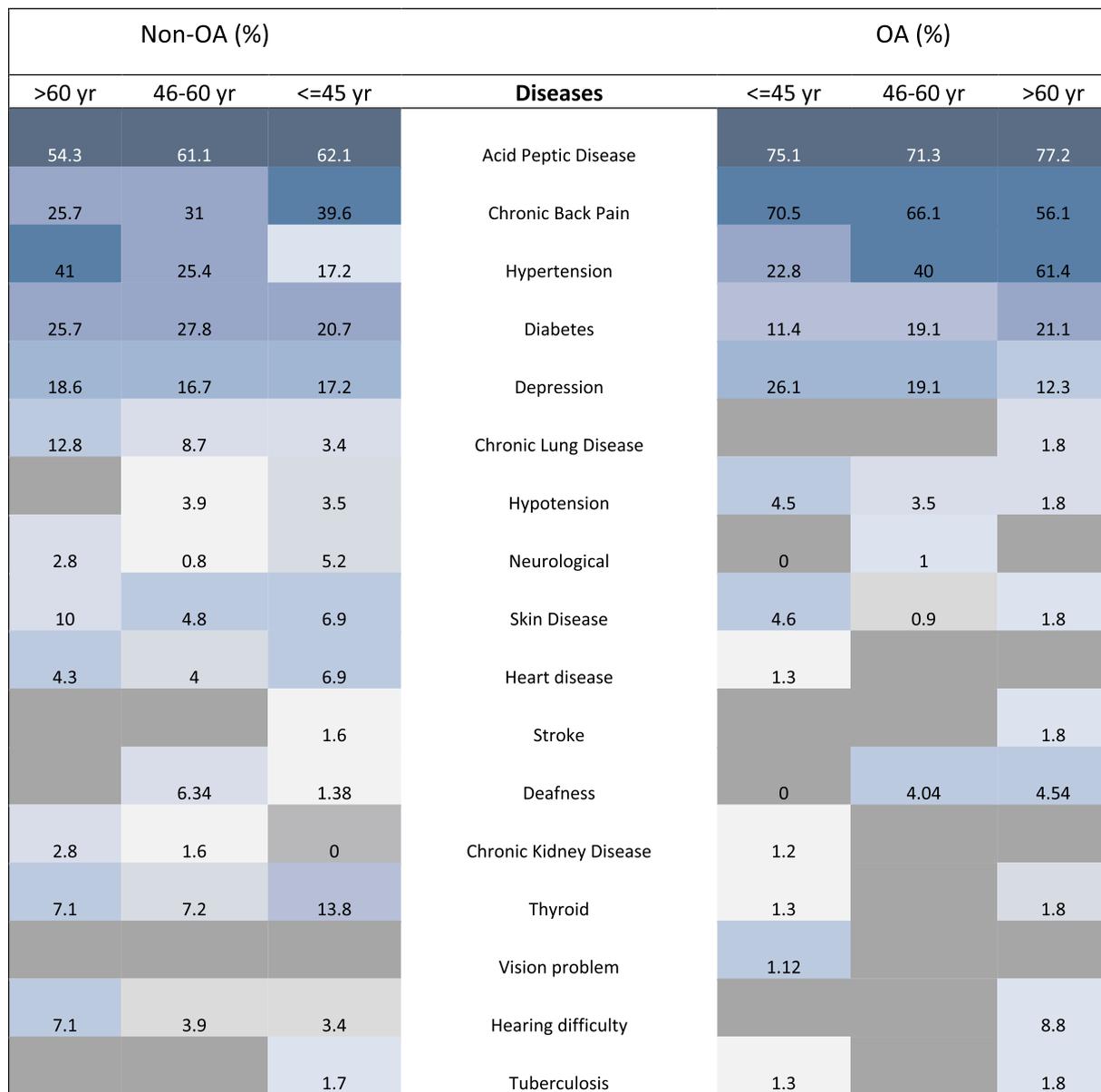
The adjusted (for sex, age, education, marital status, smoking habits and BMI) multivariate linear regression models for medicine use predicts the count of medicine use is 46.7% more among patients with OA and more than two comorbidities compared to non-OA patients having less than two comorbidities. Whereas, the count of outpatient visits decreases by 70% in OA with more than two comorbidities after the adjustment (Table 3).

