Real-World Anti-Tumor Necrosis Factor Treatment in Rheumatoid Arthritis, Psoriatic Arthritis, and Ankylosing Spondylitis: Cost-Effectiveness Based on Number Needed to Treat to Improve Health Assessment Questionnaire

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ABSTRACT. ***Objective.*** To determine the effectiveness and cost-effectiveness of anti-tumor necrosis factor (anti-TNF) medications in a real-world environment for the treatment of rheumatoid arthritis (RA), psoriatic arthritis (PsA), and ankylosing spondylitis (AS) using the Health Assessment Questionnaire (HAQ).

Methods. We created a database of patients with RA, PsA, or AS treated with anti-TNF agents (etanercept, infliximab, or adalimumab) at a large outpatient rheumatology clinic. Patient characteristics, baseline HAQ prior to treatment, subsequent yearly HAQ, and reasons for termination were collected. The cost based on percentage of patients achieving ≥ 0.2 improvement in HAQ (minimal clinically important difference, MCID) was calculated using the 2008 direct cost (Cdn) of the medication.

Results. Data were available on 297 patients (206 with RA, 57 PsA, 34 AS). The mean age was 55 years, with 12 years of disease, and the mean baseline HAQ (standard error, SE) was 1.37 (0.04). The changes in HAQ (SE) at Years 1, 2, and 3 were –0.31 (0.04), –0.24 (0.06), and –0.27 (0.07) for annual cost to achieve MCID of $41,636, $42,077, and $42,147, respectively. The number needed to treat (NNT) was 1.94 (RA), 1.88 (PsA), and 2.30 (AS). There were no statistical differences between the diseases studied.

Conclusion. We obtained data on the effectiveness and cost-effectiveness of anti-TNF drugs using the HAQ score, which is known to be an excellent predictor of work disability, morbidity, and mortality. HAQ scores decreased with treatment and were sustained throughout the 3–5 years of followup. The NNT of approximately 2 seems favorable and was similar between diseases. (J Rheumatol First Release June 1 2009; doi:10.3899/jrheum.081122)

Key Indexing Terms:
RHEUMATOID ARTHRITIS PSORIATIC ARTHRITIS
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Inflammatory arthritides, including rheumatoid arthritis (RA), psoriatic arthritis (PsA), and ankylosing spondylitis (AS), are chronic, debilitating diseases that lead to significant decreases in quality of life secondary to severe functional impairment and pain[1,2]. These disorders are quite prevalent (worldwide prevalence of about 1%)[3-5] and incur rising costs to society both from a healthcare perspective and from loss of work productivity. It is estimated that the cost of rheumatic disorders is almost 3% of the US gross domestic product[6].

The development of tumor necrosis factor (TNF) antagonists (etanercept, infliximab, and adalimumab) has revolutionized the treatment of inflammatory arthritis. These drugs have been shown to be very effective at controlling the symptoms of these disorders and may halt the radiographic progression of joint destruction[7-10]. Currently, they are indicated for patients with a variety of inflammatory disorders (RA, PsA, AS, and juvenile chronic arthritis) who have significant disease activity despite aggressive treatment with the usual standard of care, including methotrexate (MTX) and other disease modifying antirheumatic drugs (DMARD).

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The Health Assessment Questionnaire Disability Index (HAQ-DI) is a validated tool for measuring patient function and it has been found to be a good predictor of functional impairment in RA and PsA[11-13]. In addition, studies in patients with RA have shown that higher HAQ scores translate into increased morbidity, mortality, and hospitalizations; conversely, improving HAQ has been shown to decrease mortality[14,15].

Most randomized controlled trials (RCT) have shown a HAQ score reduction of approximately 0.5 at 6 months to 1 year[16-18]. However, large observational studies in Europe and the USA have not shown the same degree of improvement[19,20]. It may be difficult to translate benefits determined from RCT to actual clinical practice, as RCT have a relatively short placebo-controlled duration of 6 to 12 months and are conducted in an idealized clinical environment where the patient population may be quite different compared to the real world. Thus, real-world effectiveness studies are needed and comparisons of response between diseases are helpful when resources are limited.

