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Prevalence and correlates of arthritis in Indian older adults: Findings from the Longitudinal Aging Study of India

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Abstract--There are no estimates of arthritis in older adults from a nationally representative population in India and this is a major gap in evidence for effective policy making. Therefore, this study was planned to use secondary data available from the Longitudinal Aging Study of India (LASI) to estimate the prevalence of arthritis and study its risk factors in older adults from India. We used data from the first wave of LASI, a national and state-level study of aging and health in India. Weighted prevalence with 95% confidence intervals (CI) for Arthritis was estimated in different age groups. We built unadjusted and adjusted logistic regression models for identifying the risk factors associated with arthritis. We also evaluated the relationship between functional dependence and arthritis using a multivariable regression model. Overall, 9.36% of the Indian population aged 45 years or above had Arthritis. The prevalence was 7.49% and 11.03% in males and females respectively. Females are more at risk for arthritis as compared to males with an odds ratio of 1.59 (95% CI: 1.50, 1.69). Age also was a significant risk factor with an adjusted odd ratio of 1.41 (95% CI: 1.31, 1.52). Overweight and obesity was associated with an increased risks with AOR of 1.86 (95% CI: 1.68, 2.07), and 2.48 (95% CI: 2.19, 2.81), respectively. Diabetic people had a 1.54 (95% CI: 1.43, 1.67) higher risk of arthritis than non-diabetic people. Physical dependence was more common among arthritis patients, but the risk

was reduced in age-gender adjusted models to 1.13 (95% CI: 1.02, 1.25) compared to unadjusted models at 1.56 (95% CI: 1.05, 1.28). We found that arthritis is a major concern in older. Urban residents, better economic status, female gender, increasing age, obesity, and diabetes were associated with an increased risk of arthritis among those aged over 45 years. Arthritis is also independently and significantly associated with a decreased functional ability in older adults.

Keywords---Arthritis, LASI, older adults, Osteoarthritis, prevalence.

Background

Arthritis is a general term used for disorders of joints and connective tissue around them. While there are over 100 types of arthritis, osteoarthritis is the most common form, which is a degenerative disease occurring frequently in the hands, hips, and knees. (1) This type of arthritis is characterized by pain, stiffness, decreased flexibility, and swelling. (2) While evidence on burden is not uniformly available from across the world, over a third of the American population has been found to have arthritis on imaging. (3) It has been estimated that between 19% to 30% of adults aged above 45 years have osteoarthritis of the knee while 27% have osteoarthritis of the hand and hip each. Around 40% of men and 47% of women will have osteoarthritis in their life. (3) The pooled prevalence of osteoarthritis has been found lower, but still significant, in low-middle income countries at 16%. (4)

Outcomes of arthritis are varied in the spectrum depending on multiple risk factors. Apart from physical limitations, the associated pain and deformity lead to functional dependence and poor quality of life among patients with arthritis. Age is another major factor that influences the adverse outcomes associated with arthritis. Other risk factors such as past trauma, occupation, exercise, gender and ethnicity, obesity, and diet also play crucial roles in the pathophysiology and natural history of arthritis. (5)

While in systematic reviews, only 34 studies were identified from the entire block of low and middle-income countries that summarized the estimates of osteoarthritis, very few studies have reported directly the prevalence in India. (4,6) Government of India has recognized osteoarthritis as a major public health challenge affecting between 22-39% of the population. (7) Although studies on multimorbidity in localized populations have estimated the prevalence of arthritis in India previously, these are few and do not explore the risk factors associated. (8) There are no estimates of arthritis in older adults from a nationally representative population in India and this is a major gap in evidence for effective policy making. Therefore, this study was planned to use secondary data available from the Longitudinal Aging Study of India to estimate the prevalence of arthritis and study its risk factors in older adults from India.

