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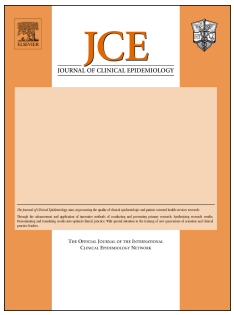

Collection of Anti-Rheumatic Medication Data from Both Patients and Rheumatologists Shows Strong Agreement in a Real World Clinical Cohort: The Ontario Best Practices Research Initiative (OBRI) a Rheumatoid Arthritis Cohort

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Collection of Anti-Rheumatic Medication Data from Both Patients and Rheumatologists Shows Strong Agreement in a Real World Clinical Cohort: The Ontario Best Practices Research Initiative (OBRI) a Rheumatoid Arthritis Cohort

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Abstract

Objectives: To examine the agreement between patient and rheumatologist reported Anti-Rheumatic Medication (ARM) use in the Ontario Best Practices Research Initiative (OBRI).

Study Design and Setting: We included adult patients who enrolled on or after Sep 1st 2010 and compared ARM use where rheumatologist visits and interviews occurred within 60 days of each other. Kappa statistic was used to measure agreement. We calculated sensitivity, specificity, positive, and negative predictive value, considering patient reported data as the gold standard. To examine factors associated with agreement, a hierarchical generalized linear model was used. A subset analysis was also completed to compare start and stop dates of ARM.

Results: Overall agreement for ARM was good with higher sensitivity and lower specificity for csDMARDs compared with bDMARDs. Increased Health Assessment Questionnaire (HAQ) pain index and disease activity score (DAS)28-ESR were significantly associated with lower agreement. Reporting stop dates was higher (19.4%) for patient reported data compared to rheumatologist reported data (13.1%).

Conclusion: ARM reports had strong agreement particularly for patients who have low disease activity and pain. ARM discontinuation were reported more frequently by patients which may indicate that patients may be discontinuing use of their RA medications prior to consulting their rheumatologist.

Word count: 199

Keywords: Rheumatoid arthritis (RA); Anti-rheumatic medication; Kappa statistics; Agreement; Data sources; Disease registry

What is new?

Key findings

- Anti-rheumatic medication use reported by patients and rheumatologists in the OBRI registry showed strong agreement, however medication stop dates were more often reported by patients compared to rheumatologists.

What this adds to what was known

- We showed that these two data sources could be used interchangeably and are both accurate and reliable sources of medication data in a real world setting.

What is the implication and what should change new?

- Having more than one source of primary data can minimize the concern of missing data in real world settings.
- Patients may be stopping their RA medications without consulting their rheumatologists.

1. Introduction

While some registries rely on medication data reported directly from physicians, others will collect this information solely through patient reports. Collection of medication use from both patients and physicians could be considered a strength for disease registries and cohorts including rheumatoid arthritis (RA). Medication use obtained through patient interviews is costly and subject to recall bias [1, 2]. On the other hand, collecting medication information from physician's offices, using case report forms (CRFs), does not guarantee complete and accurate data reporting. Greater accuracy and reliability of medication reporting could be gained by using both data sources. For example, medication data would continue to be available through patient interviews for patients not seeing their rheumatologists on a regular basis or patients who decide to switch to a new rheumatologist (i.e., one that may not be participating in the research study). Medication data would also continue to be available through physician reports, for those patients who choose not to participate in interviews. However, in order to use these two data sources as alternatives for each other, and to justify the added cost of collecting medication data from two sources it is important to consider the strength of agreement between patient and physician reported medication use.

Previous studies have shown moderate to good agreement between drug use reported through interviews and claims data [3-10] for medications used in common diseases. Nielson et al (2008) showed that agreement between surveys and claims data are stronger for cardiovascular and diabetes medication compared to medications used on an as needed basis [5]. Allin et al (2013) showed good agreement between self-reported (Canadian community Health Survey) and claims data (Ontario Drug Benefit Program) for oral diabetes medication and moderate agreement for anti-hypertensive medication in elderly patients[3]. Taipale et al (2016) examined agreement between self-reported drug use and data in a drug dispensing-based register in elderly Finish patients. They found good agreement for regularly used drugs but poor agreement for drugs used "as needed "[10].

