

ORIGINAL ARTICLE

Comorbidities among patients with rheumatoid arthritis in Qassim, Saudi Arabia: a retrospective cross-sectional study

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ABSTRACT

Background: Comorbidities contribute substantially to morbidity and treatment complexity in rheumatoid arthritis (RA), but regional data from Saudi Arabia are limited. This study assessed the prevalence, patterns, and factors associated with documented comorbidities among patients with RA in Qassim.

Methodology: This retrospective cross-sectional medical-record study included 793 eligible adults with RA followed or treated at King Fahad Specialist Hospital during 2015–2025. Comorbidities were identified from documented physician diagnoses and relevant clinical or laboratory information. Multivariable logistic regression assessed factors associated with the presence of at least one comorbidity using complete-case analysis.

Results: Overall, 538 patients (67.8%) had at least one comorbidity. Hypertension (233, 29.4%), diabetes mellitus (203, 25.6%), and hypothyroidism (169, 21.3%) were most frequent. One comorbidity was present in 199 patients (25.1%), two in 151 (19.0%), and three or more in 188 (23.7%). In the expanded model ($n = 777$), age was independently associated with comorbidity presence (adjusted odds ratio 1.076 per year, 95% confidence interval 1.059–1.093; $p < 0.001$); other included variables were not statistically significant.

Conclusions: Comorbidities were common among patients with RA, particularly hypertension, diabetes, and hypothyroidism. Older age was independently associated with comorbidity burden. Routine comorbidity assessment should be integrated into RA care, while findings should be interpreted in light of the retrospective single-center design.

Keywords: Rheumatoid arthritis, comorbidity, multimorbidity, Qassim, Saudi Arabia.

Introduction

Rheumatoid arthritis (RA) is a chronic autoimmune inflammatory disease characterized by persistent synovial inflammation, progressive joint destruction, extra-articular manifestations, and systemic comorbidity [1]. Its global prevalence is approximately 0.5%–1% [1]. Global Burden of Disease estimates have reported a comparatively low prevalence of RA in Saudi Arabia; these estimates should be interpreted as national modeled estimates rather than region-specific prevalence measurements [2]. In 2019, RA affected an estimated 18 million people worldwide, with women representing approximately 70% of cases and more than half of affected individuals being older than 55 years [3].

Advances in early disease-modifying antirheumatic drug (DMARD) treatment, biologic therapies, and treat-to-

target strategies have improved disease control and long-term outcomes [4]. Nevertheless, morbidity and mortality in RA are strongly influenced by coexisting conditions, including cardiovascular and metabolic disease, osteoporosis, infection, depression, and malignancy [5,6]. Cardiovascular mortality is substantially higher in

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RA than in the general population [7], while depression is common and is associated with poorer treatment response and clinical outcomes [8]. Consequently, international recommendations emphasize systematic identification and management of comorbidities in inflammatory rheumatic disease [9].

Saudi studies have also demonstrated a substantial comorbidity burden in RA, but regional patterns may vary according to patient characteristics, referral setting, screening practices, and methods of comorbidity ascertainment [12,13]. Data from the Qassim region remain limited. Therefore, this study aimed to determine the prevalence and pattern of documented comorbidities and to identify factors associated with the presence of at least one comorbidity among patients with RA receiving care at King Fahad Specialist Hospital.

Methods

Study design and setting

A retrospective cross-sectional medical-record study was conducted at King Fahad Specialist Hospital (KFSH) in the Qassim region of Saudi Arabia. The source population comprised patients diagnosed with RA who were followed and/or treated at KFSH during 2015–2025. The study was classified as cross-sectional because the primary analysis assessed the presence of documented comorbidities from retrospectively reviewed records rather than incident outcomes over a defined longitudinal follow-up period.

Study population and sampling

A retrospective, non-probability consecutive sampling approach was used. All eligible RA patients with available medical records at KFSH during the study period were included consecutively. A total of 793 eligible records were identified and all 793 were included in the final descriptive analysis; no otherwise eligible records were excluded after application of the predefined eligibility criteria.