Anti-TNF drugs are very costly (~$20,000/yr) and they are used longterm because discontinuation may result in a flare of the disease. Additional cost may be incurred given the increased risk of serious infections in patients taking anti-TNF medication[21,22]. However, it is thought that these drugs reduce joint replacement and work loss[23-25]; therefore, in the long term, there is potential for cost savings. Because of the high up-front costs of anti-TNF drugs and the significant number of partial responders and nonresponders, there has been a growing need for cost-effectiveness analyses. Unfortunately, the majority of these studies have extrapolated cost benefits using models based on RCT[26-29], which may be overestimating drug effectiveness in the real world.

The purpose of our study was to use results obtained from a large clinical practice of patients with RA, PsA, or AS to determine the number needed to treat (NNT) and cost per minimal clinically important difference (MCID) in the HAQ.

MATERIALS AND METHODS

The design of this study was a retrospective cohort and it was conducted at St. Joseph's Health Care in London, Ontario, at an outpatient rheumatology practice. HAQ scores have been done routinely at every visit for most patients since 2002. Charts from patients with RA, PsA, and AS between 2000 and 2007 were identified via billing codes (4042 charts). Inclusion criteria were a diagnosis of RA, PsA, or AS per the rheumatologist; treatment at any time with etanercept, infliximab, and/or adalimumab; and at least 1 HAQ score post 1 year of anti-TNF treatment. Patients were excluded if they were taking anti-TNF medications for other diseases or if they had no followup HAQ scores. For the 1 to 3 year analyses, only patients with baseline HAQ scores were included. A database was produced to record patient baseline characteristics, yearly HAQ disability and pain scores, duration of treatment and if drug was stopped, and the reason for termination. After termination, HAQ scores were not included in our study. HAQ subscales were not documented as we were primarily interested in the HAQ disability and pain scores, which are routinely used in the literature.

All patients were followed at least yearly with HAQ-DI and visual analog scale (VAS) pain scores (converted to a 0–3 scale) completed at each visit. Prior to 2002, HAQ scores were inconsistently recorded, thus, analyses comprising only longterm users (> 5 yrs) do not include baseline HAQ scores (completed in < 30%). Change in HAQ scores in Years 1 to 3 were calculated from baseline HAQ (recorded from the last visit prior to drug initiation within 3 mo). Per the available literature, MCID was considered for HAQ-DI at least 0.2 and for HAQ-Pain Score (HAQ-PS) at least 0.3[30,31].

Anti-TNF medications were initiated in patients with DMARD-refractory disease [defined as failure of at least 2 DMARD; the majority of RA and PsA patients had failed high-dose MTX (≥ 20 mg/wk), at least 1 DMARD combination and use of leflunomide as a condition of government funding of medication costs]. For AS, there had to be at least 2 nonsteroidal antiinflammatory drugs (NSAID) failed, and for government funding the previous use of MTX or sulfasalazine. The majority of patients taking anti-TNF drugs in RA and PsA were also concurrently treated with MTX (usually 20 to 25 mg/wk). Doses of anti-TNF medications were as follows: etanercept 50 mg subcutaneously (sc) each week, infliximab 3 to 5 mg/kg every 6–8 weeks, and adalimumab 40 mg sc every 2 weeks. A small percentage of patients were able to decrease etanercept doses to 25 mg/week, but this was not accounted for, as rarely patients with PsA were taking 50 mg twice a week for their skin manifestations.

The NNT was determined by the percentage of patients achieving at least MCID for HAQ scores (1 over percentage achieving MCID). For the cost-effectiveness analysis, only direct drug costs of anti-TNF were considered and these were estimated from 2008 prescription costs ($390.70 Cdn per 50 mg for etanercept, $726.80 per 40 mg for adalimumab, and $1017.53 per 100 mg vial of infliximab). We assumed that there was no extra laboratory monitoring in these patients as they were usually taking DMARD or other medications. The costs related to infusion times for infliximab were not taken into account. Costs were calculated per year in Canadian dollars, using the costs per one patient achieving at least MCID for HAQ. Comparisons of patient characteristics and HAQ responses between diseases were done.

