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DETERMINANTS OF HEALTH-RELATED QUALITY OF LIFE IN PATIENTS WITH OSTEOARTHRITIS IN BAHRAIN

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ABSTRACT

Introduction: Osteoarthritis (OA) is a prevalent degenerative condition, with long-term consequences for public health-related quality of life (HR-QoL). OA's severity, impacting individuals' QoL through chronic pain and restricted activity.
Aim: This study aimed to investigate the relationship between selected demographic and clinical characteristics and HR-QoL scores in patients with OA in Bahrain.
Methods: A cross-sectional study was conducted at two hospitals in Bahrain (Dec 2024–Mar 2025). The HR-QoL Index was used to assess 35 items across six domains evaluated for satisfaction and importance: physical health, psychological well-being, social relationships, environment, spirituality, and general well-being domain.
Results: This study included 98 adult patients (27 men and 71 women), with a mean age of 63.9 ± 10.7 years, and mean OA disease duration of 9.6 ± 7.8 years. The mean satisfaction score was 4.8 ± 0.6, and importance score was 5.3 ± 0.4, and weighed HR-QoL score of 26.7 ± 4.4. Among HR-QoL domains, the highest satisfaction was reported in spirituality (5.5 ± 0.5) and general well-being (5.3 ± 0.7), while physical health satisfaction was the lowest (4.4 ± 1.0). For perceived importance, physical health (5.8 ± 0.5) and spirituality (5.6 ± 0.8) ranked the highest.
Conclusions: Our results highlight variations in gender, marital status, education level, occupation, income, and BMI classification influence patients' perceptions of QoL. Clinical and lifestyle factors, including medication use, physical deformities, disease duration, hospital admissions, and job impact, also significantly shape HR-QoL outcomes. These findings emphasize the importance of personalized, holistic care strategies in managing OA.

KEYWORDS: Arthritis burdens; degenerative OA; QoL; Health status; Pain; Daily Activities.

INTRODUCTION

Assessing health-related quality-of-life (HR-QoL) in osteoarthritis is becoming an increasingly important research and clinical practice area. Questionnaires are among the most accepted and widely used tools for measuring HR-QoL (1). The global and regional prevalence of disability, years lived with disability (YLDs), and global burden of disease (GBD) were reported recently (2). Using the available data from the systematic reviews and population-based data sets, a meta-regression analysis and age-standardized prevalence estimates were modeled for 1990 and 2010. The prevalence estimates for musculoskeletal (MSK) disorders within 21 world regions or countries were reported. In the GBD 2010 Study, extensive systematic reviews of the prevalence of each of the MSK disorders (knee and hip OA, RA, lower back pain (LBP), neck pain (NP), gouty arthritis (GA), and other MSK disorders) were conducted from 1980 to 2009. The burden of disability of all MSK disorders was estimated in 187 countries and 21 regions of the world (3-13). The burden of musculoskeletal disorders in the Gulf Cooperation Council (GCC) countries from 1990–2019 has been reported that there was an increase in both age-standardized prevalence of MSK disorders and YLDs between 1990 and 2019 observed for all GCC countries. The study emphasizes only two risk factors, such as higher BMI and exposure to occupational ergonomic factors, which were highly associated with YLDs due to MSK disorders. The results of this study guide the potential nature of preventative and management programs to optimize the individual's health (14).
OA is a common disorder, and case numbers have increased over the past few decades to 14·8% of the global population older than 30 years. Numbers are expected to continue to grow to the year 2050 for all sites of osteoarthritis, leading to a more significant health-system burden everywhere. The main limitation to modeling the global burden of osteoarthritis was data sparsity; high-quality data collection should be prioritized and funded. Addressing the burden in the long term also requires a focus on prevention and access to highly effective treatments, including joint replacement. Further research is needed into known risk factors that cause osteoarthritis or increase severity and disease progression, such as high BMI. For many individuals, the burden of OA includes pain, activity limitations, and markedly reduced quality of life. OA is a disease that is not resolved and is typically accompanied by chronic pain. The recent rapid evidence assessment (REA) study investigated only the substantial burden of osteoarthritis in weight-bearing joints in Africa and the Middle East (15). Furthermore, WHO designated 2021–2030 to be the decade of healthy aging, with an emphasis not only on life expectancy but also the quality of life. This designation provides an opportunity to focus on the burden of osteoarthritis in the context of adult health (16), especially given the chronic nature of osteoarthritis and its effect on mobility and daily activities.

Osteoarthritis can manifest relatively early in adulthood, including people younger than 50 years (10, 17), and therefore, preventing or mitigating the effects of osteoarthritis could avoid decades of reduced quality of life.
The main objective of the current study is to assess the HR-QoL in osteoarthritis patient in Bahrain. To date, there has been limited evidence regarding the burden of OA in Bahrain. We aim to investigate the economic burden of OA disease, but also to gain a better insight into the patient's perception of their QoL.

MATERIALS AND METHODS

Patients self-report their symptoms and experiences using a structured questionnaire. The questionnaire covers domains such as joint pain, physical function, job, education, health care, children, husband, family happiness, emotion, support, and overall well-being.
The questionnaire (attached) comprises demographic data with general information in two parts (Part 1 and Part 2). Part 1 describes how a patient is satisfied with a particular area of their life. It contains domains with scores from 1 to 6, where one is Very Dissatisfied and 6 is Very Satisfied (Very Dissatisfied, Moderately Dissatisfied, Slightly Dissatisfied, Slightly Satisfied, Moderately Satisfied, and Very Satisfied). Part 2 describes how important a specific area of one's life is. It contains domains with scoring from 1 to 6, where 1 is Very Unimportant, and 6 is Very Important (Very Unimportant, Moderately Unimportant, Slightly Unimportant, Slightly Important, Moderately Important, Very Important).
Patients self-report their symptoms and experiences using a structured questionnaire. The questionnaire covers domains such as joint tenderness and swelling, pain, physical function, and overall well-being. Each item is rated on a scale of 0 to 10; for items 1 and 2, 0 = "completely," with higher scores indicating more significant disease activity.

The importance of our study.

We also aim to gain a better insight into the OA patient's perception of their quality of life (QoL).

Ethical considerations of the study.

