

Prevalence of knee osteoarthritis, its determinants, and impact on the quality of life in elderly persons in rural Ballabgarh, Haryana

Abhishek Jaiswal¹, Kiran Goswami¹, Partha Haldar¹, Harshal Ramesh Salve¹, U. Singh²

¹Centre for Community Medicine, ²Department of Physical Medicine and Rehabilitation, All India Institute of Medical Sciences, New Delhi, India

ABSTRACT

Background: Osteoarthritis (OA) is the most common type of arthritis and a very common disease of elderly. It is one of the leading causes of disability. The present study was conducted to estimate the burden of the knee OA among rural elderly. **Methods:** A community-based cross-sectional study was conducted among 500 randomly selected elderly resident of rural Ballabgarh, Haryana. A semi-structured interview schedule was used by a trained investigator for face-to-face interview, clinical examination of knee using American College of Rheumatology criteria, and quality of life assessment using WHOQOL-BREF. **Results:** Almost two-third of the participants among 454 elderly recruited, suffered from knee OA (292, 64.3%) had knee OA. History of a knee injury, a family history of knee pain, current physical activity and smoking status were found to be significantly associated with knee OA, in multivariate logistic regression model. Elderly suffering from knee OA had significantly lower quality-of-life scores contrasted to those not (p -value < 0.001). The scores were significantly lower for all the domains (P -value < 0.001) among elderly suffering with the knee OA, with the maximum effect seen in psychological, and physical domain. **Conclusion:** Rural elderly of Ballabgarh, Haryana, had a high burden of knee OA. Elderly suffering from knee OA had significantly lower perception of their quality of life most affected is the psychological and physical domains of quality of life.

Keywords: Aged, burden, factors, osteoarthritis knee, quality of life

Introduction

Osteoarthritis (OA) is an irreversible joint condition causing pain, joint stiffness, movement limitations, and disability. It is linked with ageing and likely to occur in the joints that have been repeatedly strained throughout the years. Joints most commonly affected by it are, namely, cervical and lumbosacral

spine, hip, knee, and first metatarsal phalangeal joint. OA is the most common type of arthritis.^[1]

According to 2016 Global Burden of Disease (GBD) study, musculoskeletal disorders (MSDs) were the second highest contributor to the global disability. The burden of MSDs varies by age, however, 20%–33% of people across the globe live with a painful MSDs.^[2] Among the MSDs, arthritis contributes to global disabilities burden significantly. Analysis of data from WHO study on global ageing and adult health (SAGE) points that prevalence of arthritis in low- and middle-income settings is higher.^[3] Other MSDs (including OA) have been ranked as 10th

Address for correspondence: Dr. Abhishek Jaiswal, Room No. 14, PG Room, Centre for Community Medicine, Old OT-Block, All India Institute of Medical Sciences, Ansari Nagar, New Delhi - 110 029, India. E-mail: jaiswal.aiims@gmail.com

Received: 19-07-2020

Revised: 17-09-2020

Accepted: 20-10-2020

Published: 30-01-2021

Access this article online

Quick Response Code:



Website:
www.jfmpc.com

DOI:
10.4103/jfmpc.jfmpc_1477_20

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Jaiswal A, Goswami K, Haldar P, Salve HR, Singh U. Prevalence of knee osteoarthritis, its determinants, and impact on the quality of life in elderly persons in rural Ballabgarh, Haryana. J Family Med Prim Care 2021;10:354-60.

and 11th among top causes of years lived with disabilities (YLDs) in 2017 males and females respectively and 8.34 million YLDs attributable to knee OA globally.^[4] OA is 50% of the entire MSDs. Globally among individuals aged more than 60 years, 9.6% of men and 18% of women suffer from symptomatic OA, with knee being most commonly affected joint.^[5]

The economic burden of OA has risen by three times or higher especially among individuals with Total knee replacement/Total hip replacement.^[6] In a nationally representative study conducted in India, it was reported that disorders of joint/pain were respectively the second and fourth most common causes of outpatient clinic visits and out-of-pocket expenses among all non-communicable diseases.^[7] The knee OA contributes to nearly 80% of the total OA burden globally.^[1] Though it would not cause mortality, it decreases the quality of life (QOL) by causing disability.