4. Discussion

Our study is one of the first to explore OA and its comorbidities among people aged ≥30 years attending primary care settings in India. The average age of the OA patients was 52.7 year and nearly, 77% of them had more than two chronic conditions compared to 72% in non-OA patients. Presence of arthritis was found to be nearly 2 times higher associated with two or more comorbidities. Multimorbidity in OA is positively associated with increased healthcare utilization such as medicine use and hospital visits. Our study is consistent with findings from developed countries and studies from specialized hospitals.[18,19]

Common to the notion, most of the studies in OA was done among elderly population aged ≥60 years. However, in the present study, the average age of the patients was 52.7 years with range of 32 years–86 years. It is well known that, being at the age of the forty increases the risk of getting OA, but 7.7% OA patients below 40 years of age in our study indicates the epidemiological shift in onset of the disease. Our findings on the average age of the patients are consistent with some of the studies based on the medical records.[24,25] As the burden of OA on physical functioning is high because of pain and joint movement limitations, early onset of the disease postulates an emerging threat as non-communicable diseases. Though our finding is from a small sample of patients, a large population-based study in all age group is required to validate the epidemiological shift.

Presence of two more chronic conditions is increasing among adults.[7] Literatures are adding to the evidence of multimorbidity, mostly in patients with cardiovascular diseases owing to its common shared physiology and pathology.[26] In our study, the mean number of comorbidity was 2.5 among OA patients compared to non-OA patients could be due to the linear relationship between the ageing and multimorbidity. This is similar to findings from developed countries.[27,28] We found the prevalence of three or more chronic conditions was higher among OA patients. This could be due to the limited diagnosis among non-OA patients. In both the group acid peptic disease was reported to be higher followed by back pain in OA and hypertension. However, much higher reporting of acid peptic diseases among these cases corroborates with findings from other studies done among primary care patients in India.[14,29] Well established evidences are available on the medicines used in OA and acid peptic disease,[30] however, the higher prevalence among non-OA patients necessitates further investigation.

Non-OA (%)			Diseases	OA (%)		
>60 yr	46-60 yr	<=45 yr		<=45 yr	46-60 yr	>60 yr
54.3	61.1	62.1	Acid Peptic Disease	75.1	71.3	77.2
25.7	31	39.6	Chronic Back Pain	70.5	66.1	56.1
41	25.4	17.2	Hypertension	22.8	40	61.4
25.7	27.8	20.7	Diabetes	11.4	19.1	21.1
18.6	16.7	17.2	Depression	26.1	19.1	12.3
12.8	8.7	3.4	Chronic Lung Disease			1.8
	3.9	3.5	Hypotension	4.5	3.5	1.8
2.8	0.8	5.2	Neurological	0	1	
10	4.8	6.9	Skin Disease	4.6	0.9	1.8
4.3	4	6.9	Heart disease	1.3		
		1.6	Stroke			1.8
	6.34	1.38	Deafness	0	4.04	4.54
2.8	1.6	0	Chronic Kidney Disease	1.2		
7.1	7.2	13.8	Thyroid	1.3		1.8
			Vision problem	1.12		
7.1	3.9	3.4	Hearing difficulty			8.8
		1.7	Tuberculosis	1.3		1.8

*Darker is the color higher is the frequency, blank cells had frequency less than 0.5%

Fig. 1. Distribution of chronic diseases across age group among OA and Non-OA patients.

Table 2
Logistic regression model for association of OA with two or more comorbidities.

|	Unadjusted OR, 95% CI	Model 1 OR, 95% CI	Model2 OR, 95% CI
Osteoarthritis Yes	1.9[1.6–2.3][a]	1.9[1.5–2.3][a]	1.8[1.4–2.2][a]

#Significant at p value < 0.05.
Model 1 adjusted for age, sex, education, economic status, smoking habit, BMI.
Model 2 adjusted for age, sex, education, economic status, smoking habit, BMI, hypertension and diabetes.
[a] Reference group 'Non-Osteoarthritis'.

