EE197

# Cost-Effectiveness of Monoclonal Antibodies for Rheumatoid Arthritis in the United States

Nathan Jordan PharmD Candidate, Western New England University College of Pharmacy and Health Sciences, Springfield, MA

WESTERN NEW ENGLAND UNIVERSITY | WNE
COLLEGE of PHARMACY and HEALTH SCIENCES

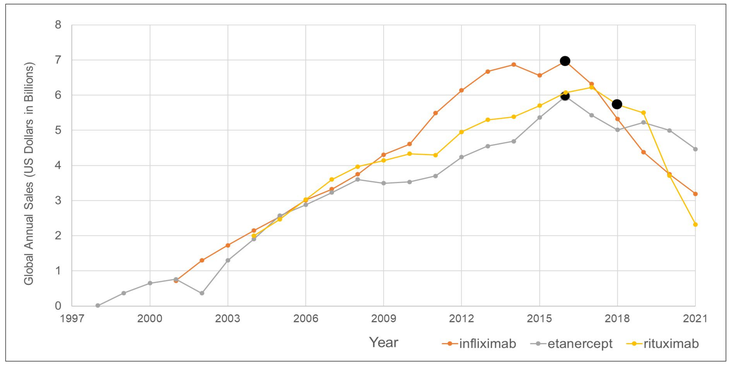
## Background:

In the last 2 decades, biologics have changed the treatment of Rheumatoid Arthritis (RA). The 9 approved monoclonal antibodies (MABs) on the market have shown improved outcomes. However, these agents have created a massive economic burden among U.S. payers.[1] Until biosimilars were approved, the revenue for these agents steadily increased year over year (Figure 2). Specifically, the introduction of competition from biosimilars decreased revenue for infliximab, etanercept, and rituximab (Figure 1).[2] Nonetheless, this mechanism requires time, and significant players, including Adalimumab, have demonstrated resistance.[3] One method to curb these elevated costs is by choosing the most cost-effective agent. Current pharmacoeconomic analyses in RA utilize Quality–Adjusted Life Years (QALYs). However, many of these studies present varying results, making it difficult for payers to discern which agent is best to cover.[4] In reality, current practices include prior authorizations, step therapy, specialty tiers, and coinsurance.[5] Clinical endpoints used for comparing efficacy such as the American College of Rheumatology 20 (ACR20) and Disease Activity Score 28 (DAS-28) could provide a more robust endpoint for payers to use in decision-making. ACR20 and DAS28 are composite endpoints used to measure disease activity. ACR20 requires a 20% improvement in joint counts, assessments of disease activity, physical function, and laboratory measures of inflammation. DAS28 is similar but excludes physical function and indicates remission with a score <2.6.[6] Both endpoints have been used for comparing efficacy, but do not appear in cost-effectiveness studies.[7] Therefore, this study seeks to provide a cost-effectiveness analysis of MABs for RA using clinical endpoints.

## Objective:

The objective of this study was to compare the cost-effectiveness of 9 MABs over 12 months using clinical endpoints from a societal perspective.

## Figure 1: Global Annual Sales (Billions $) with Approval of Biosimilars




- The approval date of biosimilars: Truxima for rituximab in 2018, Erelzi for etanercept in 2016, and Inflectra for infliximab in 2016

MAB revenue generated from 10-k or 20-f SEC filing, and financial reports. Biosimilar approval date was gathered from FDA.gov.