The burden of knee OA has been determined in several countries, however, epidemiological data among elderly in India is scarce. Also, there are limited data in India on the bearing of knee OA over the quality of life of elderly. The present study was conducted to measure the prevalence of knee OA among elderly residing in rural Ballabgarh, Haryana.

Material and Methods

A community-based cross-sectional study was conducted in the Intensive Field Practice Area (IFPA) of Comprehensive Rural Health Services Project (CRHSP), Ballabgarh of Centre for Community Medicine Department, AIIMS, between November 2015 and November 2017. Health infrastructure in area includes two primary health centers and 12 sub-centers covering 28 villages with a total population of approximately 1 lakh. Health Management Information System (HMIS) maintains the database of the population under the IFPA. Sample size was calculated by applying the equation $4PQ/d^2$ where “P” was the prevalence of knee OA taken as 30%^[8] and taking relative precision (d) and non-response rate as 15%. The final sample size was rounded off to 500. The study population included elderly resident of study-area for 6 months or more (preceding the study). The line listing of elderly residing in IFPA obtained from HMIS was used as sampling frame. Elderly in the study area were 9231 (as on 1 May 2016). Five hundred elderly were selected as study sample was taken using simple random sampling.

Operational definitions

Elderly: Elderly was defined as the person who is of age 60 years or above (as on 1 May 2016).^[9]

Knee pain: Pain in the knee joint (unilateral/bilateral) currently or within last 1 month.

Knee OA: Knee OA was defined according to American College of rheumatology (ACR) criteria^[10] as knee pain plus at least three of the following: [A] Age more than 50 years, [B]

Morning stiffness less than 30 minutes, [C] Presence of crepitus, [D] Presence of bony tenderness, [E] No palpable warmth, and [F] Presence of bony enlargement (Sensitivity 95%, Specificity 69%).^[11]

Selected elderly was visited house to house. Elderly who were bed-ridden or diagnosed with knee joint pathology other than OA were excluded from the study.

Study instruments

The self-designed semi-structured interview schedule was used which collected data on selected socio-demographic variables, knee pain, clinical examination (for diagnosing knee OA), and quality of life (WHO-QOL-BREF questionnaire). Hindi version of WHO-QOL-BREF was used. Interview schedule was translated in Hindi and back translated and compared. The interview schedule was pretested in elderly.

Ethical approval and permission for the study was taken from Institute Ethics Committee, All India Institute of Medical Sciences, New Delhi (IECPG/120/30.12.2015). Purpose of the study was explained and informed consent was taken from the participants. Patients who were found symptomatic were counseled by the investigator and treated. Seriously ill patients were referred to Physical Medicine and Rehabilitation (PMR) outpatient department specialist for further evaluation and treatment.

Statistical analysis

Data entry was done using Epi data (v2.0.7.22) software. Data were extracted into Microsoft excel as output file from Epi data. The data were cross-checked and cleaned. Statistical analysis was done using STATA 13 (StataCorp. 2011. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP). Prevalence of knee OA was reported as percentage with 95% Confidence Interval (C.I.). Categorical variables were analyzed using Chi square test/Fisher test. Non-normal continuous variable was analyzed using Mann-Whitney U test. Factors with *P* value less than 0.25 were selected for multivariate analysis. Outcome variable was OA of any knee joint. WHO-QOL-BREF questions were divided into domains and raw score was calculated for each domain which was transformed using WHO-QOL-BREF manual into 0-100 scores. Total score was also converted into 0-100 scale. Individual domains and total score were analyzed.