Based on our knowledge to date, the comparability of two or more anti-rheumatic medication data sources within a registry or a real world observational cohort has not been studied in Canada. Few studies in other countries have looked at agreement between two different data sources for anti-rheumatic medication use [11-13]. Noize et al (2009) found a substantial agreement between interview and reimbursement medication data for drugs used for cardiovascular diseases, diabetes, neuropsychiatric and rheumatic diseases [13]. Richardson et al (2013) found poor to moderate agreement between interview-ascertained medication use and pharmacy records among a population aged 50 years or older, for 19 drug classes including anti-rheumatic medications [11]. Walitt et al (2008) evaluated the validity of self-reported rheumatoid arthritis medication data compared with chart review in the Women's Health Initiative [12]. However, they did not assess agreement between the two different data sources. Using US

RA registry, one recent study examined patient-reported adherence to Methotrexate which was recorded by rheumatologist at the most recent registry visit [14].

The aim of this study was to examine the strength of agreement (as the primary outcome) between patient and rheumatologist reported Anti-Rheumatic medication (ARM) use in the Ontario Best Practices Research Initiative (OBRI). We identified individual level factors associated with higher agreement between these two data sources. We also calculated sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) (as secondary outcomes) overall and by 1) type of ARM (conventional synthetic Disease-Modifying Anti-Rheumatic Drugs (csDMARDs) and biologic DMARDs (bDMARDs)); 2) ARM administration route and 3) ARM start and stop date.

2. Materials and methods

2.1. Data source and patients

The OBRI is a multicenter registry across Ontario, Canada collecting data from both rheumatologists and patients with RA followed under routine care. Canada has a publicly funded health care system which covers all services provided by hospitals and physicians. Under the publicly funded health care system, in Ontario, prescription drugs are covered for seniors (≥ 65 years of age). Canadians must be referred to a rheumatologist through primary health care services (e.g., their family doctor). Once referred, the rheumatologist takes over their RA care. The OBRI incorporates rheumatologist assessments and a unique method of collecting data directly from the patients, using telephone interviewers. Patients in the OBRI are interviewed every six months. To minimize recall bias, patients are asked to have all their medication bottles in front of them at the time of the interview. Rheumatologist assessments are conducted as per routine care. All patients have a rheumatologist confirmed diagnosis of RA with disease onset after 16 years of age, and are 18 years of age or older at enrollment into the registry. Between January 2008 and January 2019, 3669 eligible patients across 65 sites gave their consent to participate in rheumatologist evaluations, and 3525 agreed to patient interviews. Institutional research ethics approval was obtained prior to recruitment.

For this study we restricted our population to patients who were enrolled in OBRI on or after Sep 1st 2010. Prior to this date the interviewers were not collecting start and stop dates for reported ARM. We compared ARM use reports only where rheumatologist visits and interviews occurred within 60 days of each other believing that by restricting the time window between the two data sources, discrepancies would more likely reflect actual changes in the patients ARM use rather than disagreement in ARM

reporting. In a subset analysis comparing start and stop dates reported in the two data sources, we additionally excluded patients who started their ARM more than 30 days before enrolment (Figure 1).

2.2 Statistical analysis

Characteristics of the cohort at enrolment were described using the mean and standard deviation (SD) for continuous variables or the count and proportion for categorical variables.

In the primary analysis, the prevalence of ARM use overall and for csDMARDs and bDMARDs in the two data sources were compared. To calculate sensitivity and specificity, PPV, and NPV we arbitrarily selected patient reported data as the gold standard, acknowledging that unlike diagnostic studies, neither of these two sources is considered the gold standard. The same approach was used for comparing the administration routes for bDMARDs and csDMARDs between the two data sources.

To examine factors associated with agreement of ARM use, hierarchical generalized linear models (HGLM) (multilevel models) taking into account two levels (patient level and rheumatologist level as patients are nested within rheumatologists) was used [15-17]. The factors considered were patient's age, sex, disease-related factors, and socio-economic characteristics. Diseases related factors included disease duration, disease activity score (DAS28-ESR), physician global score, health assessment questionnaire disability Index (HAQ-DI), HAQ pain index, and number of comorbidities. Socioeconomic status was measured by marital status, health insurance type (Ontario Health Insurance plan (OHIP) / private health insurance coverage), annual household income, and educational attainment. Sex and academic rheumatologist (rheumatology practices within a university affiliated teaching hospital)/community rheumatologist were also considered as additional level predictors for agreement. Using HGLM, we calculated Intraclass Correlation Coefficient (ICC) to indicate how much of the total variation in the probability of agreement is accounted for by the rheumatologist.

2.3 Subset analysis

The prevalence, sensitivity, specificity, PPV, NPV, and agreement for ARM start and stop dates for both data sources were calculated in a subset analysis (No of patients=1483). The absolute time gap (days) for ARM start dates (No of patients=983) and stop dates (No of patients=112) available in both patient and rheumatologist reported data were also calculated (Figure 1).