Eligibility criteria

Patients were eligible if they: (1) had a diagnosis of RA according to either the 1987 American College of Rheumatology (ACR) classification criteria or the 2010 ACR/European League Against Rheumatism (EULAR) classification criteria [10,11]; (2) were aged 18 years or older at diagnosis; and (3) were followed and/or treated at KFSH during 2015–2025. Patients younger than 18 years were excluded. No additional exclusion criteria were applied.

Data collection and variable definitions

Demographic and clinical information was retrospectively extracted using a structured data collection form developed for this study. Recorded variables included age, sex, height, weight, smoking status, date of RA diagnosis, RA serostatus, erythrocyte sedimentation rate (ESR), current conventional DMARD and glucocorticoid use, current biologic/targeted therapy, and up to seven

documented comorbid conditions. The comorbidity fields were based on relevant literature and prior studies and were reviewed by consultant rheumatologists.

For this analysis, a comorbidity was defined operationally as any non-RA diagnosis documented by the treating physician and captured in the comorbidity fields, with relevant clinical or laboratory information available in the medical record where applicable. No study-specific active screening or uniform re-diagnosis of each condition was performed. Thus, the prevalence estimates represent conditions documented during routine care. The extraction data did not systematically distinguish active disease from a historical diagnosis or record the onset date of each comorbidity; therefore, conditions could not be classified as pre-existing at RA diagnosis versus developing subsequently. In the revised data audit, obvious spelling and capitalization variants were standardized and duplicate entries of the same condition within a patient were counted once.

Seropositive RA was defined as documented positivity for rheumatoid factor (RF) and/or anti-cyclic citrullinated peptide (anti-CCP) antibodies; patients negative for both markers were classified as seronegative [11]. Assay-specific numerical RF and anti-CCP cutoff values were not available in the extracted dataset, so the documented laboratory interpretation was used. Body mass index (BMI) was calculated from the most recent documented height and weight as weight in kilograms divided by height in meters squared (kg/m^2). Five records with implausible or unparseable height entries were treated as missing for BMI-dependent analyses rather than being silently corrected. For the revised analysis, RA duration was derived as 2025 minus the recorded year of RA diagnosis; one malformed diagnosis date could not be used for this variable.

Missing data

Missingness was assessed during data cleaning. No imputation was performed. Descriptive and bivariate analyses used available data for each variable. The expanded multivariable model used complete-case analysis. Three records had missing RA serostatus, eight had missing or non-numeric ESR values, five had unavailable BMI values after source-data quality checks, and one had an unusable RA diagnosis date; because one patient had more than one missing covariate, 777 patients were included in the complete-case regression model.

Statistical analysis

Categorical variables were summarized as frequencies and percentages, and age was summarized using the mean and SD. The presence of at least one recorded comorbidity was the binary dependent variable. Pearson chi-square tests were used for exploratory bivariate associations. Because only four patients were underweight, underweight and normal BMI were combined as $\text{BMI} < 25 \text{ kg/m}^2$ for the bivariate analysis, while BMI was entered as a continuous variable in multivariable regression. Smoking was modeled as ever versus never smoking in the regression because of the small numbers of current and former smokers. ESR

was entered as a continuous variable, with odds ratios expressed per 10-mm/h increase.

The multivariable logistic regression model included covariates selected a priori for clinical relevance rather than by univariable statistical significance: age, sex, continuous BMI, ever-smoking status, RA duration, seropositivity, ESR, methotrexate, hydroxychloroquine, leflunomide, sulfasalazine, prednisolone, any current biologic therapy, and tofacitinib. Azathioprine was not entered separately because only four patients were receiving it. Adjusted odds ratios with 95% confidence intervals (CIs) were reported. A two-sided p -value <0.05 was considered statistically significant. No multiplicity adjustment was applied to the exploratory bivariate tests; these findings were therefore interpreted as hypothesis-generating. The revised statistical analyses were performed using Python version 3.13.5 (Python Software Foundation, Wilmington, DE) with statsmodels version 0.14.6.

Ethical considerations

Ethical approval was obtained from the Qassim Institutional Review Board, Ministry of Health, Kingdom of Saudi Arabia (Registration No. 607-47-2916; approved September 1, 2025). The study was conducted in accordance with the Declaration of Helsinki. Patient information was handled confidentially and data were anonymized before analysis.