For this study, we will obtain ethical approval from the Ethical Committee of the Institutional Review Board at Arabian Arabian Gulf University (E36-PI-03-24) and King Hamed University hospital (RMS-KHUH /IRB/ 2024-863). All participants have been informed of the confidentiality of this study. All patients participated as volunteers, and written consent participation.

Statistical analysis

For the data entry and verification, we used Excel Spreadsheet, which we exported into the IBM SPSS Statistics for Windows version 28.0 software (IBM Corp., Armonk, NY, USA). Categorical variables will be presented as frequency and percentages, while quantitative variables will be presented as mean ± standard deviation (SD), median and range. We will use Regression analysis and Pearson's correlation coefficient when needed. We will use a one-way analysis of the variance method and Student's T-test to compare the differences in QOL scores. Differences with $P < 0.05$ will be considered statistically significant.

RESULTS

This study included 98 patients (27 men and 71 women), with a mean age of 63.9 ± 10.7 years, and mean OA duration of 9.6 ± 7.8 years. The mean satisfaction score was 4.8 ± 0.6, and importance score was 5.3 ± 0.4, and weighted HR-QoL score of 26.7 ± 4.4. Among HR-QoL domains, the highest satisfaction was reported in spirituality/growth (5.5 ± 0.5) and general well-being (5.3 ± 0.7), while physical health satisfaction was the lowest (4.4 ± 1.0). For perceived importance, physical health (5.8 ± 0.5) and spirituality/growth (5.6 ± 0.8) ranked highest (Table 1 and Figure 5).
Figure 1 presents the distribution of key demographic characteristics among OA patients in the study cohort, highlighting variations in gender, nationality, marital status, education level, occupation, income, and BMI classification. Our results regarding Healthcare Utilization and Treatment Characteristics are shown in Figure 2. It displays the distribution of healthcare access, medication use, and functional limitations among OA patients. Percentages represent the proportion of participants reporting each characteristic, including medication adherence, doctor visit frequency, hospital admissions, sick leave, transportation dependence, and ability to perform daily tasks. Figure 3 illustrates the prevalence of comorbidities and other rheumatic or systemic conditions reported by OA patients. Percentages indicate the proportion of individuals affected by each condition, including deformities, diabetes, hypertension, cardiovascular disease, and family history of rheumatic disorders. Figure 4 presents smoking behaviors among OA patients across three panels: (A) general smoking status, (B) patients who currently smoke, and (C) patients who have quit smoking. Most patients reported never smoking, with smaller proportions indicating current or former use. Detailed breakdowns include type of smoking (e.g., cigarettes, hookah), frequency, and total duration.
Patients receiving injections ($U = 1525$, $p = 0.007$) or joint surgery ($U = 505.0$, $p = 0.001$) had significantly higher satisfaction and HR-QoL scores ($U = 1581.5$, $p = 0.005$; $U = 487.0$, $p = 0.004$). Physical deformities were associated with higher perceived importance and lower satisfaction in physical ($U = 815.0$, $p = 0.021$), psychological ($U = 990.0$, $p = 0.009$), and social domains ($U = 810.5$, $p = 0.023$). Hospital admissions and job disruption correlated with poorer HR-QoL, including lower satisfaction ($U = 1286.0$, $p = 0.041$), HR-QoL scores ($U = 1307.0$, $p = 0.027$), and greater importance ratings (Figure 6, A–M).
Manual labor and unemployment were linked to longer disease duration ($H = 24.1$, $p = 0.001$) and lower HR-QoL ($H = 15.4$, $p = 0.031$). Functional limitations were linked to older age ($U = 1231.0$, $p = 0.011$), longer disease duration ($U = 1322.5$, $p = 0.009$), and lower satisfaction in environment ($U = 1130.0$, $p = 0.048$) and physical health ($U = 1177.0$, $p = 0.012$). Transportation dependence negatively affected physical satisfaction ($H = 6.7$, $p = 0.036$). Past smoking was linked

to reduced importance in social (H = 10.2, p = 0.017), environmental domains (H = 8.6, p = 0.036), and overall (H = 8.3, p = 0.039), (Figure 6, N–W). Strong inter-domain satisfaction (ρ = 0.84) and negative correlations between hospitalizations and HR-QoL (ρ = –0.87 to –0.52) were observed (Figure 7).

Table 1. Descriptive Statistics of Patient Characteristics and HR-QoL Scores

Variable	Count	Mean (± SD)	Median (Range)
Age	98	63.9 ± 10.7	64 (19.0 - 92.0)
Weight (kg)	98	79.5 ± 15.2	79.5 (45.0 - 134.0)
Height (cm)	98	160.5 ± 8.2	160 (138.0 - 178.0)
BMI	98	31.0 ± 6.2	30.4 (17.6 - 59.6)
Disease Duration (years)	98	9.6 ± 7.8	7 (1.0 - 40.0)
Hospital Admission Count/Year	7	6.0 ± 6.9	2 (1.0 - 20.0)
Total Satisfaction Score	98	4.8 ± 0.6	4.8 (3.6 - 5.8)
Total Importance Score	98	5.3 ± 0.4	5.4 (3.5 - 5.8)
Weighted HR-QoL Score	98	26.7 ± 4.4	27.1 (12.9 - 34.9)
Satisfaction (Domain 1-6)			
Physical Health	98	4.4 ± 1.0	4.6 (2.0 - 6.0)
Psychological Well-Being	98	5.0 ± 0.8	5 (3.0 - 6.0)
Social Relationships	98	5.1 ± 0.7	5.1 (2.8 - 6.0)
Environment	98	4.3 ± 0.5	4.3 (2.7 - 5.2)
Spirituality / Growth	98	5.5 ± 0.5	5.5 (4.0 - 6.0)
General Well-being	98	5.3 ± 0.7	5.5 (3.5 - 6.0)
Importance (Domain 1-6)			
Physical Health	98	5.8 ± 0.5	6 (3.1 - 6.0)
Psychological Well-Being	98	5.6 ± 0.5	5.8 (3.2 - 6.0)
Social Relationships	98	5.4 ± 0.6	5.6 (3.1 - 6.0)
Environment	98	4.4 ± 0.5	4.5 (2.8 - 5.0)
Spirituality / Growth	98	5.6 ± 0.8	6 (2.0 - 6.0)
General Well-being	98	5.2 ± 0.6	5.2 (3.5 - 6.0)

Table 1. Summarizes the count, mean± standard deviation (SD), median, and range for key demographic and HR-QoL variables among OA patients. The HR-QoL assessment includes 35 items grouped into six domains: Physical Health, Psychological Well-Being, Social Relationships, Environment, Spirituality/Growth, and General Well-Being. Each domain was assessed for both satisfaction and importance. A Total Satisfaction Score and Total Importance Score were calculated across all items. Additionally, a Weighted HR-QoL Score was computed by multiplying each satisfaction score by its corresponding importance score, offering a patient-centered measure of perceived quality of life.