Result

A total of 454 (95%) elderly were interviewed and included in the study. Of them, 10 elderly (2.1%) were excluded and 13 (2.7%) were either shifted or found absent in three visits. Their age ranged from 60 to 104 years. More than half of the elderly were in 60-69 years of age. The mean age of the elderly was 69.5 years (S.D. 7.25). The majority of elderly was females (60.1%), belonged to the Hindu religion (97.1%) and had no formal schooling (64.5%). Most of elderly were

married (63.7%). Socioeconomic status was categorized using Uday Pareek scale.^[12] Almost half of the participants (49.8%) were of lower middle class of Uday Pareek scale. Farming was the predominant past occupation (40.5%). More than half (52%) of the elderly were living with family with spouse. Most of the elderly (83.7%) were not availing any health insurance. Of those availing health insurances, more than one-third (39.2%) were availing it from state health insurance. In all, 397 (87.4%) elderly were getting old age/widow pension. About two-third (69.8%) of the elderly were partially financial independent.

More than half of males (61.3%) were current smokers while females were non-smokers (57.9%). Majority never consumed chewable tobacco (96.2%) or alcohol (89.4%). Most (61.4%) had normal BMI [Table 1]. Mentioned in Table 1 out of which 16 had history of fracture involving knee joint. Family history of knee pain was present in 80 (17.6%). Almost 62% of elderly were suffering from other chronic disorders (other than knee OA), most common of which was hypertension (32.8%).

Prevalence of knee OA: Out of the 454 elderly, 298 (65.6%) reported knee pain in last 1 month preceding the date of the interview. Among them, 292 elderly had OA of at least one knee joint (64.3% C.I. 59.7-68.7). Majority (57.1% C.I. 52.5-61.6) had bilateral knee OA. Thirty-three elderly (7.3% C.I. 4.9-9.7) had unilateral knee OA.

Prevalence of knee OA was higher among females, illiterate, elderly living alone, elderly belonging to lower socioeconomic status, elderly who reported manual occupation as major past occupation, obese persons, elderly suffering from other chronic illness, elderly with history of knee trauma, and elderly with family history of knee pain [Table 1].

Prevalence of knee OA was lower among current smokers, and elderly currently doing physical activity [Table 1].

In the multivariate logistic regression model, sex, age grouping, education status, smoking usage, alcohol usage, BMI, history of other chronic illness, history of knee trauma, family history of

Table 1: Distribution of knee osteoarthritis* with socio-demographic characteristic

Characteristics (n=454)	Frequency n	Percentage %	P (Chi-square/Fischer Exact test)	
Sex	Male (n=181)	98	54.1	<0.001
	Female (n=273)	194	71.1	
Age groups (in years)	60-64 (n=130)	79	60.8	0.24 <i>P</i> _{trend} =0.12
	65-69 (n=135)	83	61.5	
	>70 (n=189)	130	68.9	
Education	Any formal education (n=161)	92	57.1	0.02
	Illiterate (n=293)	200	68.2	
Living arrangement	Living alone (n=14)	10	71.4	0.30
	Living with spouse (n=46)	25	54.4	
	Living with family (n=394)	257	65.2	
Socioeconomic status (Uday Pareek scale)	Lower (n=19)	15	79.0	0.44
	Lower middle (n=226)	143	63.3	
	Middle (n=189)	123	65.1	
	Upper middle (n=20)	11	55.0	
Smoking	Never/Past smoker (n=248)	183	73.8	<0.001
	Current smoker (n=206)	109	52.9	
Alcohol	Never/Past (n=427)	282	66.0	0.003
	Current (n=27)	10	37.0	
Financial independence	Independent (n=102)	65	63.7	0.86
	Partially dependent (n=317)	203	64.0	
	Dependent (n=35)	24	68.6	
Major past Occupation	Others (n=177)	111	62.7	0.57
	Manual (n=277)	181	65.3	
BMI	Normal (18.5-24.9) (n=279)	166	59.5	0.017 <i>ptrend</i> =0.061
	Underweight (<18.5) (n=45)	15	33.3	
	Obese (>25) (n=130)	96	73.8	
Self-reported other chronic illness	Absent (n=173)	102	59.0	0.06
	Present (n=281)	190	67.6	
History of trauma	Absent (n=387)	228	58.9	<0.001
	Present (n=67)	64	95.5	
Family history of knee pain	Absent (n=374)	225	60.2	<0.001
	Present (n=80)	67	83.8	
Currently doing exercise	No (n=243)	194	79.8	<0.001
	Yes (n=211)	98	46.4	

*Knee osteoarthritis: Osteoarthritis (any knee) was used in bivariate analysis

knee pain and physical activity were adjusted. History of knee trauma, family history of knee pain, current physical activity, and smoking status remained significantly associated with knee OA in the model (*p*-value of 0.25 was taken as cut-off for putting in multivariate analysis) [Table 2].