Results

A total of 793 patients with RA were included. The mean (SD) age was 54.02 (13.43) years and 644 patients (81.2%) were female. Based on calculable BMI values, 357 patients (45.0% of the total sample) were overweight and 195 (24.6%) were obese; BMI could not be calculated reliably for five records. Most patients had never smoked (773, 97.5%). Using the revised diagnosis-year derivation, 402 patients (50.7%) had an RA duration of 5–10 years, 260 (32.8%) had <5 years, 130 (16.4%) had >10 years, and one diagnosis date was unusable. Seropositive RA was documented in 642 patients (81.0%). The most frequently recorded conventional treatments were hydroxychloroquine (331, 41.7%) and methotrexate (329, 41.5%); abatacept (68, 8.6%) and rituximab (60, 7.6%) were the most frequently recorded biologic therapies (Table 1).

At least one documented comorbidity was present in 538 patients (67.8%). After conservative normalization of obvious spelling and wording variants and patient-level deduplication, the most frequent conditions were hypertension (233, 29.4%), diabetes mellitus (203, 25.6%), hypothyroidism (169, 21.3%), osteoarthritis (67, 8.4%), dyslipidemia (60, 7.6%), bronchial asthma (58, 7.3%), anemia (46, 5.8%), and coronary artery disease (46, 5.8%) (Table 2). The revised audit also identified less frequent conditions relevant to comprehensive RA comorbidity assessment, including malignancy, stroke, venous thromboembolism, gastroesophageal reflux disease, carpal tunnel syndrome, and fibromyalgia.

The distribution of comorbidity burden was unchanged after data cleaning: 255 patients (32.2%) had no recorded

Table 1. Demographic and clinical characteristics of the study population ($N = 793$).

Characteristic	<i>n</i>	%
Age, years, mean (SD)	54.02 (13.43)	—
Age group, years		
<40	118	14.9
40–60	414	52.2
>60	261	32.9
Sex		
Female	644	81.2
Male	149	18.8
BMI category		
Underweight	4	0.5
Normal	232	29.3
Overweight	357	45.0
Obesity	195	24.6
Missing/unavailable	5	0.6
Smoking status		
Never	773	97.5
Current	13	1.6
Ex-smoker	7	0.9
RA duration, years		
<5	260	32.8
5–10	402	50.7
>10	130	16.4
Missing	1	0.1
RA serostatus		
Seropositive	642	81.0
Seronegative	148	18.7
Missing	3	0.4
ESR, mm/h		
≤ 20	279	35.2
>20	506	63.8
Missing/non-numeric	8	1.0
Current conventional DMARDs/ glucocorticoid		
Hydroxychloroquine	331	41.7
Methotrexate	329	41.5
Prednisolone	93	11.7
Leflunomide	93	11.7
Sulfasalazine	71	9.0
Azathioprine	4	0.5
Current biologic/targeted therapy		
Abatacept	68	8.6
Rituximab	60	7.6
Etanercept	55	6.9
Tocilizumab	28	3.5
Certolizumab pegol	24	3.0
Tofacitinib	17	2.1
Adalimumab	12	1.5
Infliximab	1	0.1

BMI, body mass index; DMARD, disease-modifying antirheumatic drug; ESR, erythrocyte sedimentation rate; RA, rheumatoid arthritis. Treatment categories are not mutually exclusive. Percentages use $N = 793$ as the denominator.

Table 2. Documented comorbidities among patients with rheumatoid arthritis (N = 793).

