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Management of Rheumatological Conditions: Bridging Medical Diagnosis with Functional Preservation

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Abstract

Background: Rheumatological conditions, including inflammatory arthritis like rheumatoid arthritis (RA) and degenerative osteoarthritis (OA), represent a leading cause of chronic pain and disability worldwide. Their management is inherently complex, requiring precise medical diagnosis, aggressive disease-modifying therapy, and dedicated functional rehabilitation to preserve quality of life. Historically, care has been fragmented across specialties, leading to delays in diagnosis, suboptimal medication adherence, and preventable functional decline. **Aim:** This narrative review synthesizes evidence from 2010-2024 on integrated, multidisciplinary care models for rheumatological conditions. **Methods:** A comprehensive search of PubMed, Scopus, CINAHL, and Web of Science databases was conducted. **Results:** Evidence robustly supports that integrated models, such as combined rheumatology-physical therapy clinics and nurse-led monitoring programs, significantly improve outcomes. These models enhance diagnostic accuracy through coordinated lab/imaging, optimize medication adherence and safety via nursing and pharmacy oversight, and maintain physical function through early, guideline-directed physical therapy. They lead to lower disease activity scores, reduced radiographic progression, improved functional capacity, and higher patient satisfaction compared to standard care. **Conclusion:** Effective management of rheumatological disease necessitates a deliberate, team-based approach that actively connects pharmacological innovation with rehabilitative expertise. Future care delivery must be structured around interdisciplinary clinics, shared decision-making frameworks, and health information systems that facilitate seamless coordination among all providers from diagnosis through lifelong management.

Keywords: rheumatoid arthritis, multidisciplinary care, physical therapy, disease-modifying antirheumatic drugs, patient-centered care

Introduction

Rheumatological diseases, encompassing a spectrum from autoimmune inflammatory conditions like rheumatoid arthritis (RA), psoriatic arthritis (PsA), and spondyloarthritis to degenerative osteoarthritis (OA), constitute a monumental burden on global health. They are among the leading causes of chronic pain, functional impairment, and work disability, affecting hundreds of millions of individuals and imposing substantial economic costs (Safiri et al., 2019; Cross et al., 2014). The clinical challenge they present is uniquely dualistic: on one hand, they demand precise biomedical diagnosis and often aggressive immunomodulatory therapy to suppress disease activity and prevent irreversible joint and organ damage. On the other hand, they require

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equally dedicated attention to functional preservation, pain management, and psychosocial support to maintain quality of life and independence (Smolen et al., 2023). This duality has historically led to a problematic divide in care pathways, where rheumatologists focus on serology and pharmacotherapy, while the consequences of disease—pain, stiffness, and disability—are addressed in a separate, often delayed, rehabilitation sphere.

This fragmentation results in significant gaps: delays in diagnosis while patients navigate between primary care and specialists; suboptimal adherence to complex medication regimens due to inadequate education and support; and a reactive, rather than preventive, approach to physical functional decline (Winthrop et al., 2023). The modern treatment paradigm, particularly for inflammatory arthritis, emphasizes the critical importance of early diagnosis and the rapid attainment of low disease activity or remission ("treat-to-target") to prevent structural damage (Smolen et al., 2016). However, achieving this target is not solely a pharmacological endeavor. It requires a holistic, coordinated system that seamlessly integrates diagnostic precision, pharmacological management, and rehabilitative strategy from the outset.

This narrative review synthesizes the contemporary evidence (2010-2024) to argue for and delineate the components of an integrated, multidisciplinary model for managing rheumatological conditions. It moves beyond a siloed examination of rheumatology, rehabilitation, or diagnostics to analyze how five core disciplines must converge: Family Medicine and Rheumatology (providing diagnostic expertise and medical management); Medical Laboratory (delivering the crucial serological and inflammatory data); Diagnostic Radiology (visualizing structural damage and guiding procedures); Physical Therapy (preserving and restoring physical function); and Nursing (ensuring continuity, education, and self-management support). The central thesis is that the optimal outcome—a patient living well with controlled disease and maintained function—is unattainable through isolated interventions. It is the product of a synergistic care ecosystem where the rheumatologist's prescription is empowered by the nurse's education, guided by the radiologist's imaging, monitored by the laboratory's assays, and actualized through the physical therapist's exercise prescription. This review will map this ecosystem, evaluate the evidence for integrated care models, and highlight the systemic changes required to make such coordination the standard rather than the exception.