Quality of life: The total transformed score of WHO-QOL-BREF of elderly showed non-normal distribution (*P*-value for Shapiro-Wilk test and Shapiro-Francia test were 0.001). The total transformed score (0-100) ranged from 7.75 to 90.75 with median score of 43.75 and interquartile range (IQR) of 31.5-66. The four domains in WHO-QOL-BREF are (1) Physical (2) Psychological, (3) Social relationship, and (4) Environment. Among domain-wise scores, Physical health domain transformed score ranged from 0 to 100 with median of 38 (IQR 19-69); Psychological health domain transformed score ranged from 0 to 100 with median of 44 (IQR 25-75); Social relationship domain transformed score ranged from 0 to 81 with median of 44 (IQR 31-56); and Environmental quality of life domain transformed score ranged from 19 to 94 with median of 50 (IQR 44-69).

Figure 1 is showing the boxplot depicting the distribution of quality of life scores (Total and domain wise) by knee OA status.

The quality-of-life scores was significantly lower for elderly diagnosed with knee OA than to those without knee OA (Mann-Whitney U test, *P* value <0.001). Elderly suffering with knee OA had significantly inferior domain-wise quality-of-life scores for each of the four domains compared to those without knee OA (Mann-Whitney U test, *P* value <0.001). Regarding the domain-wise distribution of scores in elderly with and without knee OA, the maximum difference was reported in physical health (75 vs. 25) and psychological health score (81 vs. 31 [Table 3].

Discussion

The present study was conducted to estimate the burden of knee OA among rural community-dwelling elderly of Ballabgarh, Haryana and its effect on their quality of life. Sample size was calculated taking prevalence of 30% (existing literature) and relative precision of 15%.

We found that knee OA is highly prevalent (64.3%, C.I. 59.7-68.7) among elderly in rural Ballabgarh, Haryana. The prevalence is higher than the prevalence reported by other studies from rural areas.

The reported prevalence of knee OA in elderly in other studies is done in India ranged between 32% and 64%. The variability in the prevalence may be due to the heterogenous operational

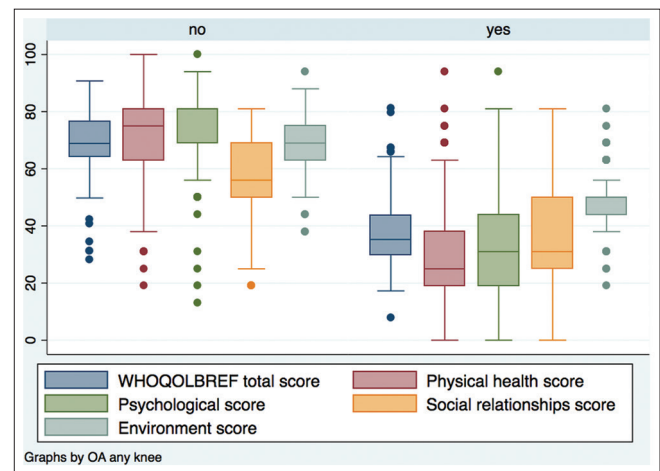


Figure 1: Boxplot showing distribution of quality of life scores by knee OA status

Table 2: Logistic regression models for factors associated with knee osteoarthritis*