## Table 1: MAB Efficacy and Cost Effectiveness

| MAB | Total Annual Costs ($) | ACR20 (%) | CEA for ACR20 | DAS28 (%) | CEA for DAS28 | Δ HAQ-DI | Δ SF-36 PCS |
|---|---|---|---|---|---|---|---|
| Adalimumab | 73,309 | 27.7 | 264,405 | 18.7 | 392,366 | 0.25 | 3.15 |
| Rituximab | 74,927 | 20.4 | 368,102 | 10.4 | 723,410 | 0.32 | 4.29 |
| Golimumab SQ | 61,224 | 24.0 | 254,959 | 10.3 | 594,412 | 0.28 | |
| Tocilizumab IV | 31,035 | 15.9 | 195,635 | 19.3 | 160,632 | 0.16 | 1.75 |
| Sarilumab | 32,149 | 29.8 | 107,975 | 23.6 | 136,065 | 0.25 | 4.08 |
| Infliximab IV | 19,324 | 27.4 | 70,474 | 17.0 | 113,673 | 0.3 | 3.32 |
| Certolizumab Pegol | 73,626 | 24.2 | 303,742 | 15.0 | 492,254 | 0.21 | |
| Abatacept IV | 45,598 | 30.9 | 147,407 | 16.8 | 270,964 | 0.27 | 4.92 |
| Etanercept SQ | 83,613 | 19.0 | 440,069 | 8.4 | 993,704 | 0.19 | |

ACR20 reported as the % of patients achieving ≥ 20% improvement in swollen and tender joint counts assessed in 66 joints and a ≥20% improvement in at least 3 of the 5 remaining core set measures: patient global assessment of disease activity, patient assessment of pain, HAQ-DI, physician global assessment, and level of CRP. DAS28 reported as the % of patients achieving a score < 2.6. DAS28 score computed from: swollen and tender joint counts assessed in 28 joints, patient global assessment of disease activity, and level of CRP or ESR. HAQ-DI, Health Assessment Questionnaire Disease Index. SF-36 reported as the short form physical component score. Total costs were calculated based on the total annual direct and indirect costs accrued per patient.

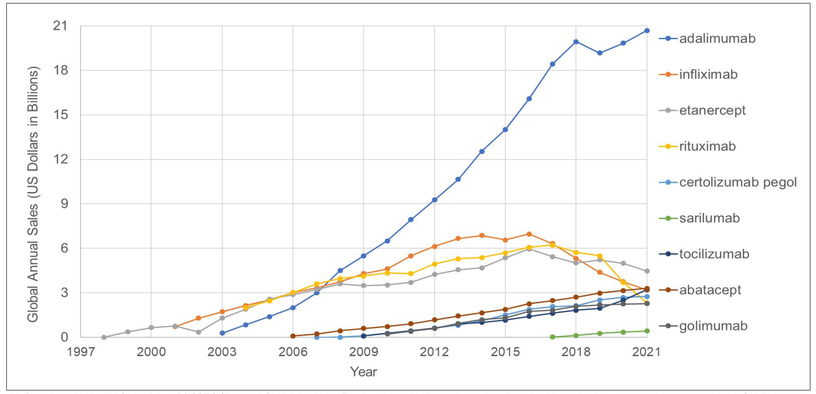
## Methods:

A literature search across PubMed and clinicaltrials.gov was conducted to identify studies. Filters included: (Rheumatoid Arthritis), (Biologic), (ACR20), and (DAS28). Additional studies were included from package inserts and refined searches on clinicaltrials.gov. Data extracted included baseline DAS28, % achieving DAS28 <2.6, % achieving ACR20, mean change in DAS28, mean change in HAQ-DI and SF-36 PCS. Cost Inputs were modeled for an inpatient hospital setting using the Federal Supply Schedule (FSS) from the U.S Department of Veterans Affairs MedSurg and Pharmaceutical catalog. Direct costs included: drug price, concomitant medications, healthcare provider, and laboratory costs. Subcutaneous formulations were assumed to be self-administered. Healthcare provider costs were calculated from the model published by (Schmier et al., 2017) with wages gathered from the U.S Bureau of Labor Statistics for 2021. All costs were modeled with a 1-year timeline and adjusted to 2023 dollars using CPI from the U.S Bureau of Labor Statistics. Absenteeism and presenteeism were included using a model for earning losses as related to HAQ-DI scores. The model adapted from (Wolfe et al., 2005) showed an annual earning loss of $4,372 per 1 unit increase in HAQ. Both direct and indirect costs were compared using a pooled analysis of 32 randomized controlled trials (RCTs).