All statistical analyses were conducted using the JMP statistics program.

RESULTS

Patient characteristics. Over 4000 charts were reviewed to identify a total of 467 patients treated with anti-TNF medications; of these, 297 (206 with RA, 57 with PsA, and 34 with AS) met inclusion and exclusion criteria. Table 1 summarizes the baseline characteristics of the patients included in our study. The mean age and sex ratios are consistent with previous trials. All baseline mean HAQ-DI scores were greater than 1.0, signifying moderate to severe functional impairment. Patients with RA were older and their mean HAQ-DI score was significantly higher than those with PsA and AS. However, the disease duration prior to initiation of an anti-TNF medication was similar in all 3 groups. The HAQ-PS was also not significantly different. Duration of treatment with any anti-TNF drug was longer in the RA group, which is a result of these drugs being approved earlier for RA compared to PsA and AS.

Efficacy of anti-TNF drugs. All patients at the St. Joseph's rheumatology clinic are asked to complete HAQ-DI and pain scores (HAQ-PS; 0–3) at least yearly; adherence in this review was 88% for HAQ-DI and 72% for HAQ-PS. Medication adherence was not specifically monitored, but

Table 1. Characteristics of patients with rheumatoid arthritis (RA), psoriatic arthritis (PsA), and ankylosing spondylitis (AS) taking anti-TNF treatment.

Characteristic	All Patients, mean (SE)	RA, mean (SE)	PsA, mean (SE)	AS, mean (SE)	p
Number	297	206	57	34	
Age, yrs	55.0 (0.61)	57.6 (0.70)	49.9 (1.25)	44.4 (1.61)	< 0.0001
Disease duration, yrs	12.9 (0.46)	12.8 (0.54)	13.0 (1.07)	13.3 (1.43)	0.9417
Treatment duration, yrs	2.57 (0.09)	2.69 (0.11)	2.52 (0.21)	1.80 (0.24)	0.0099
Sex, % F	70.8	79.9	58.7	32.6	< 0.0001
Number	297	206	57	34	
Baseline HAQ-DI	1.37 (0.04)	1.47 (0.05)	1.18 (0.08)	1.06 (0.10)	0.0002
Number	255	175	51	29	
Baseline HAQ-PS	1.85 (0.04)	1.91 (0.06)	1.79 (0.09)	1.84 (1.12)	0.8671

TNF: tumor necrosis factor; SE: standard error; HAQ: Health Assessment Questionnaire; DI: Disability Index; PS: Pain Score.

termination secondary to nonadherence was 4% (42% of those for financial reasons).

The change in HAQ-DI (standard error, SE) at Year 1 compared to baseline (Table 2) was –0.27 (0.04) for all patients, –0.29 (0.05) in RA, –0.26 (0.08) in PsA, and –0.19 (0.08) in AS. Although AS had less of a response compared to the other disorders, there was no statistically significant difference between groups (p = 0.8). This change at Year 1 was maintained through Years 2 and 3 in patients with RA. Those with PsA had a greater response at Year 3; however, a larger sample size would be needed to confirm this. There were insufficient numbers of AS patients at Year 3 of treatment to be included in our analysis. The percentages (SE) achieving ≥ MCID at Years 1, 2, and 3 were 51.0% (3.5%), 51.5% (4.7%), and 51.3% (5.6%), respectively, which was similar between the different diseases, resulting in a NNT of 1.67 to 2.34.

Similarly, there was no statistically significant difference in change in HAQ-PS (SE) scores from baseline between groups (Table 3). At Year 1, the change was –0.57 (0.07) in RA, –0.44 (0.18) in PsA, and –0.66 (0.20) in AS (p = 0.7), which was maintained at least until Year 3 of treatment in RA and PsA. The percentages of patients achieving ≥ MCID of HAQ-PS were greater than those of MCID of HAQ-DI

Table 2. Effect of anti-TNF drugs on HAQ-DI and cost percentage achieving HAQ-DI MCID over 3 years in patients with RA, PsA, and AS.