Methodology

Data

We used data from the first wave of the Longitudinal Ageing Study in India (LASI), a national and state-level study of aging and health in India. LASI is the world's largest and India's only facility of its kind. Its main goal is to collect real, reliable, and continuing scientific data on the health, social, mental, and economic well-being of India's older adults. The Government of India's Ministry of Health and Family Welfare (MoHFW) oversees LASI. The International Institute for Population Sciences (IIPS) in Mumbai is the focal institution for implementing LASI in partnership with the Harvard T.H.Chan School of Public Health (HSPH) and the University of Southern California (USC). A nationally representative multi-stage Stratified Cluster Sample of people was included in the study's initial wave. Individuals aged 45 years or older (n= 59764) were considered in this research study.

Variables & Statistical Analysis

The outcome variable analyzed, arthritis (Yes/No), defined as individuals who had been diagnosed with arthritis by any health expert (self-reported). Physical dependency is also considered as an outcome variable. Other variables retrieved include Gender (male & female), Age with three categories (45 – 54 years, 55 – 64 years, 65 or more years), Place of residence (Rural & Urban), Religion (Hindu, Christian, Muslim & Others), Level of education with four groups (No education, Up to primary, Middle school completed & Higher secondary and above), Occupation (Currently working or not), Wealth status (Poor, Middle & Rich), Marital Status (Currently married or not), Physical activity (Physically active or not); its defined by those who were engaged in moderate physical activity (at least 150 minutes throughout the week) or vigorous physical activity (at least 75 minutes throughout the week). Diabetes (Yes/No); those who were diagnosed by health professionals – self-reported, Body Mass Index (BMI); was calculated by measured weight (Kg)/squared measured height (meters) and classified by underweight (18.5 or less), normal (18.5 – 24.9), overweight (25.0 – 29.9) and obese (30.0 or more), waist circumference (less than 0.85m & 0.58 m or more), Smoking status (Yes/No) & 12) Alcohol consumption (Yes/No).

In our descriptive analysis, weighted prevalence and 95 percent confidence intervals (CI) of Arthritis were estimated in different age groups using all demographic, social, and health status variables. We calculated the odds ratio with 95 percent confidence intervals using unadjusted and adjusted logistic regression models for the arthritis outcome variable. Gender, age, wealth status, physical activity, diabetes, BMI, cigarette status, and alcohol intake were all included in the unadjusted regression analysis. The multivariate logistic regression analysis includes the factors that had a statistically significant correlation with arthritis. The outcome variable physical dependence was then subjected to unadjusted, age-gender adjusted, and fully adjusted regression analysis. Statistical analyses were performed using R Software (V.4.1.2)

Results

Overall, 9.36% of the Indian population aged 45 years or above had Arthritis. The prevalence was 7.49% and 11.03% in males and females respectively as shown in figure-1.

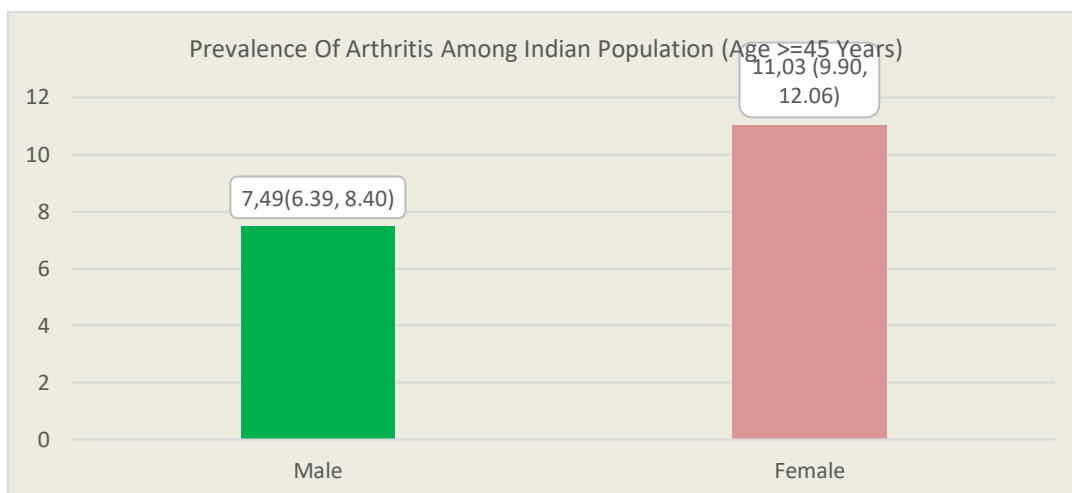


Figure 1. Prevalence of Arthritis among Indian population (age >=45 years old)