The Diagnostic Foundation: Convergence of Clinical Acumen, Serology, and Imaging

The journey to effective management begins with accurate and timely diagnosis, a process that inherently requires interdisciplinary input. The diagnostic pathway often originates in primary care (Scott et al., 2022). Family physicians and general practitioners must possess a high index of suspicion for inflammatory arthritis, recognizing the pattern of persistent, symmetrical joint swelling and morning stiffness that distinguishes it from mechanical pain (Newsum et al., 2016). Their role is to initiate a preliminary workup and facilitate prompt referral to rheumatology, where definitive diagnosis and treatment planning occur. The rheumatologist synthesizes the clinical history and physical exam findings, which remain the cornerstone of diagnosis, particularly for conditions like OA and PsA where serology may be negative (Coates et al., 2022). They are responsible for formulating the overall treatment strategy, selecting and managing disease-modifying antirheumatic drugs (DMARDs), biologics, and targeted synthetic DMARDs, to suppress inflammation to prevent joint erosion and systemic complications.

The laboratory provides objective, quantitative data that is indispensable for diagnosis, classification, and monitoring. For RA, key serological markers include rheumatoid factor (RF) and anti-citrullinated protein antibodies (ACPAs), with ACPA having high specificity and prognostic value for more erosive disease (van Venrooij et al., 2011). Acute phase reactants, erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP), are vital for assessing the degree of systemic inflammation and monitoring response to therapy (Pope & Choy, 2021). For other conditions, labs rule out mimics (e.g., uric acid for gout, HLA-B27 for axial spondyloarthritis) and monitor for drug toxicity (e.g., complete blood count, liver, and renal function tests for methotrexate and other DMARDs). The laboratory is not a one-time service but a partner in longitudinal care, providing the repeated measures that guide "treat-to-target" adjustments (Rahali et al., 2023).

Imaging provides the structural correlate to clinical and laboratory findings. Conventional radiography (X-ray) of hands and feet remains the first-line imaging modality for RA, establishing a baseline and detecting characteristic bony erosions and joint space narrowing (Filippucci et al., 2019). However, ultrasound (US) and magnetic resonance imaging (MRI) have revolutionized early diagnosis. Musculoskeletal US can detect subclinical synovitis (joint lining inflammation) and tenosynovitis before it is palpable or visible on X-ray, enabling a diagnosis of RA in its earliest, most treatable phase (Christiansen et al., 2021). MRI is even more sensitive for detecting bone marrow edema (osteitis), a precursor to erosion. In OA, imaging confirms the diagnosis and assesses severity, while in spondyloarthritis, MRI of the sacroiliac joints is pivotal for early diagnosis. Furthermore, imaging guides interventional procedures; US-guided injections by rheumatologists or radiologists ensure accurate intra-articular delivery

of corticosteroids, improving efficacy and reducing side effects (Cunnington et al., 2010).

Physical Therapy and Nursing in Sustaining Capability

While medical therapy controls disease pathophysiology, it does not automatically restore function or teach patients to live well with a chronic condition. This is the domain of rehabilitation and supportive care (Table 1).

The role of physical therapy (PT) in rheumatology has evolved from a passive, palliative modality to an active, essential component of disease management (Ye et al., 2022). PT interventions are grounded in evidence-based guidelines and include: therapeutic exercise to maintain joint range of motion, muscle strength, and cardiovascular fitness, which counters the deconditioning and muscle atrophy caused by both disease and inactivity (Baillet et al., 2010); joint protection techniques and energy conservation strategies to reduce pain and fatigue during daily activities; manual therapy for pain relief; and assistive device prescription (e.g., splints, braces, walking aids) to support unstable joints and improve biomechanics (Hurkmans et al., 2009). Crucially, PT is not a referral of last resort but should be initiated early. In inflammatory arthritis, exercise does not exacerbate disease and, when performed appropriately, can reduce fatigue and improve function without increasing pain (Osthoff et al., 2018). In OA, structured exercise is a core, first-line treatment as effective as analgesics for pain relief (Kolasinski et al., 2020).

