Ahmad Dahlan Medical Journal
VOL 6, No. 1, 18-28
http:// http://journal2.uad.ac.id/index.php/admj

Article

Characteristics of Osteoarthritis Patients at PKU Muhammadiyah Bantul Hospital in 2024

[1,2]Elvina Prisila, [1,2]Novi Wijayanti Sukirto, [1,3]Andika Ilham Rahmatullah, Adinda Pirman Abdul Aziz, Rheycado Arrafi Pratama, Salsabila Chairunnisa Ramadhani, [1]Dewi Yuniasih*

Email (Corresponding Author) : * dewi.yuniasih@med.uad.ac.id
[1]Faculty of Medicine, Universitas Ahmad Dahlan, Yogyakarta, Indonesia
[2]Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia
[3]PKU Muhammadiyah Hospital of Bantul, Yogyakarta, Indonesia
[4]PKU Muhammadiyah Hospital of Yogyakarta, Yogyakarta, Indonesia
[5]Puskesmas Dlingo II Bantul, Yogyakarta, Indonesia

ARTICLE INFO

Article history
Received 28 Apr 25
Revised 15 May 25
Accepted 16 May 25

Keywords:
degenerative,
joint disorder,
knee joint,
osteoarthritis,
radiological examination

ABSTRACT

Osteoarthritis (OA) is a degenerative joint disorder that commonly affects the elderly population, primarily resulting from the aging process and prolonged mechanical stress on articular cartilage. The risk of deceloping OA significantly increases between the ages of 30 and 65, with individuals over the age of 65 facing a tenfold higher risk. Common clinical manifestations include joint pain, stiffness, swelling, and reduced mobility, which can severely impact quality of life. This study aims to provide a comprehensive overview of the demographic and clinical characteristics of OA patients treated at PKU Bantul Hospital between January and December 2024. A cross-sectional design was employed, utilizing secondary data extracted from hospital's medical records. A total of 579 OA patients were identified, with a predominant female population (419 individals, 41,1%). The vast majority received outpatient care (540 individuals, 93,3%). Radiological examinations were conducted in 462 patients (80%), with the knee joint being the most commonly affected site (369 cases, 64%). These findings highlight the high burden of OA among elderly females and underscore the importance of early diagnosis and effective management strategies, particularly for knee involvement, to prevent disease progression and improve patient outcomes.

INTRODUCTION

Osteoarthritis (OA) is the most prevalent degenerative joint disease worldwide, commonly affecting older adults and contributing significantly to disability and reduced quality of life [1]. It is characterized by the progressive deterioration of articular cartilage, subchondral bone

remodelling, and synovial inflammation, resulting in joint pain, stiffness, and limited mobility [2]. Osteoarthritis affects approximately 7.6% of the global population, corresponding to an estimated 595 million individuals worldwide [3].

Osteoarthritis prevalence varies by joint location, with lower extremity joints being more commonly affected than non-extremity sites such as the spine. Knee OA is the most prevalent form, followed by hip OA, while hand OA is also common but generally less frequent than knee OA [4]. In older populations, symptomatic knee OA affects 7–17%, with radiographic knee OA affects more than 35% of the population. Symptomatic hip OA occurs in 4–10%, and hand OA affects 7–22% of adults over 40–50 years. Ankle OA is less common, reported in 3–5% of older adults. Although spinal OA is common, it is often studied separately due to distinct clinical features. Overall, extremity OA, particularly in weight-bearing joints, has a higher prevalence likely due to greater mechanical stress [5].

The knee joint is among the most frequently affected sites, particularly in aging populations [6]. Knee osteoarthritis exhibits a higher prevalence compared to other forms of OA, with its incidence increasing with age, longer lifespan, and higher average weight in the population, particularly among obese women [7]. Knee osteoarthritis constitutes approximately 60% to 85% of all osteoarthritis cases globally, accounting for an estimated 378 million affected individuals worldwide [8]. World Health Organization (WHO) stated that most the knee is the most commonly affected joint, followed by the hip and the hand. Knee osteoarthritis is more common than other types of OA, primarily due to the structural design of the knee joint, its role in weight-bearing, and its vulnerability to injury and repetitive stress [7].