An increasing trend of prevalence was seen in both genders with an increase in age. Individuals who identified themselves as urban residents, currently not working, relatively well-off economically, and currently not married had a higher prevalence of Arthritis as shown in table 1. Arthritis was also more prevalent among individuals with diabetes and those with increased waist circumference or obesity. Lifestyle factors such as smoking, and alcohol were less likely to be associated with arthritis.

Table 1: Prevalence of Arthritis and its correlates among Indian population with age >=45 years old

Variables	Age group (in years)			
	45 - 54	55 - 64	65 & above	Total
Gender				
Male	4.76 (4.04, 5.48)	8.38 (5.33, 11.43)	9.02 (8.17, 9.87)	7.39 (6.39, 8.40)
Female	8.23 (7.26, 9.21)	10.31 (9.24, 11.39)	14.64 (11.55, 17.73)	11.06 (9.90, 12.15)
Residence				
Rural	6.64 (5.96, 7.31)	8.64 (7.86, 9.43)	10.47 (9.61, 11.32)	8.61 (8.13, 9.09)
Urban	6.80 (5.39, 8.21)	11.41 (6.72, 16.11)	15.53 (10.22, 20.88)	11.10 (8.88, 13.33)
Religion				
Hindu	6.63 (5.90, 7.36)	9.50 (7.72, 11.28)	12.20 (10.15, 14.25)	9.44 (8.54, 10.36)

Muslim	8.00 (6.45, 9.55)	9.17 (7.43, 10.90)	12.52 (10.36, 14.68)	9.91 (8.75, 11.06)
Christian	5.30 (2.45, 8.15)	8.63 (5.96, 11.30)	10.54 (7.31, 13.77)	8.01 (6.07, 9.96)
Others	5.25 (1.90, 8.60)	9.76 (5.63, 13.89)	5.97 (3.19, 8.75)	6.76 (4.81, 8.72)
Level of education				
No Education	7.12 (6.05, 8.20)	8.44 (7.54, 9.34)	10.95 (9.97, 11.92)	9.07 (8.47, 9.66)
Up to primary	7.30 (6.22, 8.38)	9.51 (8.20, 10.82)	11.61 (10.15, 13.08)	9.44 (8.68, 10.19)
Middle school completed	6.14 (4.72, 7.56)	9.23 (7.08, 11.39)	18.72 (1.4, 36.04)	10.17 (5.40, 14.95)
Higher secondary and above	5.48 (4.11, 6.86)	12.60 (4.60, 20.60)	13.95 (5.46, 22.45)	9.73 (6.51, 12.96)
Occupation				
Currently working	6.18 (5.34, 7.02)	8.91 (6.22, 11.59)	8.20 (7.07, 9.35)	7.47 (6.45, 8.49)
Not working	9.99 (7.64, 12.34)	10.68 (9.25, 12.11)	11.68 (10.67, 12.69)	11.21 (10.42, 12.00)
Wealth				
Poor	6.05 (5.10, 7.00)	7.82 (6.82, 8.82)	10.54 (9.43, 11.62)	8.18 (7.55, 8.81)
Middle	7.06 (5.18, 8.93)	8.90 (7.47, 10.32)	10.99 (9.44, 12.54)	9.00 (8.02, 9.98)
Rich	7.19 (6.31, 8.07)	11.62 (7.92, 15.32)	14.18 (9.81, 18.55)	10.91 (9.03, 12.79)
Marital Status				
Currently married	6.34 (5.75, 6.94)	9.50 (7.67, 11.34)	10.24 (9.26, 11.23)	8.41 (7.68, 9.13)
Never married/Widowed/Divorced/separated	8.91 (6.04, 11.77)	9.22 (7.86, 10.59)	14.08 (10.50, 17.67)	12.04 (9.79, 14.28)
Physical activity				
Physically active	6.57 (5.59, 7.56)	7.71 (6.80, 8.62)	11.80 (6.87, 16.74)	8.09 (6.84, 9.35)
Physically not active	5.50 (4.17, 6.82)	13.45 (3.49, 23.41)	7.99 (6.13, 9.86)	8.74 (5.22, 12.27)
Physically dependent				
Yes	11.29 (7.95, 14.62)	14.02 (10.74, 17.30)	19.26 (11.77, 26.74)	17.02 (12.01, 22.03)
No	11.88 (10.30, 13.45)	12.23 (10.79, 13.67)	14.15 (11.28, 17.02)	13.01 (11.55, 14.46)
Diabetes				
Yes	8.87 (6.88, 10.86)	11.75 (8.76, 14.74)	20.27 (10.46, 30.09)	14.73 (10.11, 19.35)
No	6.50 (5.82, 7.17)	9.10 (7.44, 10.52)	10.52 (9.74, 11.30)	8.64 (8.00, 9.27)

