*Original Research*

# Costs of Providing Infusion Therapy for Rheumatoid Arthritis in a Hospital-based Infusion Center Setting

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## ABSTRACT

**Purpose:** Many hospital-based infusion centers treat patients with rheumatoid arthritis (RA) with intravenous biologic agents, yet may have a limited understanding of the overall costs of infusion in this setting. The purposes of this study were to conduct a microcosting analysis from a hospital perspective and to develop a model using an activity-based costing approach for estimating costs associated with the provision of hospital-based infusion services (preparation, administration, and follow-up) in the United States for maintenance treatment of moderate to severe RA.

**Methods:** A spreadsheet-based model was developed. Inputs included hourly wages, time spent providing care, supply/overhead costs, laboratory testing, infusion center size, and practice pattern information. Base-case values were derived from data from surveys, published studies, standard cost sources, and expert opinion. Costs are presented in year-2017 US dollars. The base case modeled a hospital infusion center serving patients with RA treated with abatacept, tocilizumab, infliximab, or rituximab.

**Findings:** Estimated overall costs of infusions per patient per year were $36,663 (rituximab), $36,821 (tocilizumab), $44,973 (infliximab), and $46,532 (abatacept). Of all therapies, the biologic agents represented the greatest share of overall costs, ranging from 87% to $91% of overall costs per year. Excluding infusion drug costs, labor accounted for 53% to 57% of infusion costs.

**Implications:** Biologic agents represented the highest single cost associated with RA infusion care; however, personnel, supplies, and overhead costs also contributed substantially to overall costs (8%–16%). This model may provide a helpful and adaptable framework for use by hospitals in informing decision making about services offered and their associated financial implications. (*Clin Ther*. 2017;39:1600–1617) © 2017 The Authors. Published by Elsevier HS Journals, Inc.

**Key words:** abatacept, antibodies, arthritis, hospital costs, humanized, infliximab, monoclonal, rheumatoid, rituximab.

## INTRODUCTION

Rheumatoid arthritis (RA) is an autoimmune inflammatory disease predominantly affecting the joints.[1] It tends to be symmetrical, and severity can vary, with some people having only occasional flares and others having constant symptoms, including fatigue and fever. Serious joint damage and disability can result

An abstract of this work was presented in poster format at the ISPOR 16th Annual European Congress; Dublin, Ireland; November 2–6, 2013.

*Accepted for publication June 9, 2017.*
http://dx.doi.org/10.1016/j.clinthera.2017.06.007
0149-2918/$ - see front matter

from moderate to severe disease.[2,3] In addition to joint deterioration, RA has been associated with significant systemic comorbidities, including increased prevalences of cardiovascular disease, infections, and malignancies, as well as a higher mortality risk, compared with those in the general population.[4]

In the United States, the estimated prevalence of RA in the general population ranges from 0.5% to 1%,[5] with a higher rate of disease observed in women.[1,5] The majority of affected individuals are older adults; 67 years is the mean age of patients with RA.[5] With significant growth projected in the US population aged >60 years, it is likely that rates of RA-related functional impairment, disability, morbidity, and mortality will increase.[5,6]

Treatment guidelines from the American College of Rheumatology[2] and the European League Against Rheumatism[3] emphasize that RA therapy should be commenced early to stem the progression of disease, prevent irreversible joint damage, and halt further functional decline. Recommended treatments are targeted toward achieving clinical remission or low disease activity. Patients become eligible for treatment with biologic disease-modifying antirheumatic drugs (DMARDs) if they continue to experience moderate to high disease activity following nonresponse to conventional DMARD regimens.[2,3] Several biologic agents have been approved for use in treating moderate to severe RA; some are administered orally (tofacitinib) or are self-injected (eg, adalimumab and etanercept), while others require monitored infusion in a hospital or infusion center setting. In the United States, the currently marketed biologic DMARDs that require monitored infusion include abatacept, infliximab, rituximab, golimumab, and tocilizumab.

Although self-injectables have the potential to reduce the administration costs associated with DMARDs, in the United States there remains a strong financial incentive to direct Medicare patients toward infusion-based products administered at a hospital or outpatient center. Medicare Part B directly reimburses physicians for the cost of infused therapies, with patients eligible for a copayment. Although self-injectables are subsidized by the Medicare Part D program, there exists a coverage gap, whereby patients are responsible for 100% of the drug cost until the "catastrophic" phase of coverage.[7] In a recent study, Yazdany et al[8] found that, in patients with RA and Medicare Part D, the mean out-of-pocket cost of self-injected biologic DMARD therapy was $835/mo.

However, monitored infusion of biologic DMARDs in the hospital setting encompasses costs beyond drug acquisition. To facilitate a comparison of the costs of RA infusion therapy to those of treatment alternatives, it is important to understand the constellation of relevant costs in addition to drug acquisition. Therefore, the purposes of the present study were to conduct a microcosting analysis from a hospital perspective and to develop a model that accounts for all identifiable costs associated with the provision of hospital-based infusion services (preparation, administration, and follow-up) for maintenance treatment of moderate to severe RA in the United States. As such, the model provides infusion center administrators with a reliable framework and tool for identifying and assessing the multitude of costs related to providing infusion therapy at their facilities.

## MATERIALS AND METHODS

A model was developed in Excel (Microsoft Corp, Redmond, Washington) for estimating the costs per year associated with providing monitored infusions of biologic DMARDs to patients for the treatment of moderate to severe RA in a US hospital setting. In this analysis, costs were estimated using an activity-based costing framework approach, which allows for the estimation of direct costs of a specific activity by thorough identification of all resources required for completing that activity in order to calculate the overall cost of care.[9,10] The model analyses were conducted from a provider perspective in a US hospital setting.

Base-case model input estimates were based on data from multiple sources. First, individuals at 5 community hospital–based infusion centers completed a survey about their patient volume, patient mix, and infusion center–specific overhead and payroll costs (data on file, Survey of Community-Based US Infusion Center Administrators, 2007). Second, published literature provided estimates on the time required for reconstitution and administration of infusion drugs[11,12] and rates of infusion reactions.[13–15] Third, product package inserts informed most of the assumptions around the administration, dosing, and schedules of monitored infusions.[13,16–18] Fourth, standard