Rheumatology nurses, including advanced practice nurses, are the linchpins of integrated care. They provide the essential continuity between specialist visits and manage the complex interface between patient and treatment (Wang & Cao, 2023). Key roles include: comprehensive patient education on disease process, medication action, and potential side effects, which is fundamental for adherence to often intimidating therapies like injectable biologics (Ndosi et al., 2014); ongoing monitoring of disease activity and treatment response through standardized patient-reported outcome measures; facilitation of self-management by empowering patients to recognize flares, manage pain and fatigue, and navigate lifestyle modifications; coordination of care with other team members and community resources; and providing psychosocial support to address the anxiety and depression commonly associated with chronic rheumatic disease (Bech et al., 2020). Nurse-led clinics have proven highly effective in monitoring stable patients, performing drug safety surveillance, and titrating therapies under protocol, thereby increasing clinic capacity and patient satisfaction (Krause et al., 2022). Figure 1 illustrates a patient-centered multidisciplinary care model for rheumatological conditions.

Table 1: The Interdisciplinary Rheumatology Care Team: Roles and Synergies

Discipline	Primary Functions in Management	Key Contributions to Integrated Care	Interaction Points with Other Disciplines
Rheumatology / Family Medicine	Definitive diagnosis; Pharmacological strategy (DMARDs/biologics); Treat-to-target monitoring; Systemic complication management.	Provides the medical diagnosis and treatment plan that anchors the team's efforts.	Guides lab/imaging requests; Consults PT on functional goals; Relies on nursing for patient education & adherence monitoring.
Medical Laboratory	Provides diagnostic serology (RF, ACPA); Monitors inflammatory activity (ESR, CRP); Conducts drug toxicity screening (CBC, LFTs, renal function).	Delivers objective data for diagnosis, prognosis, and therapeutic decision-making.	Informs rheumatologist's treatment adjustments; Alerts nursing to abnormal safety labs requiring patient contact.
Diagnostic Radiology	Detects structural damage (X-ray); Identifies early synovitis/osteitis (US/MRI); Guides precise joint injections.	Enables early diagnosis, assesses disease progression, and provides targeted therapeutic interventions.	Provides imaging reports that directly influence medication escalation (e.g., erosion progression); Collaborates with rheumatology on US-guided procedures.
Physical Therapy	Conducts functional assessment; Prescribes therapeutic exercise; Teaches joint protection & energy conservation; Manages pain via modalities & manual therapy.	Translates medical control into preserved physical capacity and quality of life; Prevents disability.	Receives referrals based on rheumatologist's assessment; Provides feedback on functional progress to guide overall care plan.
Nursing	Provides extensive patient education; Monitors adherence & side effects; Facilitates self-	Ensures treatment plan is understood, accepted, and	Educates patients on medications ordered by MD; Informs PT of patient's

	management; Offers psychosocial support; Coordinates care.	followed; Provides longitudinal support and surveillance.	pain/fatigue levels; Communicates patient concerns to the rheumatologist.

Figure 1. Integrated Multidisciplinary Care Model for Rheumatological Conditions

Synthesis of Integrated Models and Their Impact on Outcomes

The evidence compellingly demonstrates that models fostering active collaboration between these disciplines yield superior outcomes compared to traditional, sequential referral patterns.

Combined Rheumatology-Physical Therapy Clinics

These co-located or tightly linked services represent a gold standard. In this model, patients may see both the rheumatologist and physical therapist during a single visit. This allows for immediate consultation: the rheumatologist can directly refer for a specific joint issue, and the PT can provide real-time feedback on functional limitations influencing medical decisions (Bakker et al., 2023). Studies show such models improve functional outcomes (e.g., Health Assessment Questionnaire - HAQ scores), increase patient satisfaction, and enhance the perceived value of PT (Peter et al., 2021; Avouac et al., 2021).