Variable		Unadjusted O.R. (95% C.I.)	P	Adjusted O.R. (95% C.I.)	P
Sex	Male	Reference	-	Reference	-
	Female	2.08 (1.41-3.09)	<0.001	1.17 (0.59-2.31)	0.66
Age groups (in years)	60-64	Reference	-	Reference	-
	65-69	1.03 (0.63-1.69)	0.91	0.74 (0.41-1.34)	0.33
	>70	1.42 (0.89-2.27)	0.14	1.02 (0.59-1.76)	0.95
Education status	Any formal education	Reference	-	Reference	-
	Illiterate	0.62 (0.42-0.92)	0.02	1.08 (0.55-2.11)	0.82
BMI	Normal (18.5-24.9)	Reference	-	Reference	-
	Underweight (<18.5)	1.36 (0.70-2.64)	0.36	0.72 (0.34-1.54)	0.40
	Obese (>25)	1.92 (1.22-3.04)	0.005	1.46 (0.85-2.51)	0.17
History of other chronic illness		1.43 (0.98-2.15)	0.06	1.29 (0.81-2.06)	0.28
Alcohol	Never/Past	Reference	-	Reference	-
	Current	0.30 (0.14-0.68)	0.003	0.36 (0.13-1.00)	0.05
Smoking	Never/Past smoker	Reference	-	Reference	-
	Current smoker	0.40 (0.27-0.59)	<0.001	0.49 (0.31-0.78)	0.003
History of knee trauma		14.88 (4.59-48.19)	<0.001	14.45 (4.30-48.58)	<0.001
Family history of knee pain		3.41 (1.82-6.40)	<0.001	2.66 (1.34-5.29)	0.005
Current physical activity		0.22 (0.14-0.34)	<0.001	0.27 (0.17-0.43)	<0.001

*Osteoarthritis knee: Osteoarthritis (any knee) was used in multivariate analysis, adjusting for sex, age, education status, smoking usage, alcohol usage, BMI, history of other chronic illness, history of trauma, family history of knee pain, and physical activity. *P*=0.25 was taken as cut-off for putting in multivariate analysis

Table 3: Distribution of domain-wise WHO-QOL-BREF score by knee OA status

WHO-QOL-BREF (n=454)	With knee OA (n=292) Median (IQR)	Without knee OA (n=162) Median (IQR)	Mann-Whitney U test P
Physical health score (0-100)	25 (19-38)	75 (63-81)	<0.001
Psychological score (0-100)	31 (19-44)	81 (69-81)	<0.001
Social relationships score (0-100)	31 (25-50)	56 (50-69)	<0.001
Environment score (0-100)	50 (44-50)	69 (63-75)	<0.001
Total score (0-100)	35.2 (29.8-43.6)	68.9 (64.2-76.5)	<0.001

definition of knee OA among studies, different age groups of participants and geographical differences.

Salve H *et al.* reported burden of knee OA as 64% in elderly age group, which is similar to present study.^[13] Though the study was done among peri-menopausal women of age group of 40 years and above and reported an overall prevalence of knee OA as 47.3% (C.I. 41.2-53.4) in urban slum in Delhi using ACR criteria. Ajit N *et al.* reported burden of knee OA as 54.1% in rural Bangalore in the elderly using modified clinical ACR criteria.^[14] Though this study was not specifically among elderly and elderly comprised only about 16% (60) of subjects. Venkatachalam J *et al.* found burden of knee OA as 52% in rural Kanchipuram district, Tamil Nadu using ACR criteria in individuals of age 50 years and above, though the study was not focused on elderly.^[15] The difference could be because of difference in age groups: 50 years and above compared with 60 years and above in the present study. Singh A K *et al.* reported prevalence of 41.1% (C.I. 36.7-45.6) in urban slums in Delhi in elderly using ACR criteria, the difference being study area, the present study being rural.^[16] Also, the age distribution was towards younger side than present study. That could be the cause of finding higher burden in present study.

Pal C P *et al.* did a multi-centric study in 40 years and above age group and reported the prevalence of knee OA as 44.6% in elderly age group and 54.1% in more than 70 years of age group.^[17] They used radiographic criteria. The difference may be due to the diagnostic criteria for knee OA.