The agreement between patient and rheumatologist reports for all analyses mentioned above were calculated using Cohen's kappa statistics with 95% confidence interval (95% CI), using patient reported

ARM as the gold standard. Kappa values were interpreted as follows: poor (<0.20), fair (0.20-0.40), moderate (0.41-0.60), good (0.61-0.80), and very good (0.81-1.00) [18]

3. Results

Table 1 shows the characteristics of patients at enrollment. 2,818 patients (78.6% female) were included with a mean (SD) age at OBRI enrolment of 58.0 (13.0) years. Mean (SD) for disease parameters were: DAS28: 4.2 (1.6); physician global: 4.0 (2.5); HAQ disability Index: 1.1 (0.8) and HAQ pain index: 1.4 (0.9). Median (IQR) for disease duration was 4.0 (1.0-12.0) years.

3.1. Agreement in ARM use

The prevalence of ARM use (csDMARDs/bDMARDs) was 98.6% and 99.0% based on patient and rheumatologist reports, respectively. For csDMARDs use, the prevalence was 79.6% based on patient reports and 80.6% based on rheumatologist reports. The prevalence of bDMARDs use was 19.0% and 18.4% in patient and rheumatologist reports (Table 2).

Overall agreement for ARM use between patient and rheumatologist reported data was rated as good (Kappa: 0.78; 95%CI: 0.72-0.83). Agreement for csDMARDs (kappa: 0.76) and bDMARDs (kappa: 0.89) separately was also rated as good and very good, respectively (Table 2). The sensitivity was higher (99.8%) for csDMARDs compared to bDMARDs (95.6%) whereas specificity in csDMARDs was lower than bDMARDS (64.6% vs. 93.9%). There was a small difference in PPV and NPV between csDMARDs and bDMARDs.

3.2. Characteristics related to patient and rheumatologist reported ARM use

There was an overall statistically significant amount of variability in the log odds of agreement between rheumatologists in our analysis sample (HGLM estimate=1.28; p=0.001). Calculated ICC was 0.28 indicating 28% of total variation in the probability of agreement is accounted for by treating rheumatologist.

Table 3 shows factors associated with overall agreement for ARM use. The adjusted HGLM showed that increased HAQ-pain index (0.48; 95%CI: 0.33-0.70, p=0.0002) and increased DAS28-ESR (OR: 0.73; 95%CI: 0.58-0.91, p=0.01) were significantly associated with lower agreement.

3.3. Subset analysis for reported start and stop dates

3.3.1. ARM administration route agreement

The route of administration was reported as 62% subcutaneous (SC) or injection based on patient reports and 68% based on rheumatologist reports, whereas the prevalence of infusions for bDMARDs was higher (30.3%) in the patient reports compared to rheumatologist reports (26.4%). The agreement in subcutaneous administration route for bDMARDs was rated as very good (Kappa: 0.90; 95% CI: 0.88-0.93), while the agreement was moderate for oral and subcutaneous routes of csDMARDs (Kappa: 0.60 and 0.59, respectively (Table 2).

3.3.2. Start and stop dates agreement

For this subset analysis, 1,483 patients were included. After reviewing the outliers (i.e., absolute time gap > 180 days), the majority were found to be data entry errors and were therefore excluded from the analysis. The prevalence of reported start dates of ARM was 77.6% and 82.2% based on patient and rheumatologist reports, respectively. The prevalence of reporting stop dates was higher (19.4%) for patient reports compared to rheumatologist reports (13.1%). Sensitivity and PPV were higher and specificity and NPV were lower for start dates compared with stop dates.

Overall agreement between patient and rheumatologist reports were rated as moderate (Kappa: 0.49; 95%CI: 0.45-0.53) and poor (Kappa: 0.20; 95%CI: 0.16-0.25) for start and stop dates, respectively (Table 4).

3.3.3. Start and stop dates absolute time gap

The absolute time gap between start dates of all ARMs was approximately one week (Median: 8 days; 1.0-40.0). Figure 2a shows the distribution of the absolute time gap (days) between patient and rheumatologist reports for start and stop date by ARM type. The absolute time gap for csDMARDs was shorter (Median: 7 days; IQR: 1-36) compared to bDMARDs (Median: 14 days; IQR: 1-63).

With respect to the absolute time gap in stop dates for all ARMs, 50% of records showed a time gap of 15.5 days (IQR:6-61) between patient reported and rheumatologist reported. The time gap in reported stop dates was similar for csDMARDs (15.5 days; 6-46) compared to bDMARDs (16.0 days; 7-99.5) (Figure 2b).

4. Discussion

In this study we found good agreement between rheumatologist and patient reported ARM use. The slightly higher ARM use reported by rheumatologists may reflect the reporting of RA medications that are prescribed but for various reason, not filled by the patient (i.e., because of fear of side effects,

medication cost, or delays in getting prescriptions filled). The prevalence of both bDMARDs and csDMARDs use was comparable between the two data sources.