Coexistence of back pain with OA has been reported by many authors, the cause has to be explored beyond the susceptible ageing and occupational factors.[31,32] Adjusted regression shows that the risk of getting comorbidities are 2 times more compared to non-OA patients after adjusting for other variables. This might be explained through multimorbidity, as co-existence of chronic diseases have become very frequent. However, limited literatures are available on the risk factors of OA comorbidities[27,33,34] supporting the findings. Another reason could be the shared risk factors like obesity and smoking for most of the chronic diseases, but we could not find significant association in our adjusted model. The nexus between the risk factors and ageing towards arthritis must be studied in detail. Studies on multimorbidities around the globe have documented the existence of OA as leading chronic conditions along with cardiovascular group of diseases.[35–37]

Increased healthcare utilization has been proved to be linked with multimorbidity and OA.[16,38] We found the presence of two or more chronic conditions among OA is linearly associated with medicine intake. This is consistent with findings from studies on comorbidities and polypharmacy.[39] As OA is more associated with pain and functional limitation the use of medication is thought to be more,[40] additional presence of chronic conditions escalates the chances further. Studies have reported similar findings among OA patients and patients often
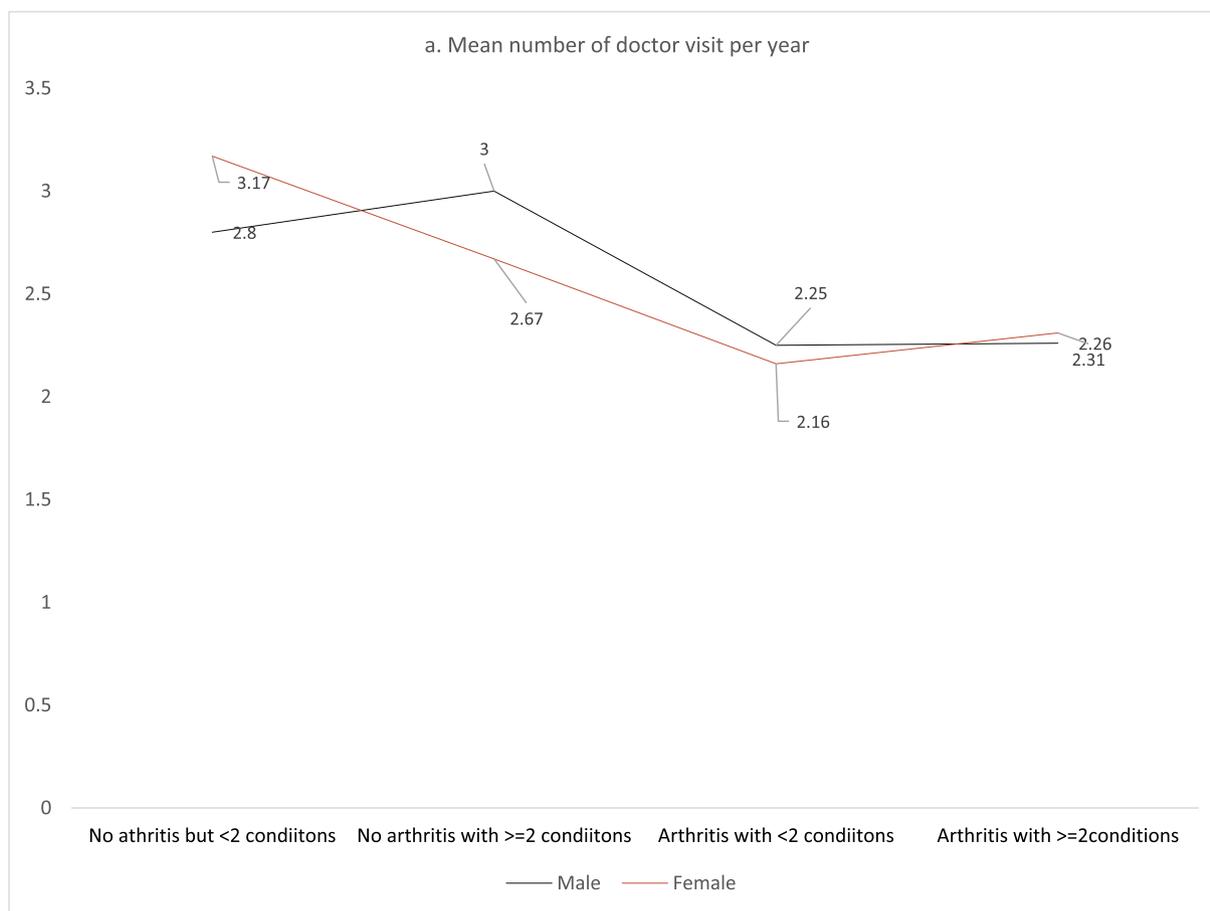
ANOVA F=13.06, P <0.001