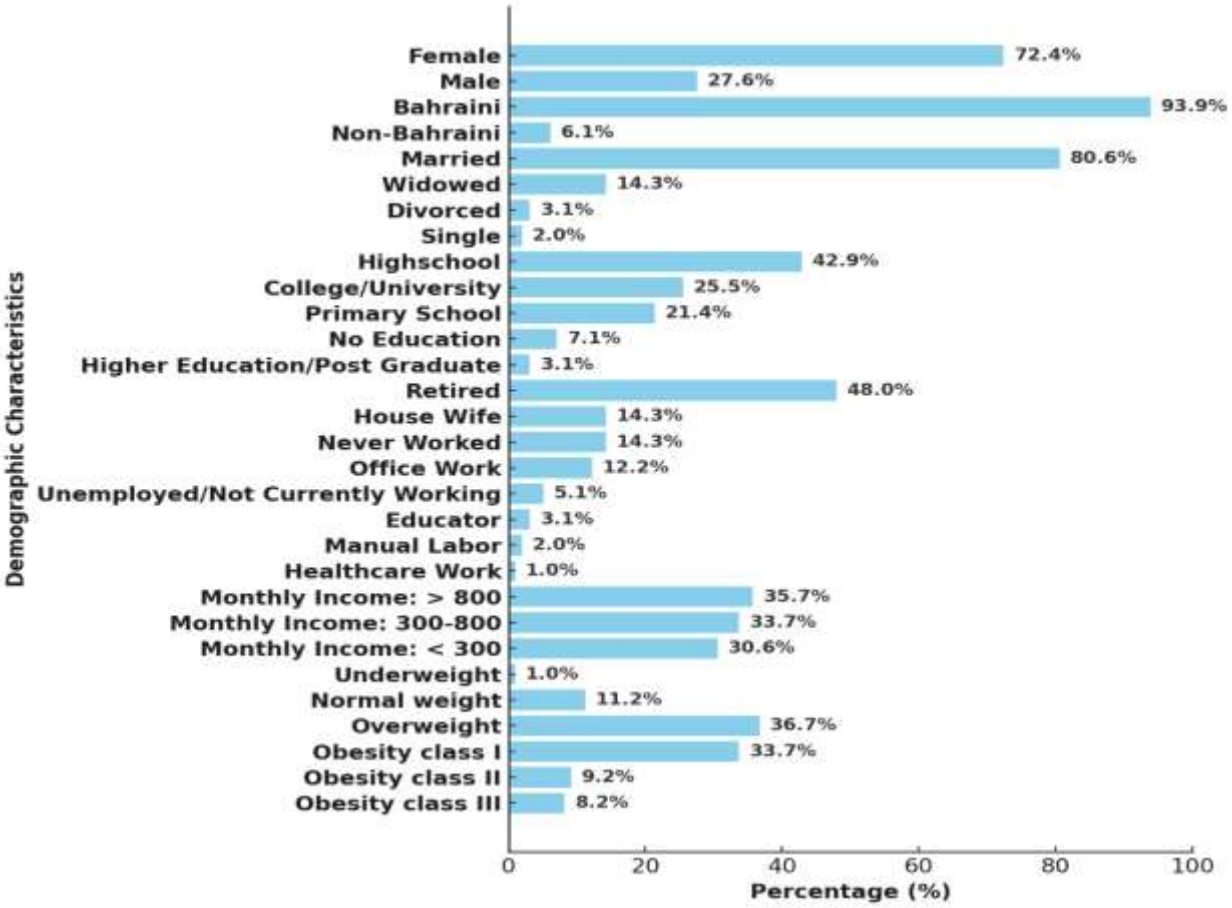

Figure 1. Demographic Characteristics

Figure 1. Demographic Characteristics. This figure presents the distribution of key demographic characteristics among OA patients in the study cohort. Percentages reflect the proportion of participants within each category, highlighting variations in gender, nationality, marital status, education level, occupation, income, and BMI classification.