Comorbidity	n	%
Hypertension	233	29.4
Diabetes mellitus	203	25.6
Hypothyroidism	169	21.3
Osteoarthritis	67	8.4
Dyslipidemia	60	7.6
Bronchial asthma	58	7.3
Anemia	46	5.8
Coronary artery disease	46	5.8
Osteoporosis	39	4.9
Interstitial lung disease	23	2.9
Vitamin D deficiency	21	2.6
Chronic kidney disease	21	2.6
Psychiatric disorder (depression/anxiety)	14	1.8
Cancer/malignancy (as recorded)	14	1.8
Sjögren syndrome	12	1.5
Stroke	11	1.4
Valvular heart disease	10	1.3
Latent tuberculosis	10	1.3
Bronchiectasis	9	1.1
Gastroesophageal reflux disease	7	0.9
Deep vein thrombosis	7	0.9
Carpal tunnel syndrome	5	0.6
Pulmonary embolism	3	0.4
Fibromyalgia	2	0.3
Peptic ulcer disease	1	0.1

Note. Patients could have more than one comorbidity. Counts are unique patients per condition after standardization of obvious spelling/case variants. "Cancer/malignancy" includes records explicitly entered as cancer. The dataset did not contain a standardized serious-infection outcome; selected infectious diagnoses were therefore not combined into a serious-infection category.

comorbidity, 199 (25.1%) had one, 151 (19.0%) had two, and 188 (23.7%) had three or more (Figure 1).

In exploratory bivariate analyses, age group was strongly associated with the presence of at least one comorbidity ($p < 0.001$). Comorbidities were present in 40.7% of patients aged <40 years, 62.8% of those aged 40–60 years, and 88.1% of those aged >60 years. Sex, BMI group, smoking status, RA duration, serostatus, and the ESR category did not reach statistical significance (Table 3).

The expanded multivariable logistic regression included 777 complete cases. Increasing age remained independently associated with the presence of at least one comorbidity (AOR 1.076 per year; 95% CI 1.059–1.093; $p < 0.001$). Sex, continuous BMI, ever-smoking, RA duration, seropositivity, ESR, methotrexate, hydroxychloroquine, leflunomide, sulfasalazine, prednisolone, biologic therapy, and tofacitinib were not statistically significant after adjustment (Table 4).

Discussion

In this retrospective cross-sectional study of 793 patients with RA receiving care at a tertiary hospital in Qassim, 67.8% had at least one documented comorbidity and 42.7% had two or more. Hypertension, diabetes mellitus, and hypothyroidism were the most frequent conditions. After the reviewer-requested expansion of the multivariable model to include disease duration, serostatus, inflammatory activity, BMI, smoking, and treatment variables, increasing age remained the only statistically significant independent correlate of comorbidity presence. These findings emphasize the substantial multimorbidity burden encountered in routine RA care while also showing that the observed

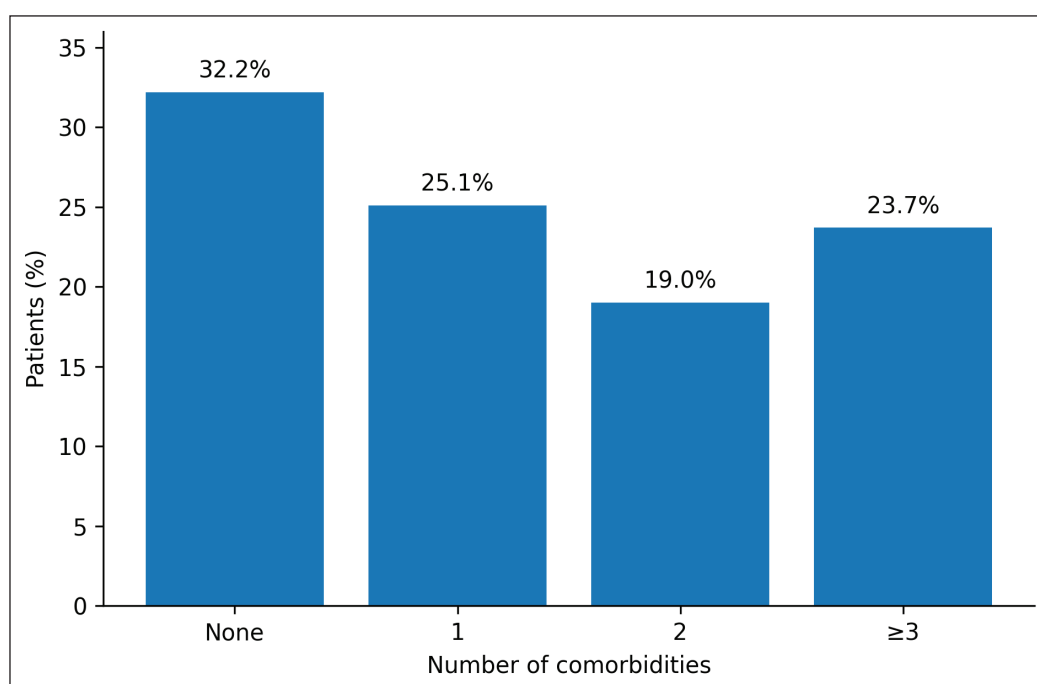


Figure 1. Number of comorbidities per patient.

