



ORIGINAL ARTICLE

KOOS DOMAIN- SPECIFIC ANALYSIS OF KNEE DISCOMFORT AND ITS ASSOCIATION WITH DEMOGRAPHIC FACTORS AMONG KPJ HEALTHCARE UNIVERSITY STAFF

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ABSTRACT

Background of study: Knee discomfort (KD) is a common issue among working adults, potentially affecting mobility and work performance. Despite its potential consequences, there is limited evidence on its prevalence and associated factors among university staff in Malaysia. Objective of the study is to determine the prevalence of knee discomfort across individual KOOS domains and their association with demographic status among university staff. **Methodology:** A cross-sectional study was conducted among university staff using the Knee Injury and Osteoarthritis Outcome Score (KOOS). Domain-specific prevalence (Pain, Symptoms, ADL, Sports/Recreation, and QoL) was analyzed in relation to demographic variables including age, gender, ethnicity, occupation, and BMI, using Mann–Whitney U and Kruskal–Wallis tests. **Results:** Age was significantly associated with all KOOS domains ($p < 0.05$), with the 51–60 years group showing the greatest impairments. Gender differences were significant in symptoms ($p = 0.020$) and sports/recreation ($p < 0.001$), favoring male staff. Academic staff scored significantly better in ADL ($p = 0.006$) and sports ($p = 0.023$) compared to non-academic staff. Ethnicity showed no significant differences. BMI was significantly associated with symptoms, ADL, sports, and QoL ($p < 0.05$), with obese individuals consistently showing the poorest scores. **Conclusion:** Knee discomfort among university staff varies across domains and is significantly influenced by demographic characteristics. Pain, ADL, and QoL were most affected in older staff, while obesity and female gender were linked to poorer outcomes in specific domains. Interventions should prioritize weight management, ergonomic adjustments, and preventive physiotherapy programs to mitigate risks in vulnerable groups.

Keywords: Demographic factors, Knee discomfort, KOOS Domains, Prevalence, University staff

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INTRODUCTION

Knee discomfort is categorized by significant pain, stiffness, swelling, and a decrease in normal joint function⁹. Knee discomfort is a common musculoskeletal condition that adversely affects people of all ages and backgrounds, greatly limiting their daily activities, affecting their quality of life, and leading to physical impairment¹⁸. It's important to note that knee pain is a collection of symptoms rather than a specific disease entity². Research suggests that Knee Pain (KP) is a more accurate predictor of disability and impaired physical function than radiographic changes in (KOA)⁷. Repetitive movements gradually wear down joint structures, causing long-term pain, inflammation, and reduced range of motion (ROM)¹¹.

Despite numerous studies on KOA, the prevalence of the condition remains underreported and undertreated (10). According to the Global Burden of Disease (2010) Study, over 251 million people worldwide suffer from KOA⁵. The incidence of knee osteoarthritis is expected to increase by 74.9% by 2050 compared to 2020¹⁷. In 2050, an estimated 642 million people would have KOA¹⁷. The Community Oriented Program for the Control of Rheumatic Diseases (COPCORD) study in Malaysia found that 64.8% of joint complaints were knee-related, with over half of those experiencing knee pain exhibiting OA symptoms⁵.

According to the Clinical Practice Guidelines on the Management of Osteoarthritis (2013)⁴, the prevalence of knee OA in Malaysia was predicted to be 10% to 20% among the elderly⁵. According to a local study, the prevalence of knee osteoarthritis ranged between 25.7% and 30.3% among age group between 55 and 75

years old. The prevalence of knee osteoarthritis among the elderly in the United States, Europe, the Middle East, and Asia is approximately 13% to 20% (Despande et al., 2016), 9-17% (Postler et al., 2018), 22% to 25% (AlKuwaity et al., 2018), and 10% to 38% (Cho et al., 2015), (Nishimura et al., 2012). Malays had the highest prevalence of knee osteoarthritis (37.7%), followed by Indians (25.7%) and Chinese (17.9%) (18). Knee pain affects 25% of individuals over 55, with women experiencing a higher prevalence compared to men (Peat et al., 2001). A cross-sectional investigation of NHANES I data encompassing persons aged 25 to 74 revealed that the prevalence of knee symptoms (including pain, oedema, and morning stiffness) increased with age, with higher rates among women (Hannan et al., 2000).

Variations in the prevalence of osteoarthritis in knee joints may be attributed to geographical differences in occupational distribution, high BMI, frequent kneeling or squatting, joint anatomy, or genetic predisposition^{6, 8, 15}. For example, sitting in a squatting position could explain a higher prevalence of knee osteoarthritis in a cohort of Japanese females compared to US females, even though the US cohort had a higher average BMI¹⁶.