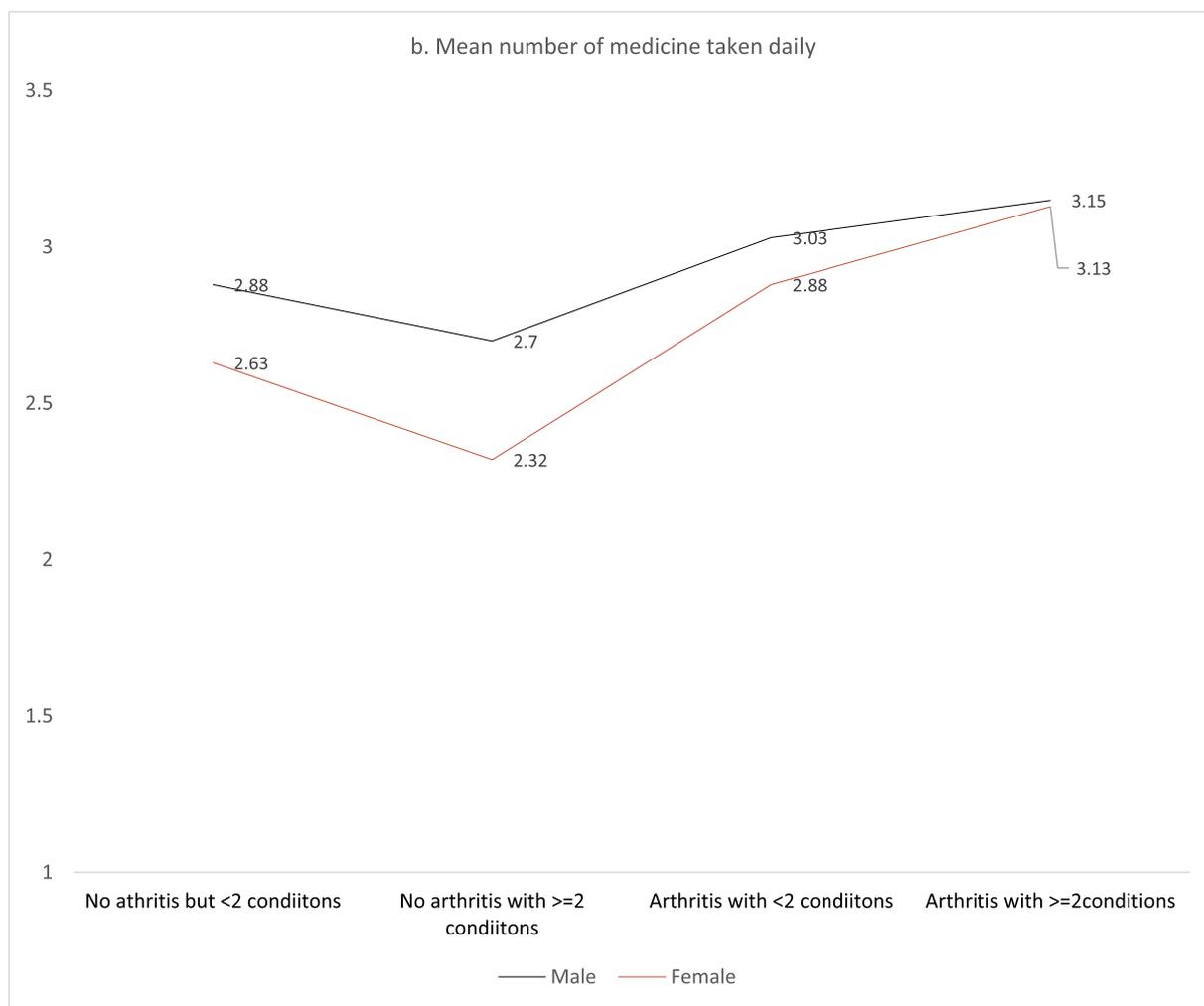**Fig. 2a.** Mean number of hospital visits among male and females across different comorbidity groups.