## Results:

32 studies were included in the analysis. Over 97% of annual costs were attributed to drug price for all MABs except infliximab (91.5%). Subcutaneous etanercept had the highest total yearly costs (83,613 $) with intravenous infliximab having the lowest (19,324 $). Intravenous tocilizumab had the lowest ACR20 (15.9) with intravenous abatacept having the highest (30.9). Intravenous infliximab was the most cost-effective using ACR20 and DAS28. The least cost-effective agent across the board was etanercept with rituximab coming 2nd.

## Figure 2: Global Annual Sales (Billions $) of MABs for RA over time




MAB revenue generated from 10-k or 20-f SEC filing, and financial reports. For rituximab, certolizumab pegol, sarilumab and abatacept currencies were converted to US dollars using Purchasing Power Parities for GDP.

## Conclusion:

Although MABs have improved patient outcomes in RA, they present payers with a financial obstacle. These results show that payers and clinicians can utilize ACR20 and DAS28 to make value-based decisions for MABs within RA. Furthermore, these MABs will continue to generate billions of dollars in revenue until biosimilars gain larger market share with the total annual cost for a patient ranging from 19,324 - 83,613 $. Efforts to improve affordability should focus on reducing drug acquisition costs, which account for more than 90% of total annual costs. These findings exemplify this as the most affordable agent (IV Infliximab) was also the most cost-effective in regards to ACR20 and DAS28. Future research into willingness-to-pay thresholds could prove beneficial in establishing the use of clinical outcomes as a robust endpoint in cost-effectiveness analyses for RA.

## References:

1. Hsieh PH, Wu O, Geue C, et al. Economic burden of rheumatoid arthritis: a systematic review of literature in biologic era. Ann Rheum Dis. 2020 Jun;79(6):771-777.
2. SEC. FORM 10-K: Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934. [Internet]. Washington D.C.: U.S. Securities and Exchange Commission; 2017 [cited 2023 Apr 17]. Available from: https://www.sec.gov/Archives/edgar/data/200406/000020040618000005/form10-k20171231.htm
3. Hustad AP. Competing with Patent Thickets: Antitrust Law's Role in Promoting Biosimilars. Boston University Journal of Science and Technology Law. 2021;27(1):25-68. Available from: https://www.bu.edu/bjostl/files/2021/02/COMPETING-WITH-PATENT-THICKETS-Hustad-2021.pdf (Accessed April 17, 2023).
4. Furneri G, Mantovani LG, Belisari A, et al. Systematic literature review on economic implications and pharmacoeconomic issues of rheumatoid arthritis. Clin Exp Rheumatol. 2012 Jul-Aug;30(4 Suppl):S72-84.
5. Chambers JD, Wilkinson CL, Anderson JE, et al. Variation in Private Payer Coverage of Rheumatoid Arthritis Drugs. J Manag Care Spec Pharm. 2016 Oct;22(10):1176-81.
6. Felson DT, LaValley MP. The ACR20 and defining a threshold for response in rheumatic diseases: too much of a good thing. Arthritis Res Ther. 2014 Jan 3;16(1):101.
7. Ma K, Li L, Liu C, et al. Efficacy and safety of various anti-rheumatic treatments for patients with rheumatoid arthritis: a network meta-analysis. Arch Med Sci. 2019 Jan;15(1):33-54.
8. Wolfe F, Michaud K, Choi HK, et al. Household income and earnings losses among 6,396 persons with rheumatoid arthritis. J Rheumatol. 2005 Oct;32(10):1875-83.
9. Schmier J, Ogden K, Nickman N, et al. Costs of Providing Infusion Therapy for Rheumatoid Arthritis in a Hospital-based Infusion Center Setting. Clin Ther. 2017 Aug;39(8):1600-1617.