Table 3. Association between selected characteristics and presence of at least one comorbidity.

Variable	Category	No comorbidity n (%)	≥1 comorbidity n (%)	χ ²	p-value
Age group, years	<40	70 (59.3)	48 (40.7)	93.94	<0.001
	40–60	154 (37.2)	260 (62.8)		
	>60	31 (11.9)	230 (88.1)		
Sex	Female	208 (32.3)	436 (67.7)	0.03	0.859
	Male	47 (31.5)	102 (68.5)		
BMI, kg/m ²	<25	81 (34.3)	155 (65.7)	3.69	0.158
	25–29.9	121 (33.9)	236 (66.1)		
	≥30	52 (26.7)	143 (73.3)		
Smoking status	Never	248 (32.1)	525 (67.9)	2.19	0.334
	Current	6 (46.2)	7 (53.8)		
	Ex-smoker	1 (14.3)	6 (85.7)		
RA duration, years	<5	91 (35.0)	169 (65.0)	3.11	0.211
	5–10	130 (32.3)	272 (67.7)		
	>10	34 (26.2)	96 (73.8)		
RA serostatus	Seronegative	42 (28.4)	106 (71.6)	1.27	0.260
	Seropositive	213 (33.2)	429 (66.8)		
ESR, mm/h	≤20	101 (36.2)	178 (63.8)	3.34	0.068
	>20	151 (29.8)	355 (70.2)		

BMI, body mass index; ESR, erythrocyte sedimentation rate; RA, rheumatoid arthritis. Pearson chi-square tests were used. Missing values were excluded variable-by-variable. Underweight and normal BMI were combined because only four patients were underweight.

Table 4. Multivariable logistic regression of factors associated with at least one comorbidity (complete-case n = 777).

Variable	AOR	95% CI	p-value
Age, per year	1.076	1.059–1.093	<0.001
Male sex (vs. female)	0.813	0.503–1.315	0.399
BMI, per kg/m ²	1.008	0.969–1.048	0.707
Ever smoker (vs. never)	0.943	0.316–2.811	0.916
RA duration, per year	1.007	0.974–1.042	0.673
Seropositive RA (vs. seronegative)	0.803	0.513–1.257	0.337
ESR, per 10 mm/h	1.007	0.944–1.075	0.828
Methotrexate use	0.869	0.596–1.268	0.467
Hydroxychloroquine use	1.094	0.750–1.597	0.640
Leflunomide use	0.839	0.452–1.558	0.579
Sulfasalazine use	0.964	0.536–1.733	0.902
Prednisolone use	1.384	0.794–2.412	0.251
Any biologic therapy	0.693	0.465–1.032	0.071
Tofacitinib use	0.476	0.157–1.442	0.189

AOR, adjusted odds ratio; BMI, body mass index; CI, confidence interval; ESR, erythrocyte sedimentation rate; RA, rheumatoid arthritis. Covariates were selected a priori for clinical relevance. No imputation was performed.

associations are dominated by age rather than the other measured cross-sectional characteristics.

The overall comorbidity prevalence was lower than the 96.7% reported by Alghamdi *et al.* in a Saudi cohort of 150 patients with RA [12], but it lies within or near the ranges described in several international RA cohorts [5, 6, 14–17]. The difference from Alghamdi *et al.* may reflect differences in study size, referral population, the breadth of conditions captured, and methods of medical-record ascertainment. Our cohort was considerably larger and the revised analysis used patient-level deduplication

of comorbidity entries. The high proportion of patients with multiple conditions is clinically important because multimorbidity can complicate therapeutic choices, monitoring requirements, functional status, and healthcare utilization.