The global burden of OA continues to rise, driven by an aging population and lifestyle changes. According to the WHO, OA is among the top ten most disabling diseases in developed countries [9]. Aging is known as the primary risk factor for osteoarthritis, as the incidence of the disease rises sharply with old age due to cumulative joint wear and declining cartilage regeneration capacity [5]. Other contributing factors include female sex, obesity, prior joint injuries, repetitive joint use, genetic predisposition, and metabolic syndromes (Shamsi et al., 2021). Post-menopausal women also represent the most at-risk group for developing osteoarthritis (OA), with prevalence rates nearly double those observed in men of the same age [11].

Recent studies have explored OA through various lenses. For instance, Zhang *et al*. conducted a population-based study highlighting the interplay between obesity, aging, and joint degeneration. Radiological examinations are essential for the diagnosis of OA, given their role in early detection and severity grading [12]. A study by Dennison in 2022 highlights the influence of

declining oestrogen levels in postmenopausal women, leading to higher prevalence of OA among the population.

There is a longstanding interest in the complex relationship between hormonal status and the progression of OA in postmenopausal women, highlighting the urgent need of new data to be gathered and new studies to be conducted [13]. In Indonesia, local studies such as by Manurung *et al.* have investigated the risk factors associated with knee OA among patients treated in orthopedic outpatient clinics, identifying significant associations with age, sex, body mass index, physical activity, and prior knee injuries, while also highlighting the need for further research on radiological findings and other comorbidities [14]. However, many of these studies are either hospital-specific or limited to certain demographic groups.

Despite these advances, there remains a notable research gap in the comprehensive understanding of OA characteristics within regional healthcare settings in Indonesia, particularly in secondary-level hospitals such as PKU Bantul. Most existing data are either generalized at the national level or derived from tertiary care centres, which may not reflect the real-world patient profiles in smaller urban or peri-urban hospitals. Moreover, there is limited integration of demographic, clinical, and radiological data in a single descriptive analysis, which is essential for planning effective interventions and healthcare services.

This study aims to fill that gap by providing a detailed overview of osteoarthritis patients treated at PKU Bantul Hospital during the period of January to December 2024. It examines patient demographics, cases predilection based on clinical features and radiological imagings, diagnostic approaches, and treatment settings to inform future strategies for OA management in similar healthcare contexts.

METHODS

This study employed a cross-sectional descriptive design using secondary data analysis derived from the medical records of osteoarthritis (OA) patients treated at PKU Bantul Hospital over a one-year period, from January to December 2024. Data were obtained from the hospital's medical record system and included all patients diagnosed with osteoarthritis during the study period. The data collected encompassed several important domains to ensure a comprehensive analysis. These included demographic data, such as the age and gender of the patients, which helped in understanding the distribution of osteoarthritis across different population groups. In addition, treatment information was documented, including the type of care each patient received, whether it was on an outpatient or inpatient basis. Finally, plain radiographic images using x-ray modality are collected and used as radiological examination data, along with specific details related to the location of the joints affected by OA. Together, these domains offered a detailed and

multidimensional view of osteoarthritis cases treated at the hospital, supporting more accurate interpretation and potential planning for future medical and support services.

The sampling method used in this study was purposive sampling, selected to ensure that the included subjects were directly relevant to the study objectives. This non-random method allowed for the inclusion of patients with specific criteria that aligned with the focus of the research. To ensure the accuracy and relevance of the data, specific inclusion and exclusion criteria were applied during the study. The inclusion criteria involved patients who had been diagnosed with osteoarthritis and had received medical care—whether outpatient or inpatient services—at PKU Bantul Hospital within the defined study period. On the other hand, the exclusion criteria were applied to patients whose medical records were incomplete or lacked critical data, such as diagnosis codes, clinical or radiological findings, or whose data could not be verified due to inconsistencies or administrative errors. These criteria were established to maintain the validity and reliability of the research findings by ensuring that only accurate and comprehensive data were included in the analysis.

Prior to data collection, ethical approval was obtained from the Ethics Committee of Universitas Ahmad Dahlan (Approval No: 012409304, dated 21 September 2024) ensuring adherence to ethical standards and the protection of patient confidentiality throughout the research process. Descriptive statistical analysis was conducted to summarize the patient characteristics. Categorical data such as gender, age group, type of care, and radiological examination were presented in frequencies and percentages. All data were analysed using Microsoft Excel.