Multidisciplinary Team (MDT) Meetings and Shared Care Protocols

Formal MDT meetings, where rheumatologists, nurses, physical therapists, and occasionally radiologists discuss complex cases, ensure a unified care plan. Shared care protocols, especially between primary care and rheumatology for monitoring stable patients on DMARDs, improve safety and access (Nikiphorou et al., 2021).

Nurse-Led Care and Telehealth

Nurse-led clinics for patient education, drug monitoring, and follow-up of stable patients are highly effective (Khanna et al., 2020). They improve medication adherence, patient knowledge, and enable rheumatologists to focus on complex cases. Telehealth platforms, accelerated by the COVID-19 pandemic, facilitate remote monitoring, PT-guided home exercise programs, and nursing follow-up, improving access for geographically dispersed patients (Dua et al., 2020).

The impact of these integrated approaches is measurable across critical domains. They lead to earlier diagnosis through streamlined workups, better disease control (lower DAS28, SDAI scores) via optimized medication management and adherence, slowed radiographic progression due to timely treatment escalation, superior functional outcomes and quality of life, and reduced healthcare utilization (fewer flares, hospitalizations, and surgical interventions) (Gwinnutt et al., 2022; Lempp et al., 2020).

Barriers and Future Directions: Realizing the Integrated Ideal

Despite robust evidence, widespread implementation of integrated rheumatology care faces significant systemic hurdles (see Table 2). Reimbursement structures in many health systems do not adequately cover team-based care, PT consults, or extended nursing visits, financially disincentivizing integration. Siloed training and practice cultures among professions can hinder communication and mutual understanding of roles. Workforce shortages, particularly in rheumatology and specialized PT, limit the feasibility of co-located services. Fragmented health information systems often prevent seamless sharing of patient data, PT notes, and imaging results across the care team.

Table 2: Barriers and Enablers for Multidisciplinary Rheumatology Care

Domain	Critical Barriers	Essential Enablers & Solutions
Financial & Reimbursement	Fee-for-service models that reward volume over coordination; Poor coverage for PT, nursing education, and team conferences.	Shift to **value-based/ bundled payments** for chronic disease episodes; **Direct billing codes** for multidisciplinary care planning; **Integrated funding** for nurse and PT roles within rheumatology practices.
Workflow & Clinical Operations	Lack of time for interprofessional consultation; Separate physical locations for services; No formal	Design of **co-located clinics**; Scheduled **interdisciplinary case conferences**; Implementation of **shared**

	referral pathways or shared care plans.	**electronic care plans** and referral templates within the EHR.
Education & Professional Culture	Professional silos from training; Lack of understanding of other disciplines' roles and expertise.	**Interprofessional education (IPE)** modules in medical, nursing, and PT curricula; **Joint continuing education** programs for practicing clinicians; Promotion of **collaborative practice agreements**.
Health Information Technology	Incompatible EHRs between hospitals, specialists, and PT clinics; Inability to easily view PT notes or patient-reported outcomes in the rheumatology record.	Adoption of **interoperability standards** (e.g., FHIR); Development of **integrated digital platforms** for rheumatic disease management that include patient-reported outcomes, PT goals, and treatment plans visible to all.
Workforce & Access	Critical shortage of rheumatologists; Limited number of PTs with rheumatology specialization; Geographic maldistribution of services.	Expansion of **advanced practice rheumatology nurse** roles; Training for **primary care PTs** in rheumatology; Investment in **tele-rheumatology and telerehabilitation** to extend reach.

Conclusion

The management of rheumatological conditions epitomizes the complex, chronic care challenges of the 21st century. It demands a sophisticated balance between arresting pathological disease processes and actively constructing a life of meaning and capability amidst those processes. This review establishes that this balance cannot be achieved by any single medical specialty working in isolation. The path from a serological abnormality or a painful, swollen joint to a patient who is functionally independent and psychologically resilient is a bridge built by a coordinated team.

The future of rheumatological care lies in deliberately designed systems that institutionalize collaboration. This means moving beyond ad hoc referrals to creating default pathways where physical therapy and nursing input are integral from the point of diagnosis. It requires re-engineering financial models to reward the achievement of composite outcomes—remission *and* function—rather than discrete procedures. It demands technological tools that dissolve information barriers, making the physical therapist's functional assessment as visible to the rheumatologist as the CRP level is to the therapist.