Hypertension affected 29.4% of the present cohort, a prevalence reasonably close to the 32.35% reported in a Saudi study of 1,490 patients with RA by Al-Ahmari [13]. Diabetes mellitus was present in 25.6% after reconciliation of spelling variants across the raw comorbidity fields. The coexistence of hypertension, diabetes, dyslipidemia, coronary disease, and chronic kidney disease underscores the need for integrated cardiovascular and metabolic risk assessment in RA rather than focusing exclusively on joint disease. These conditions may reflect a combination of age, conventional population risk factors, chronic systemic inflammation, treatment exposure, and healthcare-detection patterns.

Hypothyroidism was documented in 21.3% of patients and therefore deserves specific attention. Autoimmune clustering offers a biologically plausible explanation: a systematic review and meta-analysis of 29 studies involving 35,708 patients with RA found higher odds of thyroid dysfunction, particularly hypothyroidism, in RA than in non-RA controls [19]. Nevertheless, the present study had no non-RA comparison group and did not use a study-specific thyroid-screening protocol. The relatively high prevalence could therefore reflect a true autoimmune association, local population characteristics, greater testing among patients with chronic autoimmune disease, or differential documentation. These data should not be interpreted as demonstrating that RA caused hypothyroidism or that the prevalence is higher than in the general Saudi population.

Age was the strongest and most consistent factor associated with comorbidity. Each additional year of age was associated with approximately 7.6% higher adjusted odds of having at least one documented comorbidity. This finding is consistent with the Spanish COMORA analysis by Balsa et al., in which age was an important determinant of comorbidity burden [18], and with the general accumulation of cardiovascular, metabolic, musculoskeletal, and endocrine disease with advancing age. Clinically, this supports a lower threshold for structured comorbidity review in older patients with RA.

The revised regression also addressed medication-related confounding. Current methotrexate, hydroxychloroquine, leflunomide, sulfasalazine, prednisolone, biologic therapy, and tofacitinib use were not independently associated with overall comorbidity presence after adjustment. This differs from Alghamdi et al., who reported associations with methotrexate and biologic therapy [12], illustrating how treatment–comorbidity relationships can vary by design and case mix. Importantly, the absence of a significant association in our cross-sectional model does not establish treatment safety or lack of effect. Current therapy may be influenced by age, disease severity, prior adverse events, contraindications, and existing comorbidities (confounding by indication). In addition, the dataset did not capture cumulative drug dose or duration. Glucocorticoid exposure is particularly relevant: observational evidence in RA has associated glucocorticoids with increased risks of diabetes, osteoporosis, cardiovascular/thrombotic events, serious infection, and mortality [20]. Medication-related findings in the present study should therefore be interpreted cautiously.

From a clinical perspective, the results support systematic comorbidity assessment as part of routine rheumatology care. Blood pressure, glycemic status, lipid profile, bone health, cardiovascular risk factors, and clinically indicated thyroid assessment should be reviewed alongside RA disease activity and medication safety. The relatively high thyroid-disease burden in this cohort suggests that clinicians should remain alert to symptoms and laboratory abnormalities consistent with thyroid dysfunction, while screening decisions should follow applicable clinical guidance rather than the prevalence estimate from this single study alone. Coordination with primary care and relevant specialties may be especially valuable for older patients and those with multiple coexisting conditions.

Several limitations should be considered. First, the retrospective design relied on routinely documented medical records and is vulnerable to incomplete documentation, under-ascertainment, and diagnostic misclassification. Conditions were not re-confirmed using uniform study-specific criteria or a common ICD-based algorithm, and active disease could not always be distinguished from a historical diagnosis. Dates of comorbidity onset were unavailable, preventing determination of whether conditions preceded RA or developed later. Second, consecutive non-probability sampling at a single tertiary hospital limits generalizability to other Saudi regions and community settings and may

introduce referral or selection effects despite inclusion of all eligible available records. Third, the study did not include a non-RA control group and therefore cannot estimate excess comorbidity risk attributable to RA.