RESULTS

Table 1. Characteristics of OA patients at PKU Bantul Hospital January-December 2024

Characteristics	***Frequency***	***Percentage***
Gender		
Male	160	28
Female	419	72
Age		
5 – 35	14	2,4
36 - 45	31	5,3
46 - 55	103	17,7
56 - 65	193	33,3
> 65	238	41,1
Type of Care		
Outpatient	540	93
Inpatient	39	7
Radiological Examination		
Yes	462	80
No	117	20
Total	579	100

Based on the Table 1, a total of 579 OA patients were recorded at PKU Bantul from January to December 2024. Most patients were female (419 or 72%) and the majority were aged over 65 years. Outpatient treatment was the most common, with 540 patients (93%) receiving it, while only 39 patients (7%) were hospitalized. Additionally, 462 patients (80%) underwent radiological examinations, while 117 (20%) did not.

Table 2. Distribution of OA patients by age and gender

Age (Years)	***Female***	***Percentage (%)***	***Male***	***Percentage (%)***	***Total***
5 – 35	9	2,14	5	3,12	14
36 – 45	20	4,77	11	6,66	31
46 – 55	83	19,80	20	12,5	103
56 – 65	142	33,89	51	31,87	193
> 65	165	39,37	73	45,62	238
Total	419	100	160	100	579

The table presents the distribution of OA patients by age and gender. Out of a total of 579 patients, 419 were female and 160 were male, showing that females made up the majority of OA cases. The highest number of patients was in the >65 years age group, with 238 patients (165 females and 73 males), indicating that osteoarthritis is most prevalent in older adults. This is followed by the 56–65 years group with 193 patients, also predominantly female. Meanwhile, the youngest age group (5–35 years) had the fewest cases (only 14 patients), suggesting that OA is rare among younger individuals.

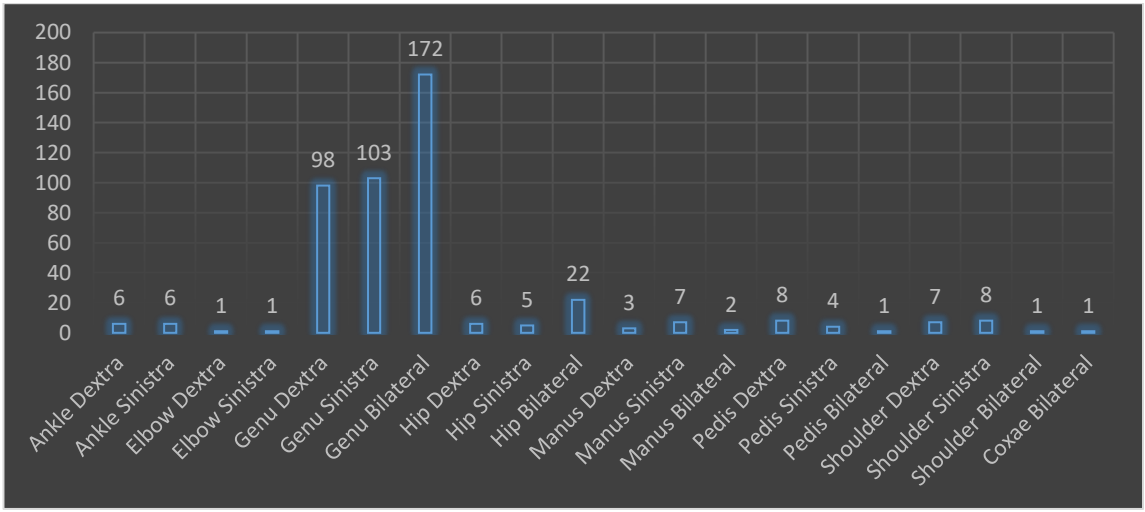

Figure 1. Distribution of OA patients based on radiological examination results for the period January - December 2024