The agreement in reporting of SC /injection route was better compared to infusions for bDMARDS (0.90 vs.0.77). Perhaps some patients are not able to accurately report on the route of bDMARDs because they cannot distinguish between the two route options provided (i.e., SC/Injection vs Infusion).

We found moderate and poor agreement between the two data source, for reporting ARM start and stop dates, respectively. Patients are more likely to report stop dates compared to rheumatologists. One possible reason for this important finding could be that patients may occasionally stop taking their medications prior to advising or consulting with their rheumatologist. Further exploration of this outcome is warranted. For example, a more detailed examination of the patient reported reason for these medication stops would allow us to better understand why this is happening and possibly allow us to improve patient care. For example, the patient may have stopped taking the medication because they experienced side effects, because they are feeling better and believe they no longer need them, or because they simply ran out of their medications.

Overall the median gap time for reporting start dates between the two data sources was smaller for csDMARDs (8 days) compared with bDMARDs (14 days). One possible reason is that while patients can refer to their medication bottles for the start date of oral medications, but may not be provided with a record of their biologic infusion dates (i.e., these medications are mostly administered through infusion clinics).

In multivariate hierarchical generalized linear models, the agreement between patients and rheumatologists was better for patients with lower disease and lower pain scores. Lack of adherence to prescribed medications may partly explain why we found less agreement between patient and rheumatologist reported ARM use in patients with higher disease scores. Patients who feel they are not being optimally treated may be less likely to take their medications as prescribed by their rheumatologist, or the higher scores in disease activity may be a consequence of their lack of adherence to their prescribed medications. Ahluwalia et al. found that patients in the OBRI with higher physician global scores were less likely to be adherent to their RA medications[19].

Rheumatologist ARM reporting had a very high sensitivity and was found to be accurate and valid when compared to patient reports. These findings suggest that the two sources of data are interchangeable. Therefore, by collecting this data from two different sources we are able to minimize missing medication data. This is an important consideration for long term follow-up studies where participant attrition is

often a major concern. In the OBRI a number of patients who are no longer being seen by the rheumatologist who enrolled them into the cohort (i.e., an OBRI investigator) continue to participate in the OBRI through interview reported data, while some patients who are too busy to participate in interviews continue to participate in OBRI rheumatologist reported data. We have specifically considered anti-rheumatic medication reporting in RA patients in a real world setting, which does not appear to have been addressed by any previous studies in Canada. Previous studies have mostly considered other drug classes, different data sources, and different settings, however, in spite of this limitation, our results are consistent with most of these studies [3, 5, 7, 9, 10, 13, 20].

Among studies which investigated the agreement between two data sources for anti-rheumatic medication use, Kehoe et al (1994)[21] compared self-reported medical history and medication use with information form the participant's physicians in a case control study. They found some differences between patient and physician reports for arthritis (15%) and aspirin medication (21%) but little differences for other diseases or medication (e.g. anti-hypertensive).

Similar to our study results, Noize et al (2009) also found good agreement between interview reported and reimbursement medication data for drugs used for musculoskeletal diseases [13]. Richardson et al (2013) assessed the agreement between interview-ascertained medication use and pharmacy records for 19 drug classes including anti-rheumatic medications [11]. They found moderate or poor agreement for anti-inflammatory and anti-rheumatic products (kappa=0.54). However, they considered all types of anti-rheumatic medication including folic acid, steroids, and non-steroids agents which may be the reason for the lower agreement (i.e., patient recall is not good for nonspecific anti-rheumatic agents and medications taken "as needed").

In a recent RA study by Curtis et al (2016), where patient self-reported medication was considered the gold standard, it was shown that of 228 patients whose rheumatologist reported current MTX use at the time of the most recent registry visit, 45 (19.7%) had discontinued or missed $\geq$ 1 dose in the last month[14]. This is consistent with our finding of a lower ARM discontinuation or stop date prevalence reported by rheumatologists compared to patients.

Limitations

While we found good to very good agreement in RA medication reporting between the two data sources in the OBRI cohort, these findings are relevant to settings with similar procedures but may not be generalizable to all registries or observational studies. Regardless, these findings are important because

they describe a novel method for collecting reliable and accurate medication data in the real world setting and support the accuracy of using either source of RA medication data.