Approximately two-thirds of obese individuals are affected by osteoarthritis (OA), and the occurrence of OA rises with higher body mass index (BMI). Studies show that over 50% of individuals undergoing total knee replacement (TKR) surgery for advanced osteoarthritis (OA) are categorized as obese. Obesity contributes to a range of pathological changes in the overall structure of the knee joint, including abnormal loading patterns, misalignment of the joint, and muscle weakness³. Several

studies on knee pain have been conducted among school teachers and found that the prevalence of knee pain range between 14.0% - 32.0%.

Despite global research on knee osteoarthritis (KOA), there is limited evidence on its prevalence among university staff in Malaysia. Knee discomfort is common among university staff due to prolonged standing, walking, or physical activity. It negatively impacts their quality of life, productivity, and teaching performance. Risk factors include age, gender, BMI, and occupational demands. Addressing knee discomfort requires workplace interventions, ergonomic solutions, and health awareness programs. Therefore, to address this gap, this study aims to investigate the association between knee discomfort and sociodemographic parameters such as age, gender, ethnic, body mass index (BMI) and occupation, among KPJ Healthcare University staff.

METHODOLOGY

A cross-sectional study was conducted among KPJ Healthcare University staff. A simple random sampling method was used to assure that the sample was representative and unbiased. The sample size was determined using the Taro Yamane (1967) formula, (1), resulting in 150 participants.

Inclusion and Exclusion Criteria:

The inclusion and exclusion criteria were adapted from Patino (2018) (14).

Eligible participants included:

- Only KPJ Healthcare University staff
- Both male and female staff
- Adults aged ≥ 20 years

Staff was excluded if they:

- Having congenital disorders

- Pre-existing knee conditions
- Recent knee surgeries (e.g., knee replacement, arthroscopy)
- Pregnant staff

Variables:

The main objective of this study is to investigate the association between knee discomfort and demographic status among KPJ Healthcare University staffs. The dependent variable for this study was knee discomfort, while the independent variables included age, gender, ethnicity, body mass index (BMI), and occupation. For analysis purposes, age was categorized into five groups: ≤ 30 , 31–40, 41–50, 51–60, and ≥ 60 years. Gender was classified as male or female, ethnicity as Malay, Chinese, Indian, or other, and occupation as academic or non-academic staff. BMI was grouped into four categories based on the WHO Asian classification: < 18.5 kg/m² (underweight), 18.5–23.0 kg/m² (normal), 23.0–27.5 kg/m² (overweight), and ≥ 27.5 kg/m² (obese).

Study Instrument:

Data were collected using the Knee Injury and Osteoarthritis Outcome Score (KOOS) questionnaire, a validated knee-specific instrument developed by Roos and Lohmander (2003). The KOOS consists of 42 items divided into five subscales:

1. Pain (9 items)
2. Symptoms, such as swelling, restricted range of motion, and mechanical symptoms (7 items)
3. Function in activities of daily living (ADL) (17 items)
4. Function in sport and recreation (5 items)
5. Knee-related quality of life (4 items)

Each item is rated on a five-point Likert scale (0 = no problems to 4 = extreme problems).

Scores for each subscale are summed and then converted into a 0–100 scale, where 0 indicates severe knee problems and 100 indicates no knee problems. For interpretation, the following cut-off values were applied¹²:

- 87.5 = No pain/difficulty
- 62.5 = Mild pain/difficulty
- 37.5 = Moderate pain/difficulty
- 12.5 = Severe pain/difficulty
- <12.5 = Extreme pain/difficulty

Data Collection:

Data collection was carried out using an online survey distributed via Google Forms. The questionnaire was developed by incorporating validated items from the KOOS and relevant domains. The survey link was shared with staff members who met the inclusion and exclusion criteria. At the beginning of the questionnaire, respondents were provided with clear information regarding the purpose of the study, and voluntary participation was emphasized. A consent form was included at the start, with completion of the survey considered as implied consent. Data collection continued until the calculated sample size was reached, resulting in 150 complete responses.

Data Analysis:

All completed responses were downloaded, anonymized, and securely coded to maintain confidentiality. Only the researcher had access to the dataset. Data were analyzed using IBM SPSS Statistics version 27.0. The results are presented and discussed in subsequent chapters.