Figure 1 illustrates the distribution of affected joints among OA patients. The most commonly affected joint is the bilateral knee (Genu Bilateral) with 172 cases, followed by the left knee (Genu Sinistra) with 103 cases and the right knee (Genu Dextra) with 98 cases, indicating that the knee is the most frequent site of OA. Other notably affected joints include the bilateral hip (Hip Bilateral) with 22 cases, and the right shoulder (Shoulder Dextra) and left shoulder (Shoulder Sinistra) with 8 cases each. Meanwhile, joints such as the ankles (Dextra and Sinistra) and elbows (Dextra and Sinistra) showed very low occurrence, with only 6 or fewer cases each. Similarly, the manus and pedis (hands and feet), both unilaterally and bilaterally, also presented with relatively low frequencies. Overall, this distribution highlights that OA predominantly affects weight-bearing joints, particularly the knees and hips, and tends to occur bilaterally in many cases

DISCUSSION

Translation and Analysis: Gender and Age Variables (with Current International Citations)

An analysis of OA patients treated at PKU Bantul revealed that the majority were female, totalling 419 cases (72%), compared to 160 male cases (28%). This higher prevalence of OA in women is largely attributed to hormonal factors, particularly the decline in oestrogen levels during and after menopause. Oestrogen plays a crucial role in maintaining cartilage health and modulating inflammation; its reduction is associated with an increased risk of OA [11]. Oestrogen plays a role in reducing inflammation, protecting chondrocytes from related degenerative processes, and delaying the onset of OA. Additionally, oestrogen stimulates the production of proteoglycans and collagen by chondrocytes, as well as the expression of genes specific to cartilage [11].

Furthermore, oestrogen influences body fat distribution. Postmenopausal hormonal changes can lead to increased fat accumulation around the abdomen and thighs, potentially adding mechanical stress to weight-bearing joints like the knees and hips, thereby exacerbating OA development.

Age is another significant factor in OA prevalence. At PKU Bantul, the highest number of OA cases was among patients over 65 years old, accounting for 238 out of 579 total cases (41%). These findings align with global trends indicating that the risk of OA increases with age. A study published in The Lancet Rheumatology projected that by 2050, nearly 1 billion people will be living with OA, with aging populations being a primary driver of this increase [15,16].

As individuals age, the body's ability to regenerate cartilage diminishes, leading to joint stiffness and reduced mobility. Additionally, age-related muscle loss (sarcopenia) decreases joint stability, further contributing to OA development.

The combined effects of female gender, particularly postmenopausal status, and advanced age significantly elevate the risk of developing OA. Preventive strategies should focus on these high-risk groups, emphasizing hormonal balance, weight management, muscle-strengthening exercises, and early medical interventions to maintain joint function and overall quality of life.

Medical Treatment

The majority of OA patients treated at PKU Bantul underwent outpatient medical care, with 540 patients (93%) receiving outpatient services, while only 39 patients (7%) were hospitalized. This trend reflects global patterns, where outpatient care is more commonly administered for OA management due to its chronic but non-acute nature [17]. Outpatient treatment allows for continuous monitoring and non-invasive interventions, such as physical therapy, NSAIDs, and lifestyle modification, which are standard approaches for early and moderate OA cases [18].

In contrast, inpatient care is typically reserved for patients with advanced-stage OA or those undergoing surgical interventions, such as joint replacement or arthroscopy [19]. Identification of patients requiring inpatient treatment is often based on the severity of symptoms, radiologic findings, and functional limitations [20]. Furthermore, the increased rate of hospitalization due to OA is higher among women, which correlates with the higher prevalence and severity of OA in females. This gender disparity is largely attributed to hormonal influences, anatomical differences, and differences in healthcare-seeking behaviour [21]. These findings underscore the importance of early detection and continuous outpatient management to prevent disease progression and reduce the need for hospitalization. Implementing patient-centred care and education programs can further reduce the burden of OA on health services [2,22].

Radiological Examination

Joint pain is commonly perceived as a hallmark symptom of OA yet it is not always a reliable indicator. Many individuals may experience knee pain without radiological signs of OA, while others may have significant radiographic changes without notable symptoms [23], This diagnostic discrepancy emphasizes the importance of radiological imaging in confirming OA, particularly in differentiating between symptomatic and asymptomatic cases [24].

In this study at PKU Bantul, 462 patients (80%) underwent radiological examinations, indicating a strong reliance on imaging in clinical decision-making. Conversely, 117 patients

(20%) were diagnosed without radiological support, which could lead to under- or over-diagnosis. This aligns with global trends where radiographic evidence remains central to OA diagnosis, particularly of the knee and hip [25].