5. Conclusion

The results of this study suggest that there is strong agreement between patient and rheumatologist reported anti-rheumatic medication use. The agreement is even better for patients who have lower disease activity and pain. Our results also suggest that some patients are discontinuing their RA medications prior to consulting their rheumatologist and recommend this finding be further investigated. Based on the results of this study, we believe it is acceptable to use either of these two data sources and to use them interchangeably, in order to minimize missing data when conducting research in a real world setting. With the increasing role of real world data in health care decisions and the current trend towards using high quality real world evidence for regulatory decisions this study provides an example of how registry data can be collected accurately and reliably and how missing data can be minimized.

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Figure 1: Cohort selection flowchart

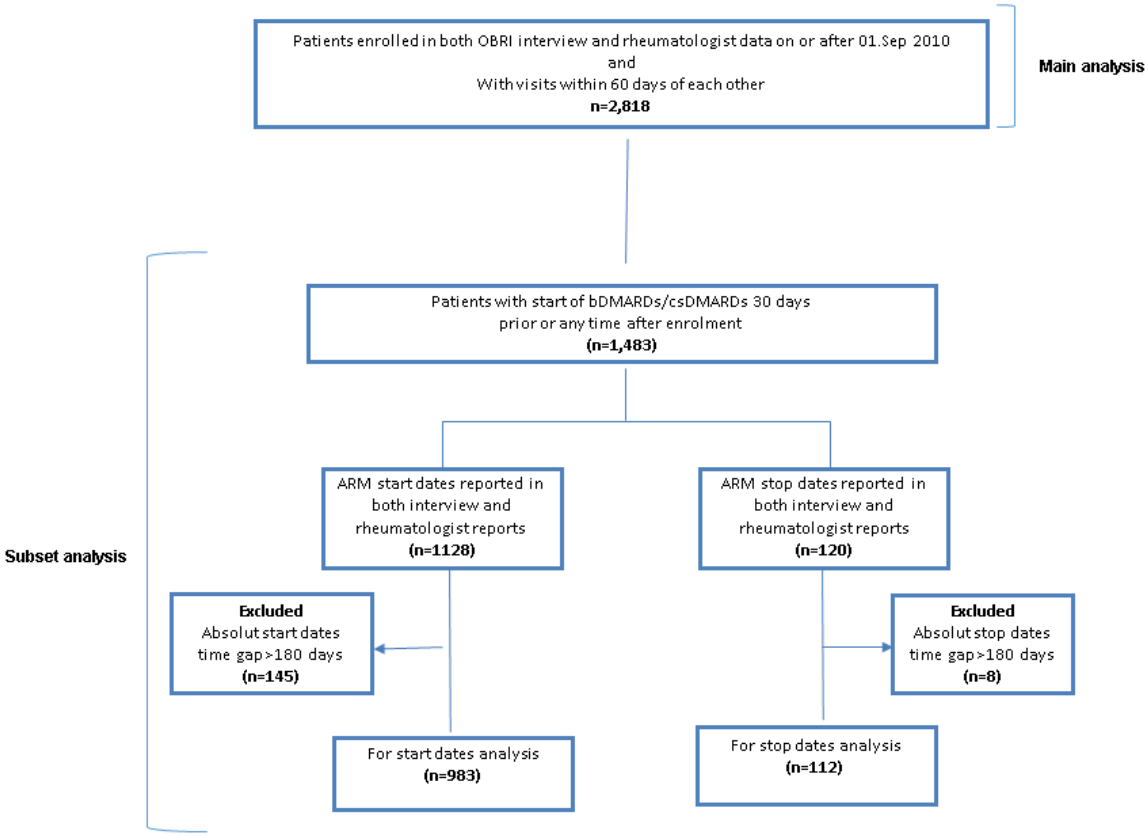


Figure 2: Box and whisker plots for absolute time gap in start and stop dates as reported by patients and rheumatologists