Feature	All Patients, mean (SE)	RA, mean (SE)	PsA, mean (SE)	AS, mean (SE)	p
Baseline					
n	297	206	57	34	
HAQ-DI	1.37 (0.04)	1.47 (0.05)	1.18 (0.08)	1.06 (0.10)	0.0002
Year 1					
n	249	170	52	27	
Δ HAQ-DI	–0.27 (0.04)	–0.29 (0.05)	–0.26 (0.08)	–0.19 (0.08)	0.8192
% HAQ-DI ≥ 0.2	51.0 (3.53)	51.5 (4.37)	53.2 (7.36)	43.5 (10.6)	
NNT*	1.96	1.94	1.88	2.30	
Cost, $*	41,636	41,211	39,937	48,859	
Year 2					
n	156	109	36	11	
Δ HAQ-DI	–0.25 (0.06)	–0.25 (0.07)	–0.26 (0.12)	–0.27 (0.25)	0.2842
% HAQ-DI ≥ 0.2	51.5 (4.69)	42.7 (5.75)	42.9 (9.52)	60.0 (16.3)	
NNT*	1.94	2.34	2.33	1.67	
Cost, $*	42,077	50,752	50,535	36,220	
Year 3					
n	96	69	21		
Δ HAQ-DI	–0.25 (0.07)	–0.23 (0.07)	–0.38 (0.14)		0.1463
% HAQ-DI ≥ 0.2	51.3 (5.62)	50.9 (6.80)	55.0 (11.4)		
NNT*	1.95	1.96	1.81		
Cost, $*	42,147	42,363	39,121		

* For percentage of HAQ-DI ≥ 0.2. TNF: tumor necrosis factor; HAQ-DI: Health Assessment Questionnaire Disability Index; MCID: minimal clinically important difference; RA: rheumatoid arthritis; PsA: psoriatic arthritis; AS: ankylosing spondylitis; SE: standard error: NNT: number needed to treat.

Table 3. Effect of anti-TNF drugs on HAQ-PS and cost percentage achieving HAQ-PS MCID over 3 years in RA, PsA, and AS.

	All Patients, mean (SE)	RA, mean (SE)	PsA, mean (SE)	AS, mean (SE)	p
Baseline					
n	255	175	51	29	
HAQ-PS	1.85 (0.04)	1.91 (0.06)	1.79 (0.09)	1.84 (1.12)	0.8671
Year 1					
n	211	145	46	20	
Δ HAQ-PS	–0.55 (0.07)	–0.57 (0.07)	–0.44 (0.18)	–0.66 (0.20)	0.7323
% HAQ-PS ≥ 0.3	62.3 (3.60)	62.3 (4.41)	60.5 (7.54)	66.7 (11.4)	
NNT*	1.61	1.61	1.65	1.50	
Cost, $*	34,201	43,201	35,051	31,866	
Year 2					
n	127	91	28	8	
Δ HAQ-PS	–0.58 (0.09)	–0.60 (0.11)	-0.65 (0.17)	–0.50 (0.35)	0.2842
% HAQ-PS ≥ 0.3	62.0 (4.69)	62.2 (5.68)	63.0 (9.47)	57.1 (20.2)	
NNT*	1.61	1.61	1.59	1.75	
Cost, $*	34,919	34,919	34,486	37,955	
Year 3					
n	79	56	18		
Δ HAQ-PS	–0.55 (0.11)	–0.56 (0.13)	–0.67 (0.23)		0.1463
% HAQ-PS ≥ 0.3	53.9 (5.76)	63.8 (7.08)	55.6 (12.1)		
NNT*	1.86	1.57	1.80		

* For percentage of HAQ-PS ≥ 0.3. TNF: tumor necrosis factor; HAQ-PS: Health Assessment Questionnaire Pain Score; MCID: minimal clinically important difference; RA: rheumatoid arthritis; PsA: psoriatic arthritis; AS: ankylosing spondylitis; SE: standard error: NNT: number needed to treat.

(SE): 62.3% (3.6%), 62.0% (4.7%), and 53.9% (5.8%) in Years 1, 2, and 3, respectively (NNT of 1.50–1.86).