RESULTS

A total of 150 respondents participated in this study. Analysis of KOOS domain scores across demographic factors revealed significant

variations. Age was strongly associated with all domains ($p < 0.05$). Younger staff (≤ 30 and 31–40 years) consistently reported better outcomes, while the 51–60 age group demonstrated the greatest impairments, particularly in pain, activities of daily living (ADL), and quality of life (QoL). Gender differences were observed in the symptoms ($p = 0.020$) and sports/recreation ($p < 0.001$) domains, with male staff reporting significantly better scores compared to females. No significant differences were detected across ethnic groups ($p > 0.05$). Occupation showed significant associations with ADL ($p = 0.006$) and sports/recreation ($p = 0.023$), where academic staff scored better than non-academic staff. BMI status was significantly related to symptoms, ADL, sports/recreation, and QoL ($p < 0.05$), with the obese group consistently showing the lowest scores. Pain showed a borderline association ($p = 0.052$).

DISCUSSION

The relationship between age and KOOS domain:

This study found a significant association between age and all KOOS domains, with older respondents reporting greater knee discomfort and functional decline. Pain scores showed a strong downward trend with age, consistent with evidence that knee osteoarthritis is a primary cause of discomfort in older adults. Symptoms such as stiffness and swelling also worsened after 40 years, supporting prior findings that age-related degeneration becomes more symptomatic in midlife. Functional ability, as measured by the ADL domain, declined markedly among respondents aged ≥ 51 years, reflecting reduced independence in mobility and daily tasks. Similarly, the Sports and Recreation

domain revealed that high-demand activities were particularly impaired in older groups, aligning with previous research on cartilage wear and reduced physical activity. Quality of Life was the most affected domain, with older respondents reporting substantial impact on well-being and daily functioning. The findings reinforce that aging is a key risk factor for worsening knee health due to degenerative changes, reduced physical activity, muscle weakness, and delayed medical care. Preventive measures such as workplace ergonomics, strengthening exercises, weight management, and early intervention are essential to slow decline and preserve knee function among aging staff. The uneven distribution of participants across age groups may have influenced the observed results. The strong link between older age and worsening KOOS scores can be explained by age-related joint degeneration, reduced physical activity, muscle weakness, altered gait, and delayed medical consultation, as older individuals often normalize pain.

The relationship between gender and KOOS domain:

This study found no significant gender differences in KOOS scores, indicating that knee discomfort levels were comparable between male and female staff. These results align with several previous studies reporting no clear gender-based differences in musculoskeletal disorders, though some research has shown higher prevalence among females due to hormonal, biomechanical, and occupational factors. The balanced workload and similar job nature among healthcare university staff may explain the neutral findings. However, the uneven gender distribution (more females than males) may have influenced results and limits

generalizability. Overall, occupational role and age may play a greater role in knee discomfort than gender alone.

The relationship between ethnicity and KOOS domain:

This study found no significant differences in KOOS scores across ethnic groups, despite minor variations in mean ranks. The results contrast with previous research that reported notable ethnic disparities in knee pain prevalence, often linked to sociocultural, lifestyle, or genetic factors. The lack of association here may be due to sample homogeneity, with Malays forming the majority, and the underrepresentation of other ethnic groups, which reduced statistical power. Additionally, shared occupational roles, education, and healthcare access among staff may have minimized ethnic differences. Overall, ethnicity did not appear to influence knee discomfort in this cohort, though larger and more diverse studies are needed to clarify its role.

The relationship between occupation and KOOS domain:

This study revealed that academic staff experienced significantly greater knee discomfort in ADL and Sports & Recreation domains compared to non-academic staff, reflecting the impact of prolonged standing, sedentary behavior, and ergonomic stressors common in academic roles. These findings are consistent with previous studies linking occupational musculoskeletal pain to poor posture, physical inactivity, and psychosocial stress. In contrast, non-academic staff may benefit from more varied physical tasks that reduce static joint strain. However, the uneven distribution of participants, with more academic than non-academic staff, may have influenced the results and limits their

generalizability. Overall, the study highlights the need for workplace interventions such as ergonomic improvements and structured activity breaks to reduce musculoskeletal discomfort among academic professionals.

The relationship between BMI and KOOS domain:

This study found significant associations between higher BMI and worse KOOS outcomes, particularly in Symptoms, ADL, Sports/Recreation, and QOL domains, with obese participants reporting the greatest knee discomfort and limitations. The Symptoms domain showed the strongest difference, suggesting more swelling, stiffness, and restricted movement in those with elevated BMI, likely due to both mechanical overload and metabolic inflammation. Although pain did not reach statistical significance, structural impairments were evident. These findings align with previous research linking excess weight to early knee osteoarthritis and emphasize the importance of weight management, physical activity, and preventive strategies to reduce knee-related disability among staff in sedentary or semi-active roles.