change the medication to relief the pain.[41,42] Generally, hospital visits were also seen to be linearly associated with comorbidities.[15,43] But our findings were contrasting to the commonly reported evidences. A qualitative research done among OA patients has reported the factors like comorbidities, priorities over other conditions and self-perceptions about the disease determines the level of utilization.[8] As osteoarthritis is a chronic condition, patients prefer to visit specialists than a primary care physician. Very often patients are advised for physiotherapy, alternative medicine and traditional medicines which are generally not available at primary care settings. As the study has been done in primary care settings, the true utilization might have been not been captured.

Our study has several limitations. Firstly, the diagnosis of OA in primary care settings might lead to misclassification. However, most of the patients were confirmed by X-ray findings, they had not brought the X-ray film on the date of interview. Even though, we did not include symptomatic patients under treatment, but validation with X-ray observation would have strengthened our sample. Secondly, the findings are based on small sample of patients attending the primary care settings in urban area, especially in control group. The required sample size has been calculated based on the statistical formula and prevalence of OA, however, designing the study on large database can provide more precise estimation. Thirdly, the chronic diseases were listed as reported by the patients. Self-reported method has its own limitations but can be used as a proxy indicator in the absence of medical records in developing countries like India. Studies have validated the use of self-

reported diseases and suggested the usefulness of its use.[44] Another limitation could be the reported number of chronic conditions in our study. We listed 18 chronic diseases, which is comparable to the list of diseases being studied by others. The healthcare utilization is based on the findings from the patients attending to the sample facilities, however, many patients prefer to visit the specialist for joint pain might influence the actual findings.

5. Conclusion

OA is prevalent among patients attending primary care settings. Common diseases present are acid peptic disease, cardiovascular comorbidities, diabetes and back pain. India is one of the leading country with largest number of diabetes and hypertensive patients.[45] The current national program on NCDs are more focused on CVDs and arthritis has been missed out. As arthritis is equally prevalent and is associated with increased comorbidities and healthcare utilization, understanding the distribution and pattern of diseases will guide in designing an integrated management plan. In the view of polypharmacy and multimorbidity, having a standard treatment protocol considering the presence of other chronic conditions will prevent many complications and healthcare cost. Further large database research is required to gather evidences on importance of considering the other chronic diseases during the management of OA.

ANOVA F=8.1, P =0.002

Fig. 2b. Mean number of medicine use among male and females across different comorbidity groups.

Table 3
Linear regression model for estimating variables associated with number of medicine intake per day and hospital visits in last one year.

Variables	Groups	Number of medicine use per day		Number of outpatient visit in one year	
		Unadjusted (Coeff) 95% CI	Adjusted (Coeff), 95% CI	Unadjusted (Coeff), 95% CI	Adjusted (Coeff), 95% CI
Comorbidity group	No OA with < 2 comorbidities	Ref	Ref	Ref	Ref
	No OA with ≥ 2 comorbidities	−0.26[-0.58 to 0.05]	−0.26[-0.6 to 0.1]	−0.17[-0.5 to 0.16]	−0.21[−0.54 to 0.11]
	OA < 2 comorbidities	0.21[−0.6 to 0.48]	0.26[−0.01 to 0.53]	−0.78[−1.05 to −0.49][a]	−0.8[−1.1 to −0.52][a]
	OA with ≥ 2 comorbidities	0.38 [0.09 to 0.67][a]	0.46[0.17 to 0.76][a]	−0.7[−0.9 to −0.40][a]	−0.7[−1.02 to −0.41][a]

[a] P value < 0.05; Adjusted for sex, age, education, marital status, smoking habit and BMI.

Conflict of interest

The authors declare no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cegh.2019.03.002.

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