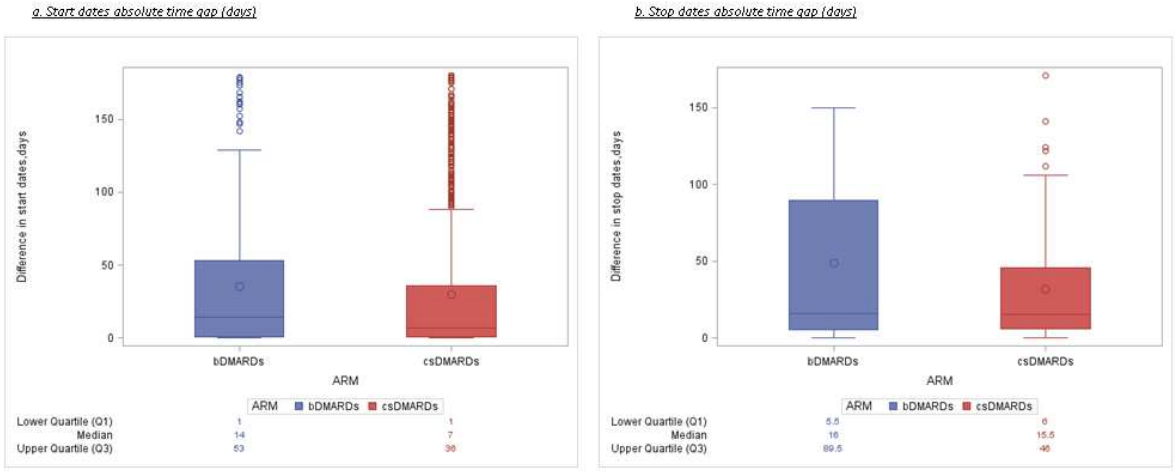


Table 1: Baseline characteristics of patients

Variables	N=2,818
Age , years	
• *Mean (SD)*	58.0 (13.0)
• *Median (IQR)*	59.0 (50.1-67.2)
Age category, years, n (%)	
• *≤ 35*	156 (5.5)
• *36-65*	1,774 (63.0)
• *66-75*	643 (22.8)
• *>75*	245 (8.7)
Sex, female, n (%)	2215 (78.6)
Marital status, married, n (%)	1,899 (67.4)
Education, n (%)	
• *High school or less*	1177 (41.8)
• *Post graduate*	1636 (58.0)
• *Missing*	5 (0.2)
Household income class, n (%)	
• *≤ 50,000 CD dollars*	933 (33.1)
• *>50,000 CD dollars*	1,358 (48.2)
• *Missing*	527 (18.7)
Health Insurance type, n (%)	
• *OHIP*	435 (15.4)
• *OHIP +(ODB or private)*	2383 (84.6)
Disease duration, years	
• *Mean (SD)*	8.1 (9.9)
• *Median (IQR)*	4.0 (1.0-12.0)
Early onset disease, n (%)	986 (35.0)
DAS28-ESR (n=2417)	
• *Mean (SD)*	4.2 (1.6)
• *Median (IQR)*	4.2 (3.1-5.3)
PhGA (range: 0-10), (N=2264)	
• *Mean (SD)*	4.0 (2.5)
• *Median (IQR)*	4.0 (2.0-6.0)
HAQ -DI (range: 0-3), (N=2815)	
• *Mean (SD)*	1.1 (0.8)
• *Median (IQR)*	1.0 (0.4-1.8)
HAQ-pain index (range:0-3), (n=2814)	
• *Mean (SD)*	1.4 (0.9)
• *Median (IQR)*	1.4 (0.6-2.1)
Number of Comorbidities, mean (SD)	
• *Mean (SD)*	3.6 (2.6)
• *Median (IQR)*	3.0 (2.0-5.0)
Patients seeing female rheumatologists, n (%)	964 (44.8)
Patients seeing academic rheumatologists, n (%)	
• *Community-based*	954 (44.2)
• *Academic or mixed based*	1,175 (54.6)

• *Missing*	25 (1.2)

OHIP: Ontario Health Insurance Plan; ODB: Ontario drug benefit; DAS-ESR: disease activity score-erythrocyte sedimentation rate; PhGA: physician global assessment; HAQ-DI: health assessment questionnaire disability index

Table 2: Agreement between patient and rheumatologist reported ARM use

Patients (n=2,818)	Prevalence (patient reports) (95% CI) %	Prevalence (rheumatologist reports) (95% CI) %	Sensitivity (95% CI) %	Specificity (95% CI) %	PPV[1] (95% CI) %	NPV[2] (95% CI) %	Kappa[3] (95% CI)
ARM use by name							
bDMARDs	19.0 (18.3-19.7)	18.4 (17.7-19.1)	95.9 (94.9-96.7)	93.9 (92.7-95.0)	95.3 (94.4-96.2)	94.7 (93.6-95.8)	0.89 (0.88-0.91)
csDMARDs	79.6 (78.8-80.2)	80.6 (79.8-81.3)	99.8 (99.7-99.9)	64.6 (59.5-69.6)	98.6 (98.4-98.9)	94.1 (91.1-97.1)	0.76 (0.72-0.80)
Both	98.6 (98.3-98.8)	99.0 (98.8-99.2)	99.9 (99.9-100)	65.5 (58.3-72.7)	99.5 (99.4-99.7)	96.5 (93.1-99.8)	0.78 (0.72-0.83)
ARM use by administration route							
bDMARDs • *SC/Injection* • *Infusion*	62.1 (60.2-64.0) 30.3 (28.5-32.3)	68.0 (66.0-69.9) 26.4 (24.5-28.2)	95.3 (93.7-96.7) 76.3 (76.3-80.3)	95.1 (93.2-96.6) 97.0 (95.6-98.1)	96.0 (94.6-97.3) 92.7 (89.9-95.5)	94.4 (92.7-96.1) 89.1 (87.1-91.1)	0.90 (0.88-0.93) 0.77 (0.73-0.81)
csDMARDs • *Oral* • *SC/Injection*	79.6 (78.8-80.4) 23.6 (22.9-24.4)	75.7 (75.0-76.4) 24.2 (23.5-24.9)	91.7 (91.1-92.4) 68.0 (65.8-70.3)	68.4 (66.2-70.7) 91.9 (91.2-92.5)	92.4 (91.7-93.0) 66.6 (64.3-68.9)	66.6 (64.3-68.9) 92.3 (91.7-92.9)	0.60 (0.57-0.62) 0.59 (0.57-0.62)