Out of all the independent variables, variables significantly associated with knee OA in multivariate analysis were history of knee trauma (OR 14.45 C.I. 4.30-48.58), and family history of knee pain (OR 2.66 C.I. 1.34-5.29). This is similar to the findings of the previous studies. Sasidharan M K *et al.* reported history of injury as a risk factor of knee OA with a OR of 17.2.^[18] Ajit N E *et al.* also reported prior knee trauma as a risk factor for OA with OR 5.2 (2.6-10.1).^[14] Lau E C *et al.* found positive association between history of joint injury and knee OA with OR of 12.1 (3.4-42.5) in men and 7.6 (3.8-15.2) in women.^[19] Felson *et al.* reported trauma as a risk factor for OA.^[20]

Sasidharan M K *et al.* reported family history of OA as a risk factor for knee OA (OR of 4.0, P value <0.03).^[18] Family studies from early sixties have shown the first degree relatives at increased risk of OA. Bijkerk C *et al.* reported strong association between OA and genetics.^[21] Genetic pathway has been implicated in OA.^[22]

Current smoking status (OR 0.49 C.I. 0.31-0.78), and current physical activity (OR 0.27 C.I. 0.17-0.43) were found to be protective for knee OA.

Kim I *et al.* also reported protective effect of exercise on knee OA, with OR of 0.59 and 0.81 for radiographic and symptomatic knee OA, respectively.^[23] Exercise is supposed to increase the muscle strength, which is protective against the daily wear and tear on joints. It is logical to think individuals not suffering from knee OA would exercise while those suffering from knee OA would not for fear of pain. Temporality of the association could not be established in current study being cross-sectional.

There are disagreements in the outcomes of different studies on the association between knee OA and tobacco smoking. Some studies have shown that smoking is associated with cartilage loss which later can lead to OA. Other studies inferred protective role of tobacco smoking on OA. Lau E C *et al.* reported smokers and ex-smokers have lower prevalence of knee OA compared to non-smokers, with OR of 0.2 (0.1-0.5) and 0.7 (0.4-1.2) for male smokers and female smokers respectively.^[19] Zhang Y *et al.* reported similar findings.^[24] Kwon H M *et al.* also reported current tobacco smoking as preventive factor for knee OA among Korean adults.^[25] It was demonstrated by Gullahorn *et al.* that nicotine up-regulates collagen and glycosaminoglycan synthetic functions of joint chondrocytes at biological levels in smokers.^[26]

There was a significant difference in quality of life of elderly suffering from knee OA than those who were not suffering from it. This difference was significant in all of the domains of quality of life (namely: physical, psychological, social, and environment). Kawano M M *et al.* reported that persons with OA had lower quality of life compared to those without OA.^[27] Riddle D L *et al.* also reported that persons suffering from OA had perceived their quality of life as low in functional capacity domain, functional limitation domain, and pain domains.^[28]

Strengths

Random sample obtained from robust sampling frame of HMIS, Ballabgarh, which has line listing of population under IFPA and is regularly updated. The response rate was high (95%). Assessment of knee OA was using clinical ACR criteria (95% sensitivity), which comprises clinical examination of knee, for which investigator was trained to ensure quality and standard in the study. Pre-validated tool was used for measurement of quality of life (WHO-QOL-BREF). Data collection was done by single investigator, so chance of

inter-observer variation is none. Relation between knee OA and quality of life and other associated factors were also assessed.

Limitation

Females were comparatively higher in the present study sample (60.1% females) compared to the study population (53% of females) from HMIS (year 2015) and SRS 2015 (52.1% females). Although after gender standardization, the prevalence came 63% that is almost similar to the finding. Information on knee trauma, family history of knee pain, etc., were self-reported and therefore could attract recall bias. Self-reported status for knee pain, morbidities, and so on was taken which can result in over/underestimation. Quality of life can be affected by factors other than knee OA alone. Other weight bearing OA as hip OA was not included which can also have effect on the quality of life and physical function. Current study being cross-sectional, temporality in association was not feasible.