Several imaging modalities are employed in OA assessment. Standard radiography remains the most widely used due to its accessibility and cost-effectiveness [26]. It provides essential information on joint space narrowing, osteophyte formation, subchondral sclerosis, and cysts—hallmark features of OA [26]. However, newer modalities like ultrasound and MRI are gaining ground for detecting soft tissue involvement, early cartilage degradation, and inflammatory changes, which plain X-rays might miss [27]. MRI, for instance, is particularly useful for evaluating synovitis and bone marrow lesions, which are predictors of OA progression [28].

The choice of imaging modality should be tailored to the patient's clinical presentation and diagnostic needs. In settings with limited access to advanced imaging, X-rays remain the cornerstone of OA assessment. However, integrating clinical evaluation with appropriate imaging improves diagnostic accuracy and helps in planning personalized management strategies [29].

Radiological Findings

Radiological findings from OA patients at PKU Bantul reveal that the most commonly affected joint is the knee, particularly bilateral knee osteoarthritis, with 172 patients diagnosed. This is followed by left knee OA in 103 patients and right knee OA in 98 patients. These findings highlight the prevalence of knee OA, consistent with broader epidemiological patterns where knee involvement is the most common site of OA globally [1].

Knee OA is recognized as a major public health issue in Indonesia and other low- to middle-income countries [30]. The natural anatomical configuration and biomechanical loading characteristics of the knee joint contribute to its increased susceptibility of developing OA relative to other joint sites. The knee joint carries a significant part of the body's weight and experiences repetitive mechanical loading and stress during walking, squatting, and kneeling. The mechanical stress causes damage to the joint tissues that include cartilage, meniscus, ligaments, peri and para-articular muscles which leads to OA [31].

Obesity is one of the key risk factor for the development of OA due to both mechanical stress on joints and metabolic factors that promote joint inflammation and degeneration [32]. Excess body weight increases mechanical loading on the knees, alters gait biomechanics, and promotes inflammation within the joint, all of which accelerate cartilage degradation [32,33]. As a result, overweight and obese individuals are at significantly higher risk of developing knee OA, particularly when combined with aging and genetic predisposition [30,34].

A sedentary lifestyle and occupational habits—such as prolonged sitting and frequent squatting (*jongkok*)—also contribute to knee OA development [35]. A study by Shamsi et al. found that the prevalence of knee pain was significantly higher among individuals with a higher body mass index (BMI >30) and those engaging in limited physical activity. Notably, 31.6% of individuals with BMI >30 experienced knee pain, highlighting the role of obesity and reduced exercise as contributing factors to knee osteoarthritis.

Additionally, 60.5% of women reported knee pain compared to 38.6% of men, indicating a gender-based vulnerability possibly related to differences in physical activity levels or biomechanical stress on the joints [6]. Squatting increases compressive forces in the patellofemoral joint and, when done repetitively, can increase the risk of knee OA [36]. These behaviours are common in certain labour-intensive occupations, contributing to the higher burden of OA among the elderly and manual workers [36,37]. Therefore, OA prevention strategies should incorporate weight management, education about safe postures, and early detection through radiological screening, especially in populations with known biomechanical and occupational risk factors.

CONCLUSION

An descriptive study of osteoarthritis (OA) patients at PKU Hospital Bantul from January to December 2024 revealed that the majority of patients were women, most of whom were over the age of 65. The decline in oestrogen and progesterone levels after menopause is believed to contribute to the development of OA in women. Furthermore, the aging process leads to changes in collagen structure and reduced proteoglycan production, which can make joints more vulnerable to stress and decrease their flexibility. Most patients received outpatient medical care, with radiological examinations commonly performed to support a more accurate diagnosis. Among the various types of OA, knee osteoarthritis was found to be the most prevalent. Factors contributing to knee OA include obesity and prolonged habits such as sitting or squatting.