[1] Positive Predictive Value

[2 Negative] Predictive Value

[3] Kappa statistic Key: Poor: <0.20; Fair: 0.20-0.40; Moderate: 0.41-0.60; Good: 0.61-0.80; Very good: 0.81-1.00

ARM: Antirheumatic medication

CI: Confidence Interval

SC: Subcutaneous

Table 3: Hierarchal generalized linear models (HGLMs) for assessing impact of selected characteristics on agreement between patient and rheumatologist reported ARM use

Patients (n=2,818)	Odds Ratio (95% CI), p-value	
	Univariable analysis	**Multivariable analysis**
Age, year	**0.99 (0.97-0.99), 0.03**	0.98 (0.96-1.00), 0.13
Sex		
Male	Ref	Ref
Female	0.72 (0.51-1.02), 0.07	0.66 (0.35-1.22), 0.18
Marital status		
Single/divorced/widow	Ref	Ref
Married	1.07 (0.82-1.40), 0.61	1.02 (0.61-1.69), 0.95
Education		
High school or less	Ref	-
Post-secondary	0.93 (0.71-1.22), 0.60	0.69 (0.42-1.15), 0.16
House hold income class		
≤ 50,000 CD dollars	Ref	Ref
>50,000 CD dollars	0.96 (0.71-1.29), 0.76	1.03 (0.60-1.78), 0.90
Insurance type, n (%)		
OHIP	Ref	Ref
OHIP +(ODB or private insurance)	**0.52 (0.34-0.80), 0.003**	0.47 (0.19-1.17), 0.10
Disease characteristics		
RA disease duration	**0.97 (0.96-0.98), <0.0001**	0.99 (0.97-1.02), 0.70
DAS28-ESR	0.85 (0.77-0.94), 0.001	**0.73 (0.58-0.91), 0.01**
PhGA	0.92 (0.86-0.98), 0.01	1.13 (0.98-1.29), 0.09
HAQ-DI	0.74 (0.62-0.88), 0.001	1.61 (1.03-2.52), 0.06
HAQ-pain index	0.60 (0.51-0.70), <0.0001	**0.48 (0.33-0.70), 0.0002**
Comorbidity number	0.96 (0.92-1.01), 0.13	1.04 (0.95-1.15), 0.40
Characteristics of consulted rheumatologists		
Patients seeing female rheumatologist	0.93 (0.48-1.79), 0.82	1.04 (0.43-2.55), 0.92
Patients seeing academic/mixed rheumatologist		
Community-based	Ref	Ref
Academic-based	0.81 (0.42-1.56), 0.44	0.58 (0.23-1.46), 0.25

OHIP: Ontario health insurance plan; ODB: Ontario drug benefit; DAS-ESR: disease activity score-erythrocyte sedimentation rate; PhGA: physician global assessment; HAQ-DI: health assessment questionnaire disability index

Table 4: Agreement between patient and rheumatologist reports for ARM start and stop dates

Patients (n=1483)	Prevalence (patient reports) (95% CI) %	Prevalence (rheumatologist reports) (95% CI) %	Sensitivity (95% CI) %	Specificity (95% CI) %	PPV[1] (95% CI) %	NPV[2] (95% CI) %	Kappa[3] (95% CI)
Start dates	77.6 (76.0-79.2)	82.2 (80.7-83.7)	92.4 (91.1-93.5)	53.1 (48.9-57.2)	87.2 (85.8-88.6)	66.8 (62.3-71.1)	0.49 (0.45-0.53)
Stop dates	19.4 (17.9-21.0)	13.1 (11.8-14.5)	27.6 (23.5-31.3)	90.4 (89.1-91.6)	40.7 (35.4-46.2)	83.8 (82.3-85.3)	0.20 (0.16-0.25)