Longterm anti-TNF users. Patients were considered longterm users of anti-TNF drugs if duration of treatment was > 5 years. Most of these patients lacked baseline HAQ scores as these were not routinely collected prior to 2002. These patients were older (mean age 59 yrs) but had shorter disease duration (mean 11.4 yrs) than those with < 5 years of treatment. The yearly HAQ-DI and HAQ-PS scores were not significantly different than in shorter-duration users. The HAQ-DI scores were 1.27, 1.35, 1.21, 1.28, and 1.33 in Years 1 to 5, respectively (Figure 1A). The HAQ-PS scores (Figure 1B) were 1.40, 1.26, 1.28, 1.31, and 1.44 (Years 1 through 5). The slight improvement in HAQ-PS seen in Years 2 to 4 was not sustained at Year 5 and could be due to a variable length of followup.

Drug discontinuation. The majority of anti-TNF drug discontinuation occurred in Year 1 (23.7%) and Year 2 (22.2%) of treatment (Figure 2). With increasing years of treatment, the discontinuation rate dropped dramatically (only 4.5% in Years 4 and 5). Patients discontinuing treatment of 2 different anti-TNF drugs were more likely to discontinue a third anti-TNF drug (42.9%; Table 4), but the rate of discontinuation of a second biologic was not different compared to the first.

The main reason for discontinuation was ineffectiveness, followed by nonadherence. Adverse events leading to discontinuation were similar to those seen in RCT. There were 8 deaths. Cancer deaths (breast and lung) were from preexisting or new cancers and were thought to be unrelated to the drug. The 2 infection deaths may be attributable to anti-TNF treatment. There was no discontinuation secondary to tuberculosis (TB); however, our center screens for TB prior to initiation with anti-TNF drugs with TB skin testing and chest radiography. Prior to the onset of our study, one patient using infliximab, who was from The Netherlands and had worked in healthcare, reactivated pulmonary TB. Other patients who were in open-label extensions from RCT were not included, but 2 of them developed cancer (one had 2 primaries, lung and bowel, and one had metastatic bowel cancer).

Cost-effectiveness. Cost per year for achieving at least MCID in HAQ scores was used to estimate the cost-effectiveness of anti-TNF drugs. Only the direct cost of the drug was considered in this analysis ($21,243 for Year 1, $21,689 for Year 2, and $21,614 for Year 3; differences in costs are secondary to dosage differences between patient population in each of the years). With NNT of 1.50 to 2.34, the costs ranged from $31,866 to $50,752 per year (Tables 2 and 3).

Subgroup analyses. The changes in HAQ-DI and HAQ-PS for several subgroups are shown in Table 5. We chose to report the changes at Years 1 and 3 as there was no statistically significant difference between years (data not shown); there was also no difference between the different diseases (data not shown). Changes in HAQ scores were not affected by sex, disease duration, and the type of anti-TNF drug. The