Conclusion

Burden of knee OA was high (64.3%) among the elderly population of rural Ballabgarh, Haryana. Elderly currently doing physical activity (OR 0.27, *P* value <0.001), and those who were current smokers (OR 0.49, *P* value 0.003) were having significantly lower proportion of knee OA; whereas prevalence of knee OA was significantly higher among elderly with history of knee trauma (OR 14.45, *P* value <0.001) and family history of knee pain (OR 2.66, *P* value 0.005). No significant association was found for sex, age, education, BMI, other chronic illness and alcohol. Individuals with knee OA had lower quality of life. The maximum effect of knee OA was on the physical and psychological domain of quality of life, though social and environmental domains were also significantly lower.

Recommendation

Knee OA is an important health problem in the elderly affecting more than 60% of the elderly person and should be emphasized in the national program for health care of elderly. Since knee OA significantly lowers QOL, we can improve the quality of life years added to life by addressing knee OA. Primary care physician being point of first contact can be utilized for early identification of individuals with knee OA by training them in using ACR criteria as done in present study, and thereby, helping in early treatment and management of the individuals with knee OA. Moreover, health workers at grass-root level can also be trained to diagnose knee OA in the community using ACR criteria helping in decreasing the social burden of knee OA in the community.

Acknowledgement

None

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. The patients understand that their names and

initials will not be published and due efforts will be made to conceal their identity.

Financial support and sponsorship

None

Conflicts of interest

There are no conflicts of interest.

References

1. World Health Organisation. Chronic rheumatic conditions. WHO [Internet]. Available from: <http://www.who.int/chp/topics/rheumatic/en/>. [Cited on 2019 Feb 7].
2. GBD 2016 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990-2016: A systematic analysis for the Global Burden of Disease Study 2016. *Lancet LondEngl* 2017;390:1211-59.
3. Brennan-Olsen SL, Cook S, Leech MT, Bowe SJ, Kowal P, Naidoo N, *et al.* Prevalence of arthritis according to age, sex and socioeconomic status in six low and middle income countries: Analysis of data from the World Health Organization study on global AGEing and adult health (SAGE) Wave 1. *BMC MusculoskeletDisord* 2017;18:271.
4. James SL, Abate D, Abate KH, Abay SM, Abbafati C, Abbasi N, *et al.* Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: A systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2018;392:1789-858.
5. Cross M, Smith E, Hoy D, Nolte S, Ackerman I, Fransen M, *et al.* The global burden of hip and knee osteoarthritis: Estimates from the global burden of disease 2010 study. *Ann Rheum Dis* 2014;73:1323-30.
6. Xie F, Thumboo J, Fong K-Y, Lo N-N, Yeo S-J, Yang K-Y, *et al.* Direct and indirect costs of osteoarthritis in Singapore: A comparative study among multiethnic Asian patients with osteoarthritis. *J Rheumatol* 2007;34:165-71.
7. Mahal A, Karan A, Engelgau M. The Economic Implications of Non-Communicable Disease for India. HNP Discussion Paper series, The World Bank. Available from: <http://siteresources.worldbank.org/HEALTHNUTRITIONANDPOPULATION/Resources/281627-1095698140167/EconomicImplicationsofNCDforIndia.pdf>. [Last accessed on 2019 Mar 15].
8. Joshi K, Kumar R, Avasthi A. Morbidity profile and its relationship with disability and psychological distress among elderly people in Northern India. *Int J Epidemiol* 2003;32:978-87.
9. Operational guidelines, National programme for health care of the elderly (NPHCE), Directorate general of health services ministry of health & family welfare government of India, 2011. [Internet]. Available from: https://mohfw.gov.in/sites/default/files/8324324521Operational_Guidelines_NPHCE_final.pdf. [Cited on 2018 May 10].
10. Altman R, Asch E, Bloch D, Bole G, Borenstein D, Brandt K, *et al.* Development of criteria for the classification and reporting of osteoarthritis. Classification of osteoarthritis