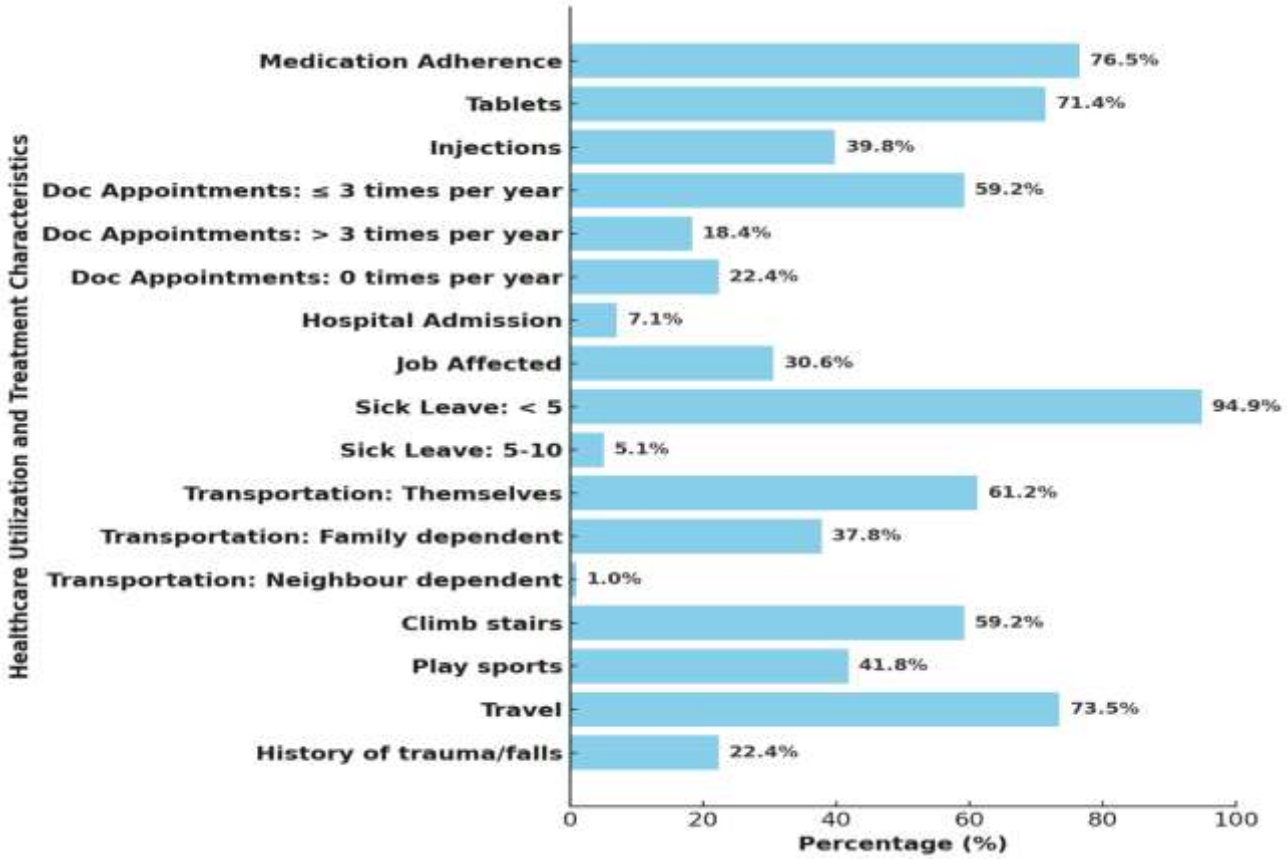

Figure 2. Healthcare Utilization and Treatment Characteristics

Figure 2. Healthcare Utilization and Treatment Characteristics This figure displays the distribution of healthcare access, medication use, and functional limitations among OA patients. Percentages represent the proportion of participants reporting each characteristic, including medication adherence, doctor visit frequency, hospital admissions, sick leave, transportation dependence, and ability to perform daily tasks.

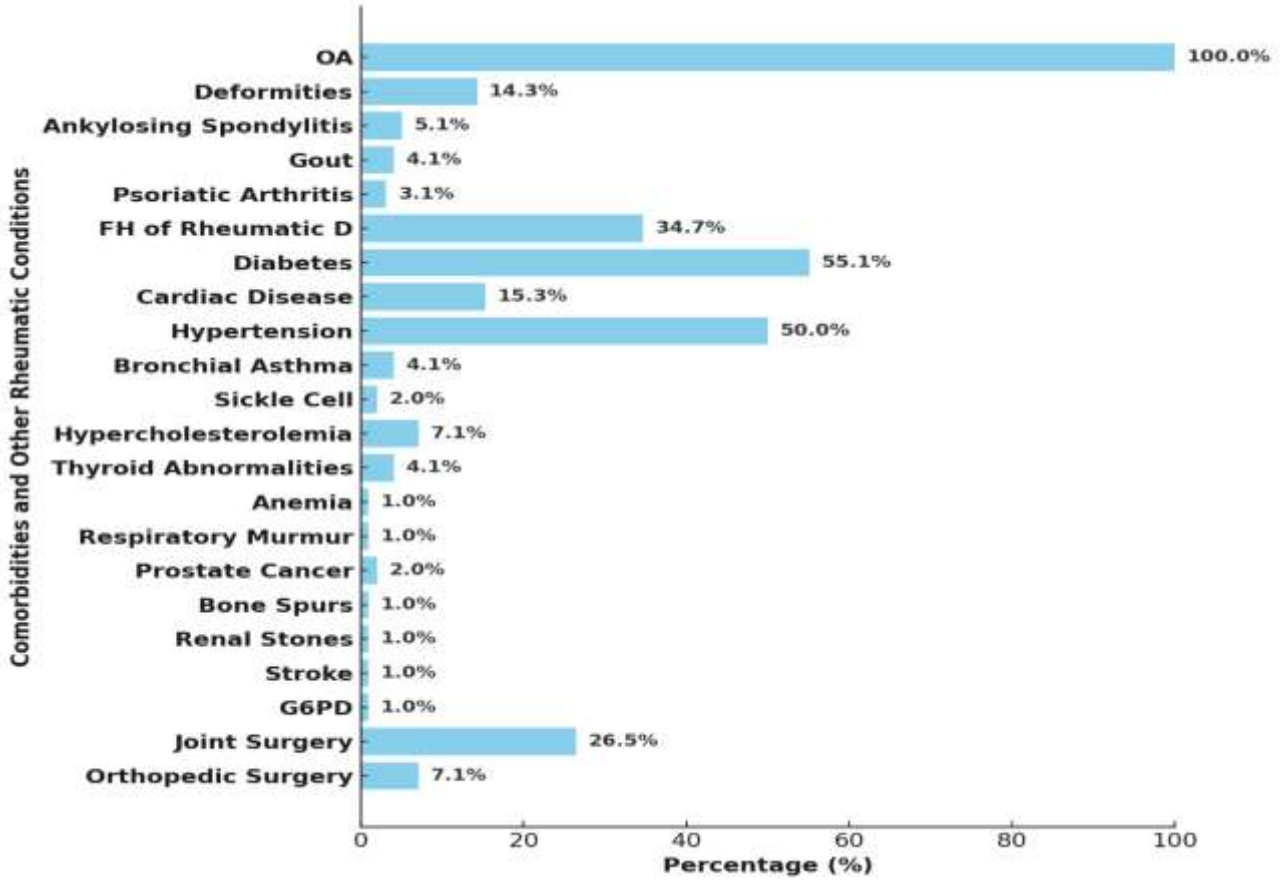

Figure 3. Comorbidities and Other Rheumatic Conditions

Figure 3. Comorbidities and Other Rheumatic Conditions This figure illustrates the prevalence of comorbidities and other rheumatic or systemic conditions reported by OA patients. Percentages indicate the proportion of individuals affected by each condition, including deformities, diabetes, hypertension, cardiovascular disease, and family history of rheumatic disorders.