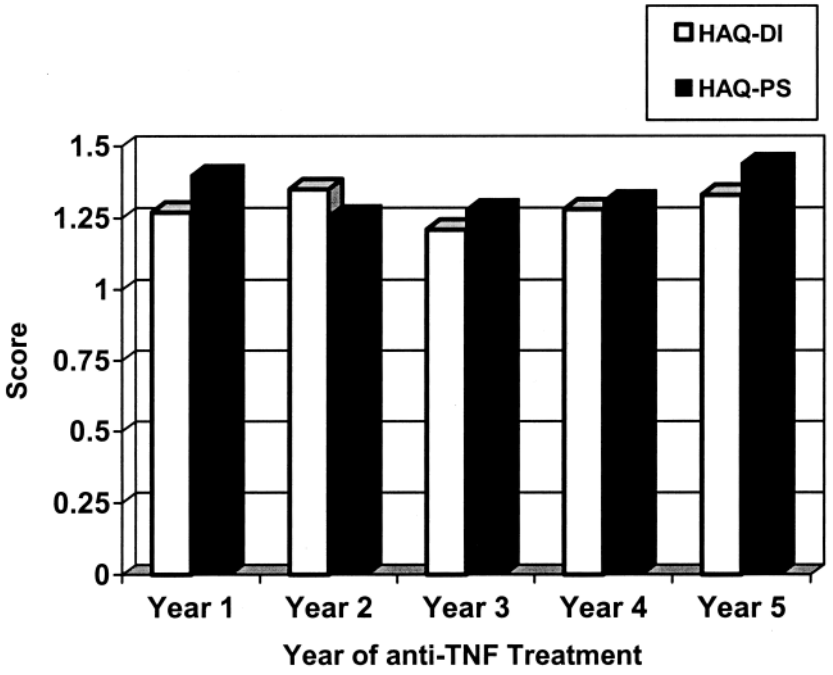

Figure 1. Health Assessment Questionnaire-Disability Index (HAQ-DI) and HAQ-Pain Score (PS) in longterm anti-TNF users.

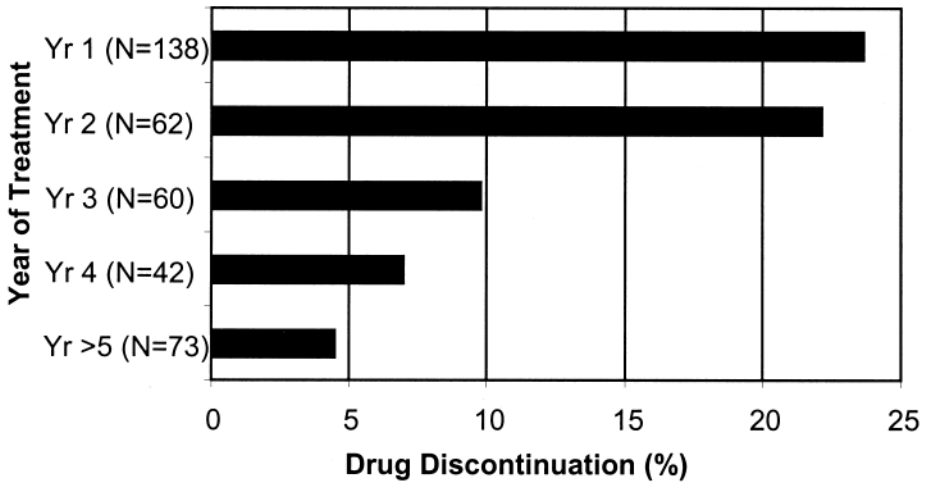

Figure 2. Percentage drug discontinuation for each treatment year.

higher the baseline HAQ-DI scores, the greater the decrease in HAQ-DI ($p < 0.001$, $p < 0.03$ for Years 1 and 3). Similarly, patients with higher baseline HAQ-PS scores had greater decreases in HAQ-PS ($p < 0.001$).

DISCUSSION

RCT are thought to overestimate treatment effects and with the rising costs of pharmacological interventions, it is becoming increasingly important to determine the true degree of treatment effectiveness, which is likely best obtained from direct patient data[19]. Our study is the largest observational study of the effectiveness and cost-effectiveness of anti-TNF drugs in multiple rheumatologic conditions. In addition, we report followup data up to 5 years, whereas most RCT followup is insufficient, given that these disorders are chronic and may require decades of treatment.

Patients included in our study are comparable to many RCT in that they had significant disease with long disease duration. However, baseline HAQ scores for RA were slightly lower than in RCT (1.47 vs average of 1.6)[19]; scores for PsA were comparable to RCT (1.18 vs 1.10)[17]. We showed a mean HAQ-DI change at Year 1 of –0.29 for RA

Table 4. Reasons for discontinuation of anti-TNF drugs in patients with rheumatoid arthritis (RA), psoriatic arthritis (PsA), and ankylosing spondylitis (AS).