Fourth, the medication variables represented current treatment and did not capture cumulative exposure, dose, treatment sequence, or adherence; residual confounding by disease severity and treatment indication is therefore likely. Fifth, assay-specific RF and anti-CCP cutoff values were not available in the extracted dataset, and disease duration had to be derived from diagnosis year for the revised analysis. Sixth, although missingness was limited and no imputation was used, five BMI records, eight ESR values, three serostatus values, and one diagnosis date were unavailable or ambiguous; the complete-case regression therefore included 777 patients. Seventh, some subgroups were very small, particularly underweight patients and current/former smokers, reducing power to detect associations in these groups. Finally, multiple exploratory bivariate comparisons were performed without adjustment for multiplicity. The findings should therefore be interpreted as hypothesis-generating rather than confirmatory, and causal relationships cannot be inferred.

Conclusion

Documented comorbidities were common among patients with RA receiving tertiary care in Qassim, with hypertension, diabetes mellitus, and hypothyroidism most frequently recorded. Older age was independently associated with the presence of comorbidity after adjustment for demographic, disease-related, inflammatory, and treatment variables. These results support structured assessment and coordinated management of coexisting conditions in RA, particularly in older patients, while recognizing that the retrospective single-center design does not establish causality or population-level prevalence.

List of Abbreviations

RA	Rheumatoid arthritis
DMARD	Disease-modifying antirheumatic drug
ESR	Erythrocyte sedimentation rate
RF	Rheumatoid factor
Anti-CCP	Anti-cyclic citrullinated peptide
BMI	Body mass index
KFSH	King Fahad Specialist Hospital
SD	Standard deviation
AOR	Adjusted odds ratio
CI	Confidence intervals
ACR	American College of Rheumatology
EULAR	European League Against Rheumatism

Conflict of interest

The authors declare that they have no conflict of interest regarding the publication of this article.

Funding

No funding was received for this study.

Consent to participate

Informed consent was waived in view of the retrospective design and the use of de-identified data. Patient information

was handled confidentially and data were anonymized before analysis.

Ethical approval

Ethical approval was obtained from the Qassim Institutional Review Board, Ministry of Health, Kingdom of Saudi Arabia (Registration No. 607-47-2916; approved September 1, 2025). The study was conducted in accordance with the Declaration of Helsinki.

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Supplementary content (If any) is available online.