Limitation of the study:

The present study has several limitations that should be acknowledged. First, its cross-sectional design restricts the ability to establish causal relationships between knee discomfort and demographic factors, as data were collected at a single point in time. Second, the use of self-reported data may have introduced recall bias and social desirability bias, which could affect the accuracy of responses. Third, the study focused only on selected demographic factors, namely age, gender, ethnicity, occupation, and BMI, while excluding other potentially relevant variables such as physical activity, nutritional status,

comorbidities, and history of knee injury. In addition, certain subgroups, including respondents aged ≥ 60 years and minority ethnic groups, had small sample sizes, reducing statistical power and limiting representativeness. The absence of Chinese respondents and the limited participation of other minority groups further restricted the ability to make inclusive ethnic comparisons. Collectively, these limitations may affect the comprehensiveness of the findings and reduce their generalizability to the wider population

Suggestions for future research:

Future research should consider adopting a longitudinal design to better establish causal relationships and track the progression of knee discomfort over time. Expanding the study population to include a more balanced and diverse sample, particularly with improved representation of Chinese and other minority ethnic groups, would enhance the inclusivity and generalizability of findings. In addition, incorporating additional variables such as physical activity, sedentary behavior, nutrition, previous injuries, and psychosocial stressors would provide a more comprehensive understanding of factors influencing knee discomfort. The use of objective clinical assessments, including radiographic imaging and physical examinations, could complement self-reported data and improve measurement accuracy. Interventional studies are also recommended to evaluate the effectiveness of workplace modifications, ergonomic interventions, and weight management programs in alleviating knee-related symptoms. Finally, exploring the role of health education and awareness in promoting early symptom recognition and care-seeking behavior may contribute to more effective prevention and management strategies.

Collectively, these directions could strengthen the depth, applicability, and impact of future research on knee discomfort.

Implication of the study:

The findings of this study carry several important implications for occupational health and staff well-being. By identifying at-risk groups such as older, female, overweight, and non-academic staff, the results support the implementation of targeted workplace health initiatives, including ergonomic modifications, structured physical activity programs, and weight management strategies. The study also underscores the importance of integrating musculoskeletal health awareness into staff wellness policies, particularly for academic staff who may be exposed to prolonged sitting or repetitive tasks. Furthermore, the evidence generated provides valuable guidance for university administrators and policymakers to

prioritize resources aimed at promoting joint health and reducing work-related disabilities. Ultimately, these implications contribute to the development of strategies that not only prevent knee discomfort but also enhance staff productivity, well-being, and overall quality of life within educational institutions.

CONCLUSION

Knee discomfort among university staff varies across domains and is significantly influenced by demographic characteristics. Pain, ADL, and QoL were most affected in older staff, while obesity and female gender were linked to poorer outcomes in specific domains. Interventions should prioritize weight management, ergonomic adjustments, and preventive physiotherapy programs to mitigate risks in vulnerable groups.

Tables

Domain	Age group (years)	N	Mean Rank	Kruskal – Wallisdf H	p - value
KOOS PAIN	≤30	18	92.00	44.749	4 < 0.001
	31 – 40	74	83.43		
	41 – 50	49	68.40		
	51 – 60	6	13.25		
	≥60	3	21.50		
KOOS	≤30	18	82.58		

SYMPTOMS

	31 – 40	74	86.23			
	41 – 50	49	61.13			
	51 – 60	6	61.75			
	≥60	3	30.50	17.075	4	0.002
KOOS ADL	≤30	18	89.00			
	31 – 40	74	83.41			
	41 – 50	49	65.31			
	51 – 60	6	14.00			
	≥60	3	89.00	42.909	4	< 0.001
KOOS SPORTS	≤30	18	82.50			
	31 – 40	74	82.03			
	41 – 50	49	72.26			
	51 – 60	6	20.00			
	≥60	3	36.50	19.464	4	< 0.001
KOOS QOL	≤30	18	108.50			
	31 – 40	74	82.35			
	41 – 50	49	62.27			
	51 – 60	6	12.50			
	≥60	3	44.00	38.571	4	< 0.001

Note: Kruskal – Wallis test shows significant differences in KOOS domain scores across age groups ($p < 0.05$).