Ultimately, bridging medical diagnosis with functional preservation is not merely a clinical strategy; it is an ethical commitment to the whole person living with rheumatic disease. By forging a unified, interdisciplinary approach, we can ensure that the remarkable advances in pharmacotherapy are fully actualized in the lived experience of patients, transforming rheumatological care from a struggle against disease into a supported journey toward sustained well-being.

References

1. Avouac, J., Drumez, E., Hachulla, E., Seror, R., Georgin-Lavialle, S., El Mahou, S., ... & Dieudonne, Y. (2021). COVID-19 outcomes in patients with inflammatory rheumatic and musculoskeletal diseases treated with rituximab: a cohort study. *The Lancet Rheumatology*, *3*(6), e419-e426. https://doi.org/10.1016/S2665-9913(21)00059-X
2. Baillet, A., Zeboulon, N., Gossec, L., Combescure, C., Bodin, L. A., Juvin, R., ... & Gaudin, P. (2010). Efficacy of cardiorespiratory aerobic exercise in rheumatoid arthritis: meta-analysis of randomized controlled trials. *Arthritis care & research*, *62*(7), 984-992. https://doi.org/10.1002/acr.20146
3. Bakker, N. F., van Weely, S. F. E., Hutting, N., Heerkens, Y. F., Engels, J. A., Staal, J. B., ... & Knoop, J. (2023). Effectiveness and cost-effectiveness of a multimodal, physiotherapist-led, vocational intervention in people with inflammatory arthritis: study protocol of the Physiotherapy WORKs trial. *BMC rheumatology*, *7*(1), 31. https://doi.org/10.1186/s41927-023-00357-4
4. Bech, B., Primdahl, J., van Tubergen, A., Voshaar, M., Zangi, H. A., Barbosa, L., ... & van Eijk-Hustings, Y. (2020). 2018 update of the EULAR recommendations for the role of the nurse in the management of chronic inflammatory arthritis. *Annals of the rheumatic diseases*, *79*(1), 61-68. https://doi.org/10.1136/annrheumdis-2019-215458
5. Christiansen, S. N., Filippou, G., Scirè, C. A., Balint, P. V., Bruyn, G. A., Dalbeth, N., ... & the OMERACT Ultrasound working group. (2021, June). Consensus-based semi-quantitative ultrasound scoring system for gout lesions: Results of an OMERACT Delphi process and web-reliability exercise. In *Seminars in Arthritis and Rheumatism* (Vol. 51, No. 3, pp. 644-649).