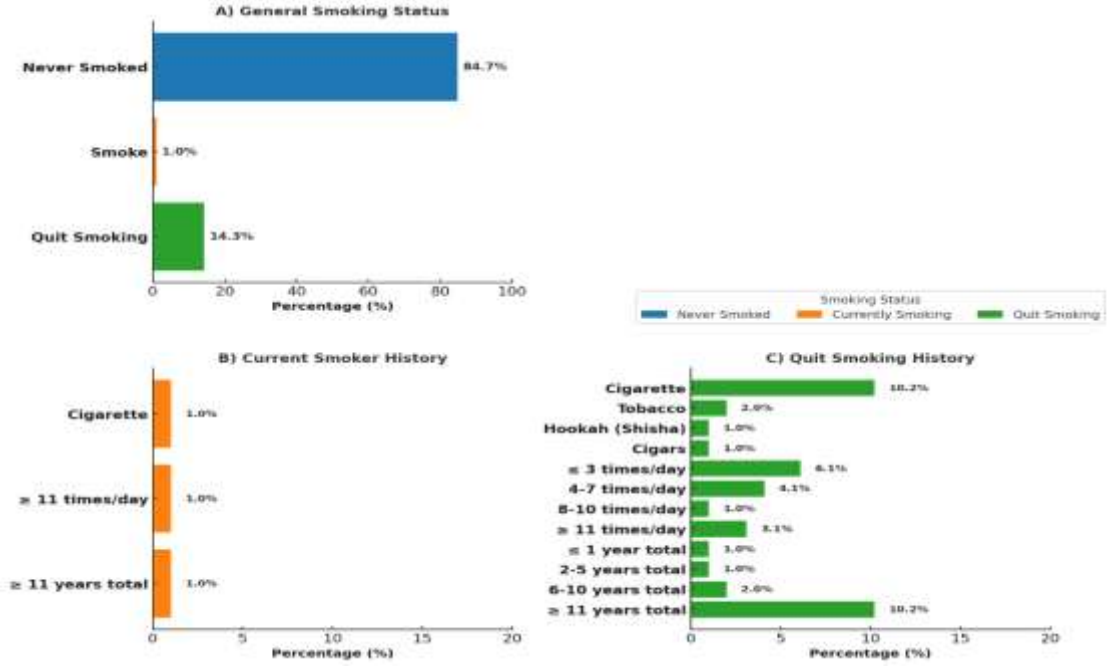

Figure 4. Smoking Status and History

Figure 4. Smoking Status and History This figure presents smoking behaviors among OA patients across three panels: (A) general smoking status, (B) patients who currently smoke, and (C) patients who have quit smoking. The majority of patients reported never smoking, with smaller proportions indicating current or former use. Detailed breakdowns include type of smoking (e.g., cigarettes, hookah), frequency, and total duration.

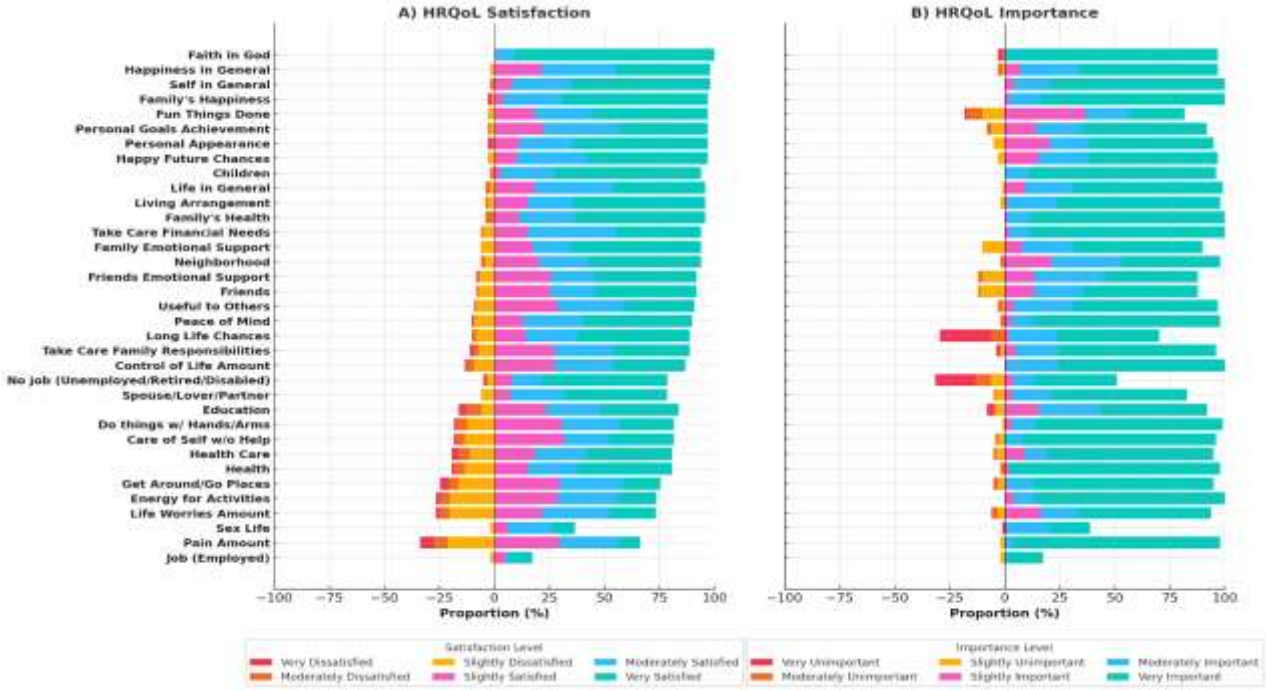

Figure 5. Diverging Stacked Bar Graph of HR-QoL Satisfaction and Importance Sorted by net satisfaction score: (sum of positives − sum of negatives)

Figure 5. Diverging Stacked Bar Graph of HR-QoL Satisfaction and Importance Sorted by net satisfaction score: (sum of positives − sum of negatives) This figure compares OA patients' ratings of satisfaction (Panel A) and importance (Panel B) across 35 HR-QoL domains. Responses are displayed as diverging stacked bar charts, sorted by net satisfaction score (sum of positive minus negative ratings). While high importance was placed on independence, physical health, and family-related domains, corresponding satisfaction levels were often lower in these areas. This side-by-side view reveals key gaps between what patient's value and their actual lived experiences, offering guidance for patient-centered care strategies.