REFERENCE

1. Allen KD, Thoma LM, Golightly YM. Epidemiology of osteoarthritis. *Osteoarthritis and cartilage*. 2022;30(2):184-195.
2. Tang S, Zhang C, Oo WM, et al. Osteoarthritis. *Nature Reviews Disease Primers*. 2025;11(1):1-22.
3. Courties A, Kouki I, Soliman N, Mathieu S, Sellam J. Osteoarthritis year in review 2024: Epidemiology and therapy. *Osteoarthritis and Cartilage*. 2024;32(11):1397-1404. doi:10.1016/j.joca.2024.07.014
4. Palmer D, Cooper D, Whittaker JL, et al. Prevalence of and factors associated with osteoarthritis and pain in retired Olympians compared with the general population: part 1 – the lower limb. Published online October 1, 2022. doi:10.1136/bjsports-2021-104762
5. Allen KD, Thoma LM, Golightly YM. Epidemiology of osteoarthritis. *Osteoarthritis Cartilage*. 2022;30(2):184-195. doi:10.1016/j.joca.2021.04.020
6. Shamsi M, Safari A, Soroush A, Safari Y. The survey of knee osteoarthritis in the population over age 50 visited in the health bus in Kermanshah, Iran. *Journal of aging research*. 2021;2021(1):9809565.
7. Lespasio MJ, Piuzzi NS, Husni ME, Muschler GF, Guarino A, Mont MA. Knee Osteoarthritis: A Primer. *TPJ*. 2017;21(4):16-183. doi:10.7812/TPP/16-183

8. Langworthy M, Dasa V, Spitzer AI. Knee osteoarthritis: disease burden, available treatments, and emerging options. *Therapeutic Advances in Musculoskeletal*. 2024;16:1759720X241273009. doi:10.1177/1759720X241273009
9. World Health Organization. Musculoskeletal Health. 2022. https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions
10. Sudo A, Miyamoto N, Horikawa K, et al. Prevalence and risk factors for knee osteoarthritis in elderly Japanese men and women. *Journal of Orthopaedic Science*. 2008;13(5):413-418.
11. Atasoy-Zeybek A, Showel KK, Nagelli C V, Westendorf JJ, Evans CH. The intersection of aging and estrogen in osteoarthritis. *npj Women's Health*. 2025;3(1):15. doi:10.1038/s44294-025-00063-1
12. Park EH, Fritz J. The role of imaging in osteoarthritis. *Best Pract Res Clin Rheumatol*. 2023;37(2):101866. doi:10.1016/j.berh.2023.101866
13. Dennison EM. Osteoarthritis: The importance of hormonal status in midlife women. *Maturitas*. 2022;165:8-11. doi:10.1016/j.maturitas.2022.07.002
14. Manurung EMF, Nababan D, Sitorus MEJ, Manurung K, Silitonga EM. Faktor Resiko Kejadian Ostoarthritis Lutut pada Pasien yang Berobat di Poli Ortopedi di Rumah Sakit Bhayangkara TK. II Medan. *PREPOTIF: JURNAL KESEHATAN MASYARAKAT*. 2022;6(3):1918-1932.
15. Halsey G. Osteoarthritis Projected to Affect Nearly 1 Billion by 2050, Obesity a Major Contributing Factor. *Patient Care (Online)*. Published online 2023:NA-NA.
16. Steinmetz JD, Culbreth GT, Haile LM, et al. Global, regional, and national burden of osteoarthritis, 1990–2020 and projections to 2050: a systematic analysis for the Global Burden of Disease Study 2021. *The Lancet Rheumatology*. 2023;5(9):e508-e522.
17. Arslan IG, van Berkel AC, Damen J, et al. Patterns of knee osteoarthritis management in general practice: a retrospective cohort study using electronic health records. *BMC Primary Care*. 2024;25(1):2. doi:10.1186/s12875-023-02198-z
18. Kolasinski SL, Neogi T, Hochberg MC, et al. 2019 American College of Rheumatology/Arthritis Foundation guideline for the management of osteoarthritis of the hand, hip, and knee. *Arthritis & rheumatology*. 2020;72(2):220-233.
19. Bunzli S, O'Brien BHealthSci (hons) P, Ayton D, et al. Misconceptions and the Acceptance of Evidence-based Nonsurgical Interventions for Knee Osteoarthritis. A Qualitative Study. *Clin Orthop Relat Res*. 2019;477(9):1975-1983. doi:10.1097/CORR.0000000000000784
20. Kiadaliri A, Englund M. Osteoarthritis and risk of hospitalization for ambulatory care-sensitive conditions: a general population-based cohort study. *Rheumatology (Oxford)*. 2021;60(9):4340-4347. doi:10.1093/rheumatology/keab161
21. Peshkova M, Lychagin A, Lipina M, et al. Gender-Related Aspects in Osteoarthritis Development and Progression: A Review. *Int J Mol Sci*. 2022;23(5):2767. doi:10.3390/ijms23052767
22. Abuwa C, Abbaticchio A, Theodorlis M, et al. Identifying strategies that support equitable person-centred osteoarthritis care for diverse women: content analysis of guidelines. *BMC Musculoskeletal Disorders*. 2023;24(1):734.
23. Wang K, Kim HA, Felson DT, et al. Radiographic Knee Osteoarthritis and Knee Pain: Cross-sectional study from Five Different Racial/Ethnic Populations. *Scientific Reports*. 2018;8(1):1364. doi:10.1038/s41598-018-19470-3
24. Majidi H, Niksolat F, Anbari K. Comparing the Accuracy of Radiography and Sonography in Detection of Knee Osteoarthritis: A Diagnostic Study. *Open access Macedonian journal of medical sciences*. 2019;7(23):4015-4018. doi:10.3889/oamjms.2019.617
25. Hayashi D, Roemer FW, Guermazi A. Imaging of osteoarthritis-recent research developments and future perspective. *The British journal of radiology*. 2018;91(1085):20170349. doi:10.1259/bjr.20170349
26. Roemer FW, Guermazi A, Demehri S, Wirth W, Kijowski R. Imaging in Osteoarthritis. *Osteoarthritis and Cartilage*. 2022;30(7):913-934. doi:https://doi.org/10.1016/j.joca.2021.04.018
27. Shakoor D, Kijowski R, Guermazi A, et al. Diagnosis of knee meniscal injuries by using three-dimensional MRI: a systematic review and meta-analysis of diagnostic performance. *Radiology*. 2019;290(2):435-445.
28. Foreman SC, Neumann J, Joseph GB, et al. Longitudinal MRI structural findings observed in accelerated knee osteoarthritis: data from the Osteoarthritis Initiative. *Skeletal radiology*. 2019;48:1949-1959.
29. Jang S, Lee K, Ju JH. Recent Updates of Diagnosis, Pathophysiology, and Treatment on Osteoarthritis of the Knee. *International journal of molecular sciences*. 2021;22(5). doi:10.3390/ijms22052619