	n (%)
First anti-TNF drug	
Total	467
Etanercept	353 (75.6)
Infliximab	58 (12.4)
Adalimumab	54 (11.6)
Discontinuation	141 (30.2)
Reason for discontinuation	
Ineffective	97 (68.8)
Patient choice	11 (7.8)
Serious infection	9 (6.4)
Financial	6 (4.3)
Allergic	2 (1.4)
Infusion reaction	2 (1.4)
Pregnancy	2 (1.4)
Neurological adverse event	2 (1.4)
Cancer	1 (0.7)
Cardiac adverse event	1 (0.7)
Vasculitis	1 (0.7)
Death	7 (5.0)
Unknown	3 (2.1)
Cancer	2 (1.4)
Infection	2 (1.4)
Second anti-TNF drug	
Total	98
Adalimumab	34 (34.7)
Etanercept	34 (34.7)
Infliximab	26 (26.5)
Discontinuation	29 (29.6)
Reason for discontinuation	
Ineffective	25 (86.2)
Serious infection	1 (3.4)
Allergic	1 (3.4)
Patient choice	1 (3.4)
Financial	1 (3.4)
Third anti-TNF drug	
Total	14
Adalimumab	7 (50.0)
Infliximab	5 (35.7)
Etanercept	2 (14.3)
Discontinuation	6 (42.9)
Reason for discontinuation	
Ineffective	3 (50)
Death (unknown cause)	1 (16.7)
Other	2 (33.3)

TNF: tumor necrosis factor.

and –0.26 for PsA, significantly less than that reported in RCT (~ –0.5), which may be a result of selection criteria for RCT. Our patients had lower baseline HAQ scores and often had less severe joint counts and lower inflammatory mediators. In addition, the comorbidity of real-world patients tends to be higher than in RCT as those patients are often excluded from trials; therefore, this may have accounted for less change in our data. However, RCT protocols generally do not allow for adjustment of other medications (such as DMARD, steroids, and NSAID) that could allow for more optimal disease control.

Previous community-based studies[32,33] also revealed greater HAQ changes than our study, but the population was derived from previous trials and thus the data were not truly observational. Two large databases, the British Society for Rheumatology Biologics Register (BSRBR) and the National Data Bank for Rheumatic Disease (NDB), may help elucidate the true effectiveness of anti-TNF drugs in the real world. Published reports based on the BSRBR have shown good European League Against Rheumatism responses with anti-TNF drugs; however, they have not specifically reported on HAQ changes and have focused only on RA[20]. The NDB reports a HAQ change of 0.14 at 1 year from a baseline of 1.34. Similarly, when the NDB VAS pain score is converted to a 0–3 scale, the change in pain was less (–0.42) than that reported here (–0.57; NDB baseline pain score 1.59 vs 1.91). Our subgroup analyses suggest that the higher the baseline HAQ for DI or pain, the greater the change in HAQ[19].

The limitations of this analysis are that the data are from a single site, although there are 6 different rheumatologists and the referral area is large. The numbers for AS are small (as anti-TNF approval in AS came after that for RA and PsA). However, it appears that the incremental HAQ improvements are similar. Although the Bath AS Disease Activity Index is a more recognized functional score for AS, we chose the HAQ in order to compare the 3 diseases. We also did not follow up on what happened to the HAQ once a person discontinued anti-TNF treatment; many RA and PsA patients treated with 2–3 anti-TNF drugs were switched to other biologic agents or entered RCT, so they did not return to standard of care. In AS, nonrespondents often returned to nonbiologic care after failing at least 2 anti-TNF drugs.

With respect to the cost-effectiveness analysis, we chose to estimate cost-effectiveness based on the NNT to achieve HAQ MCID. The NNT of approximately 2 reported in our study is very good; however, the cost remains high and this is because only direct costs were considered. Many other costs were not considered in our study, such as work disability, rehabilitation, hospitalization, and surgical costs, which we could not reliably obtain from chart review as they were inconsistently recorded. Future work will involve the inclusion of other direct and indirect costs via cost-effectiveness models.

Ours is the first study to compare real-world effectiveness and cost-effectiveness of anti-TNF drugs between different rheumatologic diseases using HAQ scores, and has a relatively long followup. HAQ scores were clinically significantly decreased at 1 year and were sustained up to 5 years. There was no difference in response between RA, PsA, and AS. Baseline HAQ scores may affect change in HAQ and even those patients with very high HAQ scores may have a reversible component of functional impairment responsive to anti-TNF agents.

Table 5. Changes in HAQ-DI and HAQ-PS analyzed by subsets of sex, disease duration, type of anti-TNF, baseline HAQ-DI, and baseline HAQ-PS.