Figures 6:

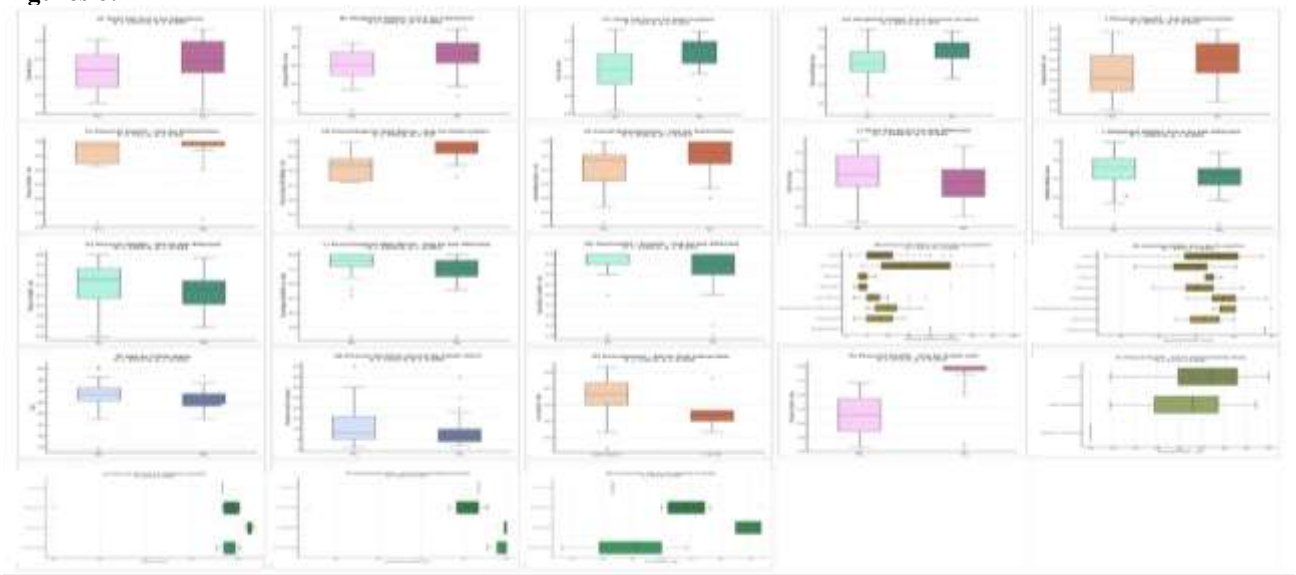

Figure 6. Composite summary of significant factors associated with HR-QoL.

Figure 6. Composite summary of significant factors associated with HR-QoL. This figure shows that treatment-related factors (injections and joint surgery) (A-D), physical deformities (E-H), Job affected (I-M), occupational impacts (N-O), functional limitations and clinical factors (P-S), transportation dependence (T), and smoking history (U-W) were significantly associated with HR-QoL outcomes. Panel titles report the corresponding Mann–Whitney U or Kruskal–Wallis H statistic and p-value. Only statistically significant findings discussed in the Results section are displayed.