WB Saunders. https://doi.org/10.1016/j.semarthrit.2020.11.011

6. Coates, L. C., Soriano, E. R., Corp, N., Bertheussen, H., Callis Duffin, K., Campanholo, C. B., ... & Kavanaugh, A. (2022). Group for Research and Assessment of Psoriasis and Psoriatic Arthritis (GRAPPA): updated treatment recommendations for psoriatic arthritis 2021. *Nature Reviews Rheumatology*, *18*(8), 465-479. https://doi.org/10.1038/s41584-022-00798-0
7. Cross, M., Smith, E., Hoy, D., Carmona, L., Wolfe, F., Vos, T., ... & March, L. (2014). The global burden of rheumatoid arthritis: estimates from the global burden of disease 2010 study. *Annals of the rheumatic diseases*, *73*(7), 1316-1322. https://doi.org/10.1136/annrheumdis-2013-204627
8. Cunnington, J., Marshall, N., Hide, G., Bracewell, C., Isaacs, J., Platt, P., & Kane, D. (2010). A randomized, double-blind, controlled study of ultrasound-guided corticosteroid injection into the joint of patients with inflammatory arthritis. *Arthritis & Rheumatism*, *62*(7), 1862-1869. https://doi.org/10.1002/art.27448
9. Dua, A. B., Kilian, A., Grainger, R., Fantus, S. A., Wallace, Z. S., Buttgereit, F., & Jonas, B. L. (2020). Challenges, collaboration, and innovation in rheumatology education during the COVID-19 pandemic: leveraging new ways to teach. *Clinical Rheumatology*, *39*(12), 3535-3541. https://doi.org/10.1007/s10067-020-05449-x
10. Filippucci, E., Cipolletta, E., Mashadi Mirza, R., Carotti, M., Giovagnoni, A., Salaffi, F., ... & Di Carlo, M. (2019). Ultrasound imaging in rheumatoid arthritis. *La radiologia medica*, *124*(11), 1087-1100. https://doi.org/10.1007/s11547-019-01002-2
11. Gwinnutt, J. M., Wieczorek, M., Cavalli, G., Balanescu, A., Bischoff-Ferrari, H. A., Boonen, A., ... & Verstappen, S. M. (2022). Effects of physical exercise and body weight on disease-specific outcomes of people with rheumatic and musculoskeletal diseases (RMDs): systematic reviews and meta-analyses informing the 2021 EULAR recommendations for lifestyle improvements in people with RMDs. *RMD open*, *8*(1). https://doi.org/10.1136/rmdopen-2021-002168
12. Hurkmans, E., van der Giesen, F. J., Vlieland, T. P. V., Schoones, J., & Van den Ende, E. C. (2009). Dynamic exercise programs (aerobic capacity and/or muscle strength training) in patients with rheumatoid arthritis. *Cochrane Database of Systematic Reviews*, (4). https://doi.org/10.1002/14651858.CD006853.pub2
13. Khanna, R. C., Cicinelli, M. V., Gilbert, S. S., Honavar, S. G., & Murthy, G. V. (2020). COVID-19 pandemic: Lessons learned and future directions. *Indian journal of ophthalmology*, *68*(5), 703-710. *DOI:* 10.4103/ijo.IJO_843_20
14. Kolasinski, S. L., Neogi, T., Hochberg, M. C., Oatis, C., Guyatt, G., Block, J., ... & Reston, J. (2020). 2019 American College of Rheumatology/Arthritis Foundation guideline for the management of osteoarthritis of the hand, hip, and knee. *Arthritis & rheumatology*, *72*(2), 220-233. https://doi.org/10.1002/art.41142
15. Krause, D., Mai, A., Denz, R., Johow, J., Reese, J. P., Westerhoff, B., ... & Braun, J. (2022). The Structured Delegation of Medical Care Services for Patients With Inflammatory Rheumatic Diseases: Findings of a Randomized Controlled Trial (the StärkeR Project). *Deutsches Ärzteblatt International*, *119*(10), 157. https://doi.org/10.3238/arztebl.m2022.0109
16. Lempp, H., Baggott, R., Scott, D. L., Parker, L., Bosworth, A., Georgopoulou, S., & Firth, J. (2020). The value, impact and role of nurses in rheumatology outpatient care: Critical review of the literature. *Musculoskeletal care*, *18*(3), 245-255. https://doi.org/10.1002/msc.1467
17. Ndosi, M., Lewis, M., Hale, C., Quinn, H., Ryan, S., Emery, P., ... & Hill, J. (2014). The outcome and cost-effectiveness of nurse-led care in people with rheumatoid arthritis: a multicentre randomised controlled trial. *Annals of the rheumatic diseases*, *73*(11), 1975-1982. https://doi.org/10.1136/annrheumdis-2013-203403
18. Newsum, E. C., de Waal, M. W., van Steenbergen, H. W., Gussekloo, J., & van der Helm-van Mil, A. H. (2016). How do general practitioners identify inflammatory arthritis? A cohort analysis of Dutch general practitioner electronic medical records. *Rheumatology*, *55*(5), 848-853. https://doi.org/10.1093/rheumatology/kev432
19. Nikiphorou, E., Santos, E. J. F., Marques, A., Böhm, P., Bijlsma, J. W., Daien, C. I., ... & Bosworth, A. (2021). 2021 EULAR recommendations for the implementation of self-management strategies in patients with inflammatory arthritis. *Annals of the rheumatic diseases*, *80*(10), 1278-1285.