		10.76)	13.30)	
BMI				
Underweight (<18.5)	3.86 (2.81, 4.90)	6.18 (4.83, 7.53)	8.04 (6.66, 9.42)	6.55 (5.67, 7.43)
Normal (18.5 – 24.9)	6.01 (5.29, 6.74)	8.84 (6.30, 11.39)	10.34 (9.40, 11.29)	8.37 (7.48, 9.25)
Overweight (25.0 – 29.9)	8.55 (6.78, 10.32)	10.57 (9.15, 12.00)	18.60 (11.47, 25.73)	11.81 (9.86, 13.76)
Obese (30 & above)	9.83 (7.68, 11.97)	18.16 (12.88, 23.43)	26.86 (7.35, 46.38)	16.84 (11.00, 22.68)
Waist Circumference				
Normal (<0.85)	4.97 (4.34, 5.60)	6.79 (6.00, 7.57)	9.00 (8.07, 9.33)	7.02 (6.52, 7.52)
Increased (>=0.85)	8.35 (7.26, 9.44)	12.12 (9.31, 14.93)	15.44 (11.78, 19.09)	11.76 (10.33, 13.20)
Tobacco				
Yes	4.77 (3.71, 5.82)	7.12 (5.87, 8.37)	9.29 (7.87, 10.71)	6.97 (6.25, 7.68)
No	7.06 (6.32, 7.79)	9.87 (8.13, 11.61)	12.34 (10.35, 14.33)	9.78 (8.89, 10.66)
Alcohol				
Yes	5.13 (4.36, 5.90)	8.10 (7.09, 9.11)	10.13 (9.11, 11.14)	7.94 (7.37, 8.50)
No	7.50 (6.62, 8.38)	10.27 (7.95, 12.60)	13.14 (10.36, 15.92)	10.20 (9.05, 11.36)

The unadjusted and adjusted logistic regression findings are shown in Table 2. The results found that females are more at risk for arthritis as compared to males with an odds ratio of 1.59 (95% CI: 1.50, 1.69). Age also was a significant risk factor with odds ranging from 1.41 (95% CI: 1.31, 1.52) to 1.73 (95 % CI: 1.61, 1.86) in the uncorrected model. Similarly, the unadjusted and adjusted wealth index models showed the same trend, with ORs ranging from 1.09 (95% CI: 1.01, 1.18) to 1.24 (95% CI: 1.16, 1.33). In the normal, overweight, and obese groups, the elevated risks were 1.25 (95 percent CI: 1.33, 1.38), 1.86 (95 percent CI: 1.68, 2.07), and 2.48 (95 percent CI: 2.19, 2.81), respectively. Diabetic people had a 1.54 (95% CI: 1.43, 1.67) higher risk of arthritis than non-diabetic people. Physical activity was not found to have any statistically significant association in the unadjusted model. In an unadjusted model, smoking status and alcohol use were associated with a lower risk of arthritis, however, odds were raised following adjustment of the model with a non-statistically significant relation.