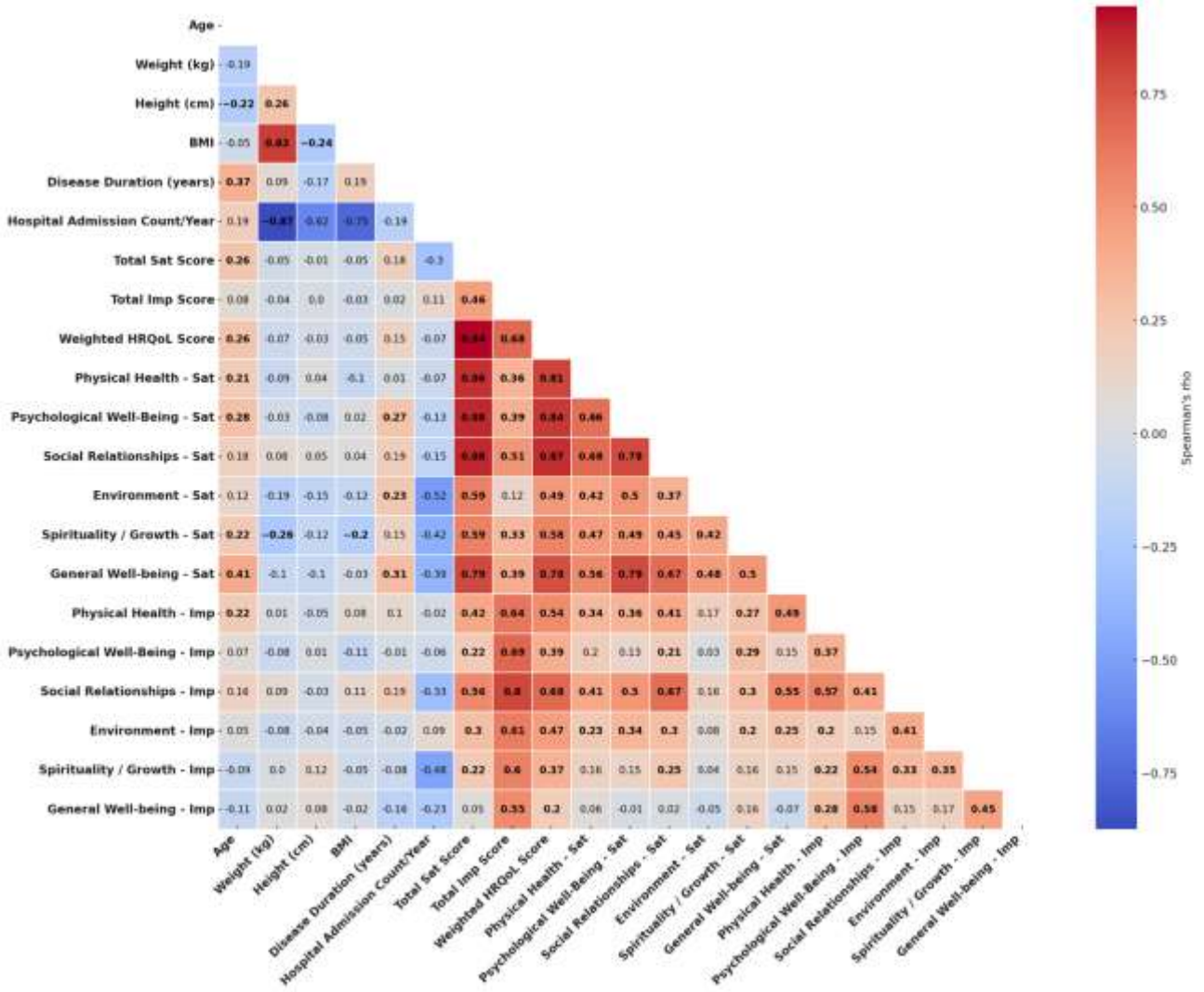

Figure 7. Spearman's rank Correlation Heatmap

Figure 7. This figure illustrates Spearman's rank correlation coefficients among continuous patient characteristics and HRQoL scores in OA patients. The heatmap includes variables such as age, anthropometrics, disease duration, hospital admissions, and both satisfaction and importance ratings across HRQoL domains. Strong positive correlations were observed among satisfaction and importance subdomains, as well as between BMI and weight. Notably, hospital admission count showed strong negative correlations with total and domain-specific satisfaction. Bolded values indicate statistically significant associations ($p < 0.05$), providing insight into interrelated patient-reported outcomes and clinical indicators.

DISCUSSION

This research examined the determinant of HR-QoL among patients with osteoarthritis (OA) in Bahrain, revealing important insight into the interaction between clinical, demographic, psychosocial element that impact patient wellness. The patient's cohort was predominantly older adults with a mean age of 64 years, a median disease duration of 7 years, and high prevalence of obesity. These characteristics are consistent with the global pattern highlighting the chronic nature of OA (18). The high incidence of comorbidity, notably diabetes mellitus, hypertension, and cardiovascular diseases, highlight the complex health challenge faced by this population.

Among the six assisted domains, the patients reported the highest satisfaction in areas of spirituality/growth and general well-being, this can be attributed to the patient's resilience being influenced by cultural and religious factors. In contrast, the environment and physical health received the lowest satisfaction, which is consistent with earlier Japanese study found that reduced physical activities were associated with low HR-QoL (19). Surprisingly, there was an obvious difference between the patients' satisfaction and their values. Domains such as independence, financial stability, and physical functioning were rated as highly important but showed lower satisfaction scores. This raises attention to unmet requirements and possible areas where Bahraini OA care could be improved by reevaluating how medical providers handle patients care, to guarantee that patient values are integrated into service enhancements to increase overall satisfaction and medical results.

OA is a known predictor of the onset of cardiovascular disease (CVD) in elderly individuals (20). The bivariate analysis of this study suggested that physical deformities, comorbidities (like diabetes mellitus and CVD), and a prior history of joint surgery were significantly linked to lower scores of HR-QoL in patients with OA (p values 0.021, 0.012, 0.001 respectively). The current results aligned with one longitudinal study in 2021 by Zhao T et al, who showed that OA

patients with various comorbid conditions experienced notable declines in HR-QoL over a span of 10 years, especially in areas related to independent living, social connections, and mental health (21). But also aligned with another longitudinal study that raised awareness of the importance of the long-term maintenance of exercise or physical activity to optimize HR-QoL and physical function (22). Additionally, we found that more frequent hospital visits and sick leaves were linked to decreased satisfaction, especially in the physical and environmental aspects of HR-QoL (p values 0.012, 0.048). Our results were consistent with another study conducted in Portugal by Costa D and his team (23). Our findings highlight how the combination of illness and dependence on healthcare services negatively affects overall well-being. Moreover, the current study revealed that the limitations in physical abilities such as trouble climbing stairs, traveling, and handling daily tasks had a notable negative effect on both physical and psychological HR-Qo (p value 0.036). Consistent with these findings, other two studies highlighted how pain, stiffness, and restrictions in daily activities significantly reduced quality of life for individuals with knee OA (24, 25). Our study together with these two studies emphasizes the importance of physical functionality in maintaining both mental and physical well-being in chronically ill populations
Overall, this research emphasizes the complex factors influencing HR-QoL in patients with chronic musculoskeletal and metabolic conditions. Strategies focused on reducing comorbidities, preserving functional independence, and enhancing work capacity could greatly improve the patient's satisfaction and overall quality of life in patients with osteoarthritis.

Limitations and strengths:
One limitation of this study was that majority of patients were not responding to our calls, messages or emails. Thus, the research took a long time. Some patients did not finish the questionnaires or skip some questions, so we must go back to them to fill in the gaps.

Recommendations:
Pain and physical function are the outcome measures of choice for assessing disability in osteoarthritis patients. To enhance HR-QoL for patients with OA in Bahrain, healthcare providers should prioritize a person-centered approach that integrates patient values into care strategies. Overall satisfaction may be greatly increased by using customized interventions to address unmet needs related to independence, financial security, and physical functioning. Preventive actions can also lessen the burden of disease, eliminating or minimizing the impact of disease and disability while promoting functional independence and preventing permanent disability or handicap.

CONCLUSIONS

This study highlights the interconnection of clinical, demographic, and psychosocial factors in shaping HR-QoL among OA patients. By incorporating holistic and proactive care models, medical providers can work towards more effective OA management, ultimately enhancing both patient satisfaction and health outcomes. Future studies should explore longitudinal trends and further assess the impact of personalized interventions on HR-QoL improvements. Moreover, a comparison between OA and other types of arthritis regarding QoL would be very valuable.