- of the knee. Diagnostic and Therapeutic Criteria Committee of the American Rheumatism Association. *Arthritis Rheum* 1986;29:1039-49.
11. Jackson JL, O'Malley PG, Kroenke K. Evaluation of acute knee pain in primary care. *Ann Intern Med* 2003;139:575-88.
 12. Singh T, Sharma S, Nagesh S. Socio-economic status scales updated for 2017. *Int J Res Med Sci* 2017;5:3264-7.
 13. Salve H, Gupta V, Palanivel C, Yadav K, Singh B. Prevalence of knee osteoarthritis amongst perimenopausal women in an urban resettlement colony in South Delhi. *Indian J Public Health* 2010;54:155-7.
 14. Ajit NE, B N, Fernandes RJ, Roga G, Kasthuri A, Shanbhag D, *et al.* Prevalence of knee osteoarthritis in rural areas of Bangalore urban district. *Internet J RheumatolClinImmunol* [Internet] 2014;1(S1). Available from: <https://www.chanrejournals.com/index.php/rheumatology/article/view/49>. [Cited on 2019 Feb 7].
 15. Venkatachalam J, Natesan M, Eswaran M, Johnson AKS, Bharath V, Singh Z. Prevalence of osteoarthritis of knee joint among adult population in a rural area of Kanchipuram District, Tamil Nadu. *Indian J Public Health* 2018;62:117-22.
 16. Singh AK, Kalaivani M, Krishnan A, Aggarwal PK, Gupta SK. Prevalence of osteoarthritis of knee among elderly persons in urban slums using American College of Rheumatology (ACR) Criteria. *J Clin Diagn Res JCDR* 2014;8:JC09-11.
 17. Pal CP, Singh P, Chaturvedi S, Pruthi KK, Vij A. Epidemiology of knee osteoarthritis in India and related factors. *Indian J Orthop* 2016;50:518-22.
 18. Sasidharan MK, Pappu AK, Devakumar I, Vikram K, Surendran M, Jayasree JT. Risk factors of osteoarthritis - A hospital based case control study. *Acad Med J India* 2014;2:49-51.
 19. Lau EC, Cooper C, Lam D, Chan VN, Tsang KK, Sham A. Factors associated with osteoarthritis of the hip and knee in Hong Kong Chinese: Obesity, joint injury, and occupational activities. *Am J Epidemiol* 2000;152:855-62.
 20. Felson DT. Weight and osteoarthritis. *Am J Clin Nutr* 1996;63 (3 Suppl):430S-2S.
 21. Bijkerk C, Houwing-Duistermaat JJ, Valkenburg HA, Meulenbelt I, Hofman A, Breedveld FC, *et al.* Heritabilities of radiologic osteoarthritis in peripheral joints and of disc degeneration of the spine. *Arthritis Rheum* 1999;42:1729-35.
 22. Valdes AM, Spector TD. The clinical relevance of genetic susceptibility to osteoarthritis. *Best Pract Res Clin Rheumatol* 2010;24:3-14.
 23. Kim I, Kim HA, Seo Y-I, Song YW, Jeong J-Y, Kim DH. The prevalence of knee osteoarthritis in elderly community residents in Korea. *J Korean Med Sci* 2010;25:293-8.
 24. Zhang Y, Zeng C, Li H, Yang T, Deng Z-H, Yang Y, *et al.* Relationship between cigarette smoking and radiographic knee osteoarthritis in Chinese population: A cross-sectional study. *RheumatolInt* 2015;35:1211-7.
 25. Kwon HM, Yang I-H, Park KK, Cho B-W, Byun J, Lee W-S. Cigarette smoking and knee osteoarthritis in the elderly: Data from the Korean National Health and Nutritional Examination Survey. *ExpGerontol* 2020;133:110873.
 26. Gullahorn L, Lippiello L, Karpman R. Smoking and osteoarthritis: Differential effect of nicotine on human chondrocyte glycosaminoglycan and collagen synthesis. *Osteoarthritis Cartilage* 2005;13:942-3.
 27. Kawano MM, Araújo ILA, Castro MC, Matos MA. Assessment of quality of life in patients with knee osteoarthritis. *Acta Ortop Bras* 2015;23:307-10.
 28. Riddle DL, Stratford PW. Body weight changes and corresponding changes in pain and function in persons with symptomatic knee osteoarthritis: A cohort study. *Arthritis Care Res* 2013;65:15-22.