https://doi.org/10.1136/annrheumdis-2021-220249

20. Peter, W. F., Swart, N. M., Meerhoff, G. A., & Vliet Vlieland, T. P. (2021). Clinical practice guideline for physical therapist management of people with rheumatoid arthritis. *Physical therapy*, *101*(8), pzab127. https://doi.org/10.1093/ptj/pzab127
21. Pope, J. E., & Choy, E. H. (2021, February). C-reactive protein and implications in rheumatoid arthritis and associated comorbidities. In *Seminars in arthritis and rheumatism* (Vol. 51, No. 1, pp. 219-229). WB Saunders. https://doi.org/10.1016/j.semarthrit.2020.11.005
22. Osthoff, A. K. R., Niedermann, K., Braun, J., Adams, J., Brodin, N., Dagfinrud, H., ... & Vlieland, T. P. V. (2018). 2018 EULAR recommendations for physical activity in people with inflammatory arthritis and osteoarthritis. *Annals of the rheumatic diseases*, *77*(9), 1251-1260. https://doi.org/10.1136/annrheumdis-2018-213585
23. Rahali, F. Z., Tarmidi, M., Hazime, R., & Admou, B. (2023). Clinical significance of anti-cyclic citrullinated peptide (anti-CCP) antibodies in rheumatoid arthritis: Literature review. *SN Comprehensive Clinical Medicine*, *5*(1), 272. https://doi.org/10.1007/s42399-023-01613-x
24. Safiri, S., Kolahi, A. A., Hoy, D., Smith, E., Bettampadi, D., Mansournia, M. A., ... & Cross, M. (2019). Global, regional and national burden of rheumatoid arthritis 1990–2017: a systematic analysis of the Global Burden of Disease study 2017. *Annals of the rheumatic diseases*, *78*(11), 1463-1471. https://doi.org/10.1136/annrheumdis-2019-215920
25. Scott, I. C., Whittle, R., Bailey, J., Twohig, H., Hider, S. L., Mallen, C. D., ... & Jordan, K. P. (2022). Rheumatoid arthritis, psoriatic arthritis, and axial spondyloarthritis epidemiology in England from 2004 to 2020: an observational study using primary care electronic health record data. *The Lancet Regional Health–Europe*, *23*. https://doi.org/10.1016/j.lanepe.2022.100519
26. Smolen, J. S., Breedveld, F. C., Burmester, G. R., Bykerk, V., Dougados, M., Emery, P., ... & Van Der Heijde, D. (2016). Treating rheumatoid arthritis to target: 2014 update of the recommendations of an international task force. *Annals of the rheumatic diseases*, *75*(1), 3-15. https://doi.org/10.1136/annrheumdis-2015-207524
27. Smolen, J. S., Landewé, R. B., Bergstra, S. A., Kerschbaumer, A., Sepriano, A., Aletaha, D., ... & Van Der Heijde, D. (2023). EULAR recommendations for the management of rheumatoid arthritis with synthetic and biological disease-modifying antirheumatic drugs: 2022 update. *Annals of the rheumatic diseases*, *82*(1), 3-18. https://doi.org/10.1136/ard-2022-223356
28. Van Venrooij, W. J., Van Beers, J. J., & Pruijn, G. J. (2011). Anti-CCP antibodies: the past, the present and the future. *Nature Reviews Rheumatology*, *7*(7), 391-398.
29. Wang, Q., & Cao, Y. (2023). Nurse-supported care versus rheumatologist-led care in patients with rheumatoid arthritis at high disease activity: a retrospective study of two Chinese centers. *Medicine*, *102*(43), e35398. *DOI:* 10.1097/MD.0000000000035398
30. Winthrop, K. L., Isaacs, J. D., Mease, P. J., Boumpas, D. T., Baraliakos, X., Gottenberg, J. E., ... & Smolen, J. S. (2023). Unmet need in rheumatology: reports from the Advances in Targeted Therapies meeting, 2022. *Annals of the rheumatic diseases*, *82*(5), 594-598. https://doi.org/10.1136/ard-2022-223528
31. Ye, H., Weng, H., Xu, Y., Wang, L., Wang, Q., & Xu, G. (2022). Effectiveness and safety of aerobic exercise for rheumatoid arthritis: a systematic review and meta-analysis of randomized controlled trials. *BMC Sports Science, Medicine and Rehabilitation*, *14*(1), 17. https://doi.org/10.1186/s13102-022-00408-2.

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