REFERENCES

1. Matcham F, Scott IC, Rayner L, Hotopf M, Kingsley GH, Norton S, et al. The impact of rheumatoid arthritis on quality-of-life assessed using the SF-36: a systematic review and meta-analysis. Semin Arthritis Rheum. 2014;44(2):123-30.
2. Sanjari M, Noorali S, Behnoush AH, Saeedi Moghaddam S, Fahimfar N, Azangou-Khyavy M, et al. The burden of rheumatoid arthritis and low back pain in North Africa and Middle East from 1990 to 2019: Results from the Global Burden of Disease Study 2019. Int J Rheum Dis. 2023;26(11):2170-82.
3. Cross M, Smith E, Hoy D, Carmona L, Wolfe F, Vos T, et al. The global burden of rheumatoid arthritis: estimates from the global burden of disease 2010 study. Ann Rheum Dis. 2014;73(7):1316-22.
4. 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(7):1323-30.
5. Hoy DG, Raikoti T, Smith E, Tuzakana A, Gill T, Matikarai K, et al. Use of The Global Alliance for Musculoskeletal Health survey module for estimating the population prevalence of musculoskeletal pain: findings from the Solomon Islands. BMC Musculoskelet Disord. 2018;19(1):292.
6. Hoy DG, Smith E, Cross M, Sanchez-Riera L, Blyth FM, Buchbinder R, et al. Reflecting on the global burden of musculoskeletal conditions: lessons learnt from the global burden of disease 2010 study and the next steps forward. Ann Rheum Dis. 2015;74(1):4-7.
7. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012;380(9859):2095-128.
8. March L, Smith EU, Hoy DG, Cross MJ, Sanchez-Riera L, Blyth F, et al. Burden of disability due to musculoskeletal (MSK) disorders. Best Pract Res Clin Rheumatol. 2014;28(3):353-66.
9. Murray CJ, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012;380(9859):2197-223.
10. Sepanlou SG, Parsaeian M, Krohn KJ, Afshin A, Farzadfar F, Roshandel G, et al. Disability-Adjusted Life-Years (DALYs) for 315 Diseases and Injuries and Healthy Life Expectancy (HALE) in Iran and its Neighboring Countries, 1990-2015: Findings from Global Burden of Disease Study 2015. Arch Iran Med. 2017;20(7):403-18.

11. Smith E, Hoy D, Cross M, Merriman TR, Vos T, Buchbinder R, et al. The global burden of gout: estimates from the Global Burden of Disease 2010 study. Ann Rheum Dis. 2014;73(8):1470-6.
12. Smith E, Hoy DG, Cross M, Vos T, Naghavi M, Buchbinder R, et al. The global burden of other musculoskeletal disorders: estimates from the Global Burden of Disease 2010 study. Ann Rheum Dis. 2014;73(8):1462-9.
13. Yang W, Xu Y, Lin J, Liu J, Tan Y, Chen J, et al. Global, regional and national burden of rheumatoid arthritis, and attributable risk factors from 1990 to 2019: update from the Global Burden of Disease 2019 study. Clin Exp Rheumatol. 2023;41(7):1516-27.
14. Alzahrani H, Alshehri MA, Alotaibi M, Alhowimel A, Alodaibi F, Alamam D, et al. Burden of musculoskeletal disorders in the gulf cooperation council countries, 1990-2019: Findings from the global burden of disease study 2019. Front Med (Lausanne). 2022;9:855414.
15. Al Saleh J, Almoallim H, Elzorkany B, Al Belooshi A, Batouk O, Fathy M, et al. Assessing the Burden of Osteoarthritis in Africa and the Middle East: A Rapid Evidence Assessment. Open Access Rheumatol. 2023;15:23-32.
16. Behr LC, Simm A, Kluttig A, Grosskopf Grosskopf A. 60 years of healthy aging: On definitions, biomarkers, scores and challenges. Ageing Res Rev. 2023;88:101934.
17. Moradi-Lakeh M, Forouzanfar MH, Vollset SE, El Bcheraoui C, Daoud F, Afshin A, et al. Burden of musculoskeletal disorders in the Eastern Mediterranean Region, 1990-2013: findings from the Global Burden of Disease Study 2013. Ann Rheum Dis. 2017;76(8):1365-73.
18. Sun X, Zhen X, Liu K, Yang W, Gu S, Zhang X, et al. Body mass index and health-related quality of life of outpatients with knee osteoarthritis: evidence from a cross-sectional study. BMC Musculoskelet Disord. 2025;26(1):220.
19. Yokota A, Maeshima E, Sasaki K, Ooi T, Sainoh T, Hosokawa H. Physical functions associated with health-related quality of life in older adults diagnosed with knee osteoarthritis. J Phys Ther Sci. 2023;35(1):60-5.
20. Veronese N, Trevisan C, De Rui M, Bolzetta F, Maggi S, Zambon S, et al. Association of Osteoarthritis With Increased Risk of Cardiovascular Diseases in the Elderly: Findings From the Progetto Veneto Anziano Study Cohort. Arthritis Rheumatol. 2016;68(5):1136-44.
21. Zhao T, Winzenberg T, Aitken D, Graaff B, Ahmad H, Jones G, et al. The impact of comorbidities on health-related quality of life of people with osteoarthritis over 10 years. Rheumatology (Oxford). 2021;61(1):139-45.
22. Lopes DG, Costa D, Cruz EB, Mendonca N, Henriques AR, Branco J, et al. Association of physical activity with physical function and quality of life in people with hip and knee osteoarthritis: longitudinal analysis of a population-based cohort. Arthritis Res Ther. 2023;25(1):14.
23. Costa D, Rodrigues AM, Cruz EB, Canhao H, Branco J, Nunes C. Driving factors for the utilisation of healthcare services by people with osteoarthritis in Portugal: results from a nationwide population-based study. BMC Health Serv Res. 2021;21(1):1022.
24. Lee SH, Nho JH, Kim HY, Lee EJ. Factors influencing health-related quality of life in older adult women with sarcopenia: analysis of the Korean National Health and Nutrition Examination Survey 2019. Korean J Women Health Nurs. 2023;29(4):328-36.
25. Shim HY, Park M, Kim HJ, Kyung HS, Shin JY. Physical activity status by pain severity in patients with knee osteoarthritis: a nationwide study in Korea. BMC Musculoskelet Disord. 2018;19(1):380.