Table 2. Un-adjusted & Adjusted logistic regression results of Arthritis with different risk factors among the Indian population with age >=45 years old

Variables	Un-adjusted OR (95% CI)	Adjusted OR (95% CI)
Gender		
Male	1	1
Female	1.59 (1.50, 1.69)	1.58 (1.47, 1.69)
Age (in years)		
45 – 54	1	1

55– 64	1.41 (1.31, 1.52)	1.43 (1.32, 1.54)
65 & above	1.73 (1.61, 1.86)	1.89 (1.75, 2.03)
Wealth		
Poor	1	1
Middle	1.09 (1.01, 1.18)	1.05 (0.96, 1.14)
Rich	1.24 (1.16, 1.33)	1.13 (1.06, 1.21)
Physical activity		
Physically active	1	
Physically not active	0.96 (0.86, 1.07)	
Diabetes		
No	1	1
Yes	1.54 (1.43, 1.67)	1.26 (1.16, 1.36)
BMI		
Underweight (<18.5)	1	1
Normal (18.5 – 24.9)	1.25 (1.33, 1.38)	1.33 (1.21, 1.47)
Overweight (25.0 – 29.9)	1.86 (1.68, 2.07)	1.93 (1.73, 2.15)
Obese (30 & above)	2.48 (2.19, 2.81)	2.43 (2.13, 2.77)
Tobacco		
No	1	1
Yes	0.77 (0.71, 0.83)	1.06 (0.96, 1.16)
Alcohol		
No	1	1
Yes	0.79 (0.74, 0.84)	1.04 (0.97, 1.17)

Physical dependence was more common among arthritis patients, but the risk was reduced in age-gender adjusted models to 1.13 (95% CI: 1.02, 1.25) compared to unadjusted models at 1.56 (95% CI: 1.05, 1.28) as shown in table-3.

Table 3. Unadjusted, Age – Gender Adjusted & Fully Adjusted regression analysis of physical dependence with Arthritis and other covariates among Indian population with age >=45 years old

Variables	Unadjusted OR (95% CI)	Age – Gender Adjusted OR (95% CI)	Fully adjusted OR (95% CI)
Arthritis			
No	1	1	1
Yes	1.56 (1.05, 1.28)	1.13 (1.02, 1.25)	1.12 (1.01, 1.24)
Wealth			
Poor	1	1	1
Middle	1.07 (0.97, 1.17)	1.06 (0.97, 1.17)	1.07 (0.95, 1.18)
Rich	1.13 (1.15, 1.22)	1.15 (1.06, 1.24)	1.15 (1.06, 1.25)
Physical activity			
Physically active	1		

Physically active	not	1.04 (0.90, 1.21)		
Diabetes				
No		1	1	1
Yes		1.37 (1.26, 1.51)	1.31 (1.20, 1.44)	1.31 (1.18, 1.44)
BMI				
Underweight (<18.5)		1	1	1
Normal (18.5 – 24.9)		0.85 (0.77, 0.93)	0.91 (0.84, 1.01)	0.90 (0.82, 0.98)
Overweight (25.0 – 29.9)		0.73 (0.65, 0.82)	0.82 (0.73, 0.93)	0.77 (0.68, 0.87)
Obese (30 & above)		1.00 (0.87, 1.16)	1.17 (1.01, 1.36)	1.08 (0.92, 1.26)
Tobacco				
No		1		
Yes		0.97 (0.88, 1.06)		
Alcohol				
No		1	1	1
Yes		1.15 (1.07, 1.24)	1.16 (1.08, 1.25)	1.20 (1.18, 1.44)

Discussion

This study used secondary data from around 60000 older Indians to assess the prevalence and associated risk factors of osteoarthritis among them. This is one of largest samples of adults over 45 years of age that have been analyzed for this objective from India, where previous data have been from localized small studies lacking generalizability to the large and diverse nation.