30. Butarbutar JCP, Basuki P, Sungono V, Riantho A, Fidiasrianto K. Burden of osteoarthritis in Indonesia: A Global Burden of Disease (GBD) study 2019. *Narra J*. 2024;4(2):e884.
31. Primorac D, Molnar V, Rod E, et al. Knee Osteoarthritis: A Review of Pathogenesis and State-Of-The-Art Non-Operative Therapeutic Considerations. *Genes (Basel)*. 2020;11(8):854. doi:10.3390/genes11080854
32. Wang T, He C. Pro-inflammatory cytokines: The link between obesity and osteoarthritis. *Cytokine & growth factor reviews*. 2018;44:38-50.
33. Mobasheri A, Rayman MP, Gualillo O, Sellam J, Van Der Kraan P, Fearon U. The role of metabolism in the pathogenesis of osteoarthritis. *Nature Reviews Rheumatology*. 2017;13(5):302-311.
34. Ji S, Liu L, Li J, et al. Prevalence and factors associated with knee osteoarthritis among middle-aged and elderly individuals in rural Tianjin: a population-based cross-sectional study. *Journal of orthopaedic surgery and research*. 2023;18(1):266.
35. Kojima N, Kim M, Saito K, et al. Lifestyle-related factors contributing to decline in knee extension strength among elderly women: a cross-sectional and longitudinal cohort study. *PloS one*. 2015;10(7):e0132523.
36. Wang X, Perry TA, Arden N, et al. Occupational risk in knee osteoarthritis: a systematic review and meta-analysis of observational studies. *Arthritis care & research*. 2020;72(9):1213-1223.
37. Das B. Work-related injuries, postural stress, and musculoskeletal disorders among the railway track maintainers in India. *Toxicology and Industrial Health*. 2020;36(5):371-385. doi:10.1177/0748233720932815