References

1. Smolen JS, Aletaha D, McInnes IB. Rheumatoid arthritis. *Lancet*. 2016;388(10055):2023–38. [https://doi.org/10.1016/S0140-6736\(16\)30173-8](https://doi.org/10.1016/S0140-6736(16)30173-8)
2. 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. <https://doi.org/10.2337/dc16-1075>
3. Vos T, Lim SS, Abbafati C, Abbas KM, Abbasi M, Abbasifard M, et al.; GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet*. 2020;396(10258):1204–22.
4. Smolen JS, Landewé RB, Bijlsma JW, Burmester GR, Dougados M, Kerschbaumer A, et al. EULAR recommendations for the management of rheumatoid arthritis with synthetic and biological disease-modifying antirheumatic drugs: 2019 update. *Ann Rheum Dis*. 2020;79(6):685–99.
5. Dougados M, Soubrier M, Antunez A, Balint P, Balsa A, Buch MH, et al. Prevalence of comorbidities in rheumatoid arthritis and evaluation of their monitoring: results of an international, cross-sectional study (COMORA). *Ann Rheum Dis*. 2014;73(1):62–8. <https://doi.org/10.1136/annrheumdis-2013-204223>
6. Biggioggero M, Mesina F, Favalli EG. The use of rheumatic disease comorbidity index for predicting clinical response and retention rate in a cohort of rheumatoid arthritis patients receiving tumor necrosis factor alpha inhibitors. *BioMed Res Int*. 2019;2019:6107217. <https://doi.org/10.1155/2019/6107217>
7. Aviña-Zubieta JA, Choi HK, Sadatsafavi M, Etmann M, Esdaile JM, Lacaille D. Risk of cardiovascular mortality in patients with rheumatoid arthritis: a meta-analysis of observational studies. *Arthritis Rheum*. 2008;59(12):1690–7. <https://doi.org/10.1002/art.24092>
8. Matcham F, Rayner L, Steer S, Hotopf M. The prevalence of depression in rheumatoid arthritis: a systematic review and meta-analysis. *Rheumatology (Oxford)*. 2013;52(12):2136–48. <https://doi.org/10.1093/rheumatology/ket169>
9. Baillet A, Gossec L, Carmona L, Wit M, van Eijk-Hustings Y, Bertheussen H, et al. Points to consider for reporting, screening for and preventing selected comorbidities in chronic inflammatory rheumatic diseases in daily practice: a EULAR initiative. *Ann Rheum Dis*. 2016;75(6):965–73. <https://doi.org/10.1136/annrheumdis-2016-209233>
10. Arnett FC, Edworthy SM, Bloch DA, McShane DJ, Fries JF, Cooper NS, et al. The American Rheumatism Association 1987 revised criteria for the classification of rheumatoid arthritis. *Arthritis Rheum*. 1988;31(3):315–24. <https://doi.org/10.1002/art.1780310302>
11. Aletaha D, Neogi T, Silman AJ, Funovits J, Felson DT, Bingham CO 3rd, et al. 2010 Rheumatoid arthritis classification criteria: an American College of Rheumatology/European League Against Rheumatism collaborative initiative. *Arthritis Rheum*. 2010;62(9):2569–81. <https://doi.org/10.1002/art.27584>
12. Alghamdi M, Somaily MY, Alemam S, Majadah S, Hassan AA, Meshary AA, et al. Prevalence and comorbidities among individuals with rheumatoid arthritis in the Saudi Arabian context. *Cureus*. 2024;16(2):e53992. <https://doi.org/10.7759/cureus.53992>
13. Al-Ahmari AK. Prevalence of hypertension and its associated risk factors among patients with rheumatoid arthritis in the Kingdom of Saudi Arabia. *Int J Gen Med*. 2022;15:6507–17. <https://doi.org/10.2147/IJGM.S370956>
14. Ağbuga ÖD, Ersözlü ED. Disease and treatment-related comorbidities in rheumatoid arthritis. *J Turk Soc Rheumatol*. 2024;16(2):64–72. <https://doi.org/10.4274/raed.galenos.2024.74755>
15. Adelowo O, Omokhowa A, Ochiagha O, Uhunmwangho CU. Comorbidities in Nigerian patients with rheumatoid arthritis. *Clin Rheumatol*. 2024;43(1):23–8. <https://doi.org/10.1007/s10067-023-06797-0>
16. Botha-Scheepers S, Mohammed AG, Gcelu A, Hodgkinson B. High prevalence of comorbidities in patients with rheumatoid arthritis in South Africa. *Ann Rheum Dis*. 2018;77 Suppl 2:1366. <https://doi.org/10.1136/annrheumdis-2018-eular.6994>
17. Bogale Z, Feleke Y. Prevalence, clinical manifestations, and treatment pattern of patients with rheumatoid arthritis attending the rheumatology clinic at Tikur Anbessa Specialized Hospital, Ethiopia: a cross-sectional study. *Open Access Rheumatol*. 2022;14:221–9. <https://doi.org/10.2147/OARRR.S383778>
18. Balsa A, Lojo-Oliveira L, Alperi-López M, García-Manrique M, Ordóñez-Cañizares C, Pérez L, et al. Prevalence of comorbidities in rheumatoid arthritis and evaluation of their monitoring in clinical practice: the Spanish cohort of the COMORA study. *Reumatol Clin (Engl Ed)*. 2019;15(2):102–8. <https://doi.org/10.1016/j.reuma.2017.06.002>
19. Liu YJ, Miao HB, Lin S, Chen Z. Association between rheumatoid arthritis and thyroid dysfunction: a meta-analysis and systematic review. *Front Endocrinol (Lausanne)*. 2022;13:1015516. <https://doi.org/10.3389/fendo.2022.1015516>
20. Wilson JC, Sarsour K, Gale S, Pethö-Schramm A, Jick SS, Meier CR. Incidence and risk of glucocorticoid-associated adverse effects in patients with rheumatoid arthritis. *Arthritis Care Res (Hoboken)*. 2019;71(4):498–511. <https://doi.org/10.1002/acr.23611>