We found that the prevalence of arthritis in the Indian population over the age of 45 years was around 9%. This was significantly lower than some cross sectional surveys in localized populations across India that reported a prevalence between 20% and 40%. (6,9–11) This is also lower than Government of India estimates of a prevalence between 22-39%. (7) Moreover, international estimates have also found a consistently higher prevalence of arthritis in older adults. While a study from Iran found around 20% prevalence, another from the Framingham cohort found a prevalence of over 30% in similar age groups. (12,13) This difference is possibly linked to the self-reporting nature of the diagnoses of arthritis that has been relied on in the LASI study as compared to either syndromic and/or radiographic investigations used by others.

In our study we found a significantly higher prevalence of arthritis among females (11%) as compared to males (7%). While it has been established that females are at a higher risk of arthritis, the difference has been variable in different studies. Different studies have shown a higher prevalence in women as compared to men by a small margin to as much as twice higher margins. (4,6,11–13) While, below the age of 50 years, men have a greater prevalence as well as incidence as

compared to women, but this trend is reversed once the age is over 50 years and again becomes less marked over the age of 80. (5) A possible mechanism could be withdrawal from estrogen due to menopause. (5) In our study we found that females were at a 1.5 times higher risk of developing arthritis as compared to males, when adjusted for age.

We also found an increasing trend of prevalence with age of the participant irrespective of the gender. This is on expected lines and has been reported by other authors previously across settings from both India and elsewhere. (4,6,10,12,13) Age is one of the most, if not the most important risk factor associated with arthritis. Normal ageing process leads to increased laxity around joints and other patho-physiological changes that lead to a higher risk of osteoarthritis. (5) The Framingham Study has reported that prevalence of arthritis of the knee increased from 27% among those aged 63 to 70 years to 44% among those over 80 years of age. (13)

In our study we have found that individuals who live in urban regions, those who are currently not working, or were relatively well off economically had a higher prevalence of Arthritis. We also found that arthritis is more prevalent among individuals with diabetes and those with increased waist circumference and obesity. There have been reports that obesity increases the risk of osteoarthritis of knee and to a lesser extent osteoarthritis of the hip and hand. (14) Similarly, there is previous evidence that diabetes is associated with osteoarthritis. (15) Cohort studies have shown that type-2 diabetes is a significant predictor of severe osteoarthritis which is independent of age and BMI. (16) Our findings corroborate this concept that there is a strong metabolic component linked to the pathogenesis of osteoarthritis. Interestingly, our study found a negative association between smoking, and alcohol consumption with arthritis. There have been previous reports that suggested that smokers have a lower prevalence of osteoarthritis as compared to nonsmokers. (17) In our study, this may be possibly due to the under reporting of such behavioral factors as these are associated with social taboo in the Indian population. This topic needs further exploration.

In our study, physical dependence was more common among arthritis patients. But this risk was reduced in age-gender adjusted models compared to unadjusted models. It is intuitive that arthritis would lead to limitations in mobility and activity which in turn leads to dependence of function. A range of different study designs have proved an unequivocal role of osteoarthritis in functional limitations and disability. (18)

While the large sample size and comprehensive assessment of risk factors are key strengths of our study, it still has some limitations. The study relied on a self-reported measure of arthritis and hence may lead to under reporting of findings. Being observational in nature, cause and effect interpretations could not be made in the present study.

In conclusion, we found that arthritis is a major concern in older Indians with a community-based prevalence of around 9%. Urban residents, better economic status, female gender, increasing age, obesity and diabetes were associated with an increased risk of arthritis among those aged over 45 years. Arthritis is also

independently and significantly associated with a decreased functional ability in older adults.

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