	N	Δ HAQ-DI Year 1	Δ HAQ-PS Year 1	N	Δ HAQ-DI Year 3	Δ HAQ-PS Year 3
All	249	–0.27 (0.04)	–0.54 (0.07)	96	–0.25 (0.07)	–0.55 (0.11)
Sex						
Female	176	–0.26 (0.05)	–0.48 (0.08)	68	–0.32 (0.08)	–0.50 (0.13)
Male	73	–0.30 (0.07)	–0.71 (0.10)	28	–0.22 (0.16)	–0.65 (0.21)
p		0.6763	0.1137		0.5413	0.5610
Age, yrs						
< 45	72	–0.29 (0.07)	–0.57 (0.10)	26	–0.13 (0.15)	–0.65 (0.48)
46–55	63	–0.23 (0.08)	–0.47 (0.12)	25	–0.27 (0.14)	–0.46 (0.20)
56–65	63	–0.9 (0.06)	–0.64 (0.13)	24	–0.17 (0.10)	–0.56 (0.25)
> 65	51	–0.28 (0.10)	–0.47 (0.21)	21	–0.48 (0.19)	–1.10 (0.19)
p		0.9170	0.8262		0.3486	0.0457
Disease duration, yrs						
< 2	20	–0.32 (0.14)	–0.55 (0.26)	20	–0.33 (0.13)	–0.68 (0.22)
3–10	100	–0.31 (0.06)	–0.40 (0.08)	38	–0.39 (0.16)	–0.46 (0.17)
11–20	78	–0.19 (0.06)	–0.50 (0.14)	35	–0.14 (0.12)	–0.65 (0.24)
> 20	38	–0.29 (0.11)	–0.88 (0.15)	23	–0.27 (0.12)	–0.84 (0.25)
p		0.5686	0.1148		0.5176	0.2818
Anti-TNF drug						
Adalimumab	30	–0.29 (0.12)	–0.75 (0.20)		—*	—*
Etanercept	202	–0.28 (0.04)	–0.53 (0.07)			
Infliximab	17	–0.15 (0.08)	–0.34 (0.21)			
p		0.6481	0.2915			
Baseline HAQ-DI						
< 0.5	29	0.00 (0.05)	–0.61 (0.17)	8	0.09 (0.10)	–0.35 (0.14)
0.6–1.0	55	–0.13 (0.07)	–0.62 (0.11)	21	0.16 (0.13)	–0.34 (0.24)
1.1–1.5	73	–0.21 (0.07)	–0.28 (0.16)	30	–0.30 (0.10)	–0.46 (0.17)
1.6–2.0	48	–0.37 (0.08)	–0.53 (0.16)	20	–0.28 (0.12)	–0.36 (0.31)
> 2.0	44	–0.63 (0.12)	–0.79 (0.13)	17	–0.81 (0.25)	–1.1 (0.28)
p		< 0.001	0.0753		0.0330	0.1166
Baseline HAQ-PS						
< 1.0	31	–0.07 (0.08)	0.31 (0.21)	18	–0.20 (0.30)	0.30 (0.24)
1.1–1.5	36	–0.25 (0.08)	–0.471 (0.12)	27	–0.10 (0.04)	0.04 (0.17)
1.6–2.0	68	–0.19 (0.07)	–0.55 (0.10)	19	–0.14 (0.20)	–0.53 (0.20)
> 2.1	75	–0.44 (0.07)	–0.94 (0.10)	23	–0.48 (0.10)	–1.04 (0.17)
p		0.005	< 0.0001		0.0842	< 0.0001

* Insufficient numbers for analysis. TNF: tumor necrosis factor; HAQ-DI: Health Assessment Questionnaire Disability Index; HAQ-PS: Health Assessment Questionnaire Pain Score; RA: rheumatoid arthritis; PsA: psoriatic arthritis; AS: ankylosing spondylitis.

We have shown that the effectiveness of anti-TNF drugs is similar for RA, PsA, and AS and the NNT is approximately 2 to achieve at least MCID of HAQ-DI or HAQ pain.

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