Table 1: KOOS Domain Scores Across Age Groups Using Kruskal–Wallis Test (n = 150)

Domain	Gender	N	Mean Rank	Mann – Whitney U	Z	p – value
KOOS PAIN	Male	45	73.20	2259.000	- 0.588	0.557
	Female	105	76.49			
KOOS SYMPTOMS	Male	45	87.00	1845.000	- 2.330	0.020
	Female	105	70.57			
KOOS ADL	Male	45	75.20	2349.000	- 0.083	0.934
	Female	105	75.63			
KOOS SPORTS AND RECREATION	Male	45	91.70	1633.500	- 3.450	< 0.001
	Female	105	68.56			
KOOS QOL	Male	45	82.70	2038.500	- 1.490	0.136
	Female	105	72.41			

Note: Mann - Whitney test shows significant differences in KOOS domain scores across gender groups ($p < 0.05$).

Table 2: KOOS Domain Scores Across Gender Groups Using Mann Whitney Test (n = 150)

Domain	Ethnic	N	Mean Rank	Kruskal – Wallis H	df	p – value
KOOS PAIN	Malay	128	75.97	1.500	2	0.472
	Indian	19	69.74			
	Others	3	92.00			
KOOS SYMPTOMS	Malay	128	74.30	1.051	2	0.591
	Indian	19	80.84			
	Others	3	93.00			
KOOS ADL	Malay	128	76.41	2.320	2	0.313
	Indian	19	67.21			
	Others	3	89.00			
KOOS SPORTS	Malay	128	73.58	3.141	2	0.208
	Indian	19	83.71			
	Others	3	105.50			
KOOS QOL	Malay	128	73.59	3.228	2	0.199
	Indian	19	83.16			
	Others	3	108.50			

Note: Kruskal–Wallis test shows significant differences in KOOS domain scores across ethnic groups ($p < 0.05$).

Table 3: KOOS Domain Scores Across Ethnic Groups Using Kruskal Wallis test (n = 150)

Domain	Occupation	N	Mean	Mann – Rank	Z	p – value
KOOS PAIN	Academic staff	111	78.22			
	Non – academic Staff	39	67.77	1863.000	- 1.789	0.074
KOOS SYMPTOMS	Academic staff	111	77.96			
	Non – academic Staff	39	68.50	1891.500	- 1.284	0.199
KOOS ADL	Academic staff	111	79.35			
	Non – academic Staff	39	64.54	1737.000	- 2.738	0.006
KOOS SPORTS AND RECREATION	Academic staff	111	79.64			
	Non – academic Staff	39	63.73	1705.500	- 2.269	0.023
KOOS QOL	Academic staff	111	78.95			
	Non – academic Staff	39	65.69	1782.000	- 1.837	0.066

Note: Mann – Whitney test shows significant differences in KOOS domain scores across BMI groups ($p < 0.05$).

Table 4: KOOS Domain Scores Based on Occupation Using Mann Whitney Test (n = 150)

Domain	BMI	N	Mean Rank	Kruskal – Wallisdf H	p - value	
KOOS PAIN	18.5 – 23.0	30	76.25	5.923	2	0.052
	23.0 – 27.5	63	81.93			
	≥27.5	57	68.00			
KOOS SYMPTOMS	18.5 – 23.0	30	72.80	27.005	2	< 0.001
	23.0 – 27.5	63	93.98			
	≥27.5	57	56.50			
KOOS ADL	18.5 – 23.0	30	74.00	15.304	2	< 0.001
	23.0 – 27.5	63	85.71			
	≥27.5	57	65.00			
KOOS SPORTS	18.5 – 23.0	30	81.50	13.946	2	< 0.001
	23.0 – 27.5	63	85.79			
	≥27.5	57	60.97			
KOOS QOL	18.5 – 23.0	30	79.55	21.857	2	< 0.001
	23.0 – 27.5	63	90.07			
	≥27.5	57	57.26			

Note: Kruskal–Wallis test shows significant differences in KOOS domain scores across BMI groups ($p < 0.05$).

Table 5: KOOS Domain Scores According to Body Mass Index (BMI) Categories Using Kruskal Wallis test (n = 150),

Ethical Approval

This study was approved by the KPJ Healthcare University Research Ethical Committee Approval Code: KPJU/RMC/SOHS/EC/027/24).

Abbreviations

BMI	Body Mass Index
COPCORD	Community Oriented Program for The Control of Rheumatic Diseases
KOA	Knee Osteoarthritis
KP	Knee Pain
NHANES	National Health and Nutrition Examination Survey
OA	Osteoarthritis
ROM	Range Of Motion
SPSS	Statistical Package of Social Science
TKR	Total Knee Replacement
US	United States
WHO	World Health Organization

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