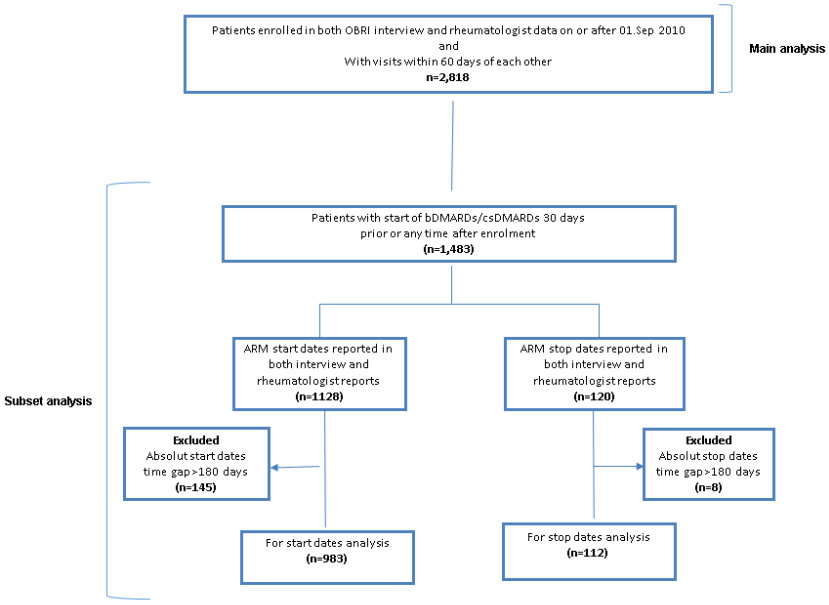
[1] Positive Predictive Value

[2 Negative] Predictive Value

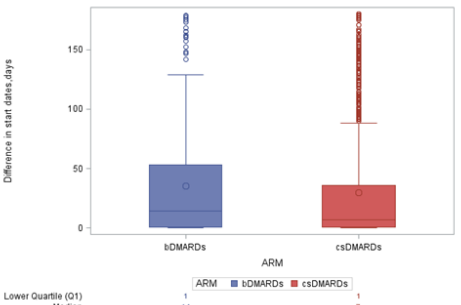
[3] Kappa statistic Key: Poor: <0.20; Fair: 0.20-0.40; Moderate: 0.41-0.60; Good: 0.61-0.80; Very good: 0.81-1.00

Appendix 1: list of individual bDMARDs and csDMARDs

ARM	Percent
- **bDMARDs**	
Etanercept	26.2
Adalimumab	18.0
Tocilizumab	11.4
Certolizumab	10.5
Golimumab	10.4
Abatacept	9.3
Infliximab	7.1
Rituximab	6.7
Other bDMARDs	10.4
- **csDMARDs**	
Methotrexate	50.5
Hydroxycholoroquine	24.3
Leflunomide	12.2
Sulfasalazine	9.6
Tofacitinab	1.7
Other csDMARDs	1.7

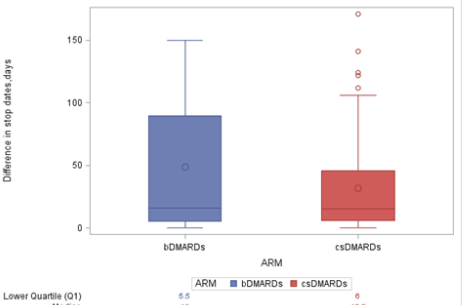


a. Start dates absolute time gap (days)



	bDMARDs	csDMARDs
Lower Quartile (Q1)	1	1
Median	14	7
Upper Quartile (Q3)	53	36

b. Stop dates absolute time gap (days)



	bDMARDs	csDMARDs
Lower Quartile (Q1)	5.5	6
Median	16	15.5
Upper Quartile (Q3)	89.5	46

Author Contributions

Study conception and design: Mohammad Movahedi, Claire Bombardier
Acquisition of data: Xiuying Li, Mohammad Movahedi, Angela Cesta

Analysis and interpretation of data: Mohammad Movahedi, Claire Bombardier

Drafting of manuscript: Mohammad Movahedi, Angela Cesta

Critical revision: Mohammad Movahedi, Angela Cesta, Claire Bombardier, Xiuying Li

What is new?

Key findings

- Anti-rheumatic medication use reported by patients and rheumatologists in the OBRI registry showed strong agreement, however medication stop dates were more often reported by patients compared to rheumatologists.

What this adds to what was known

- We showed that these two data sources could be used interchangeably and are both accurate and reliable sources of medication data in a real world setting.

What is the implication and what should change new?

- Having more than one source of primary data can minimize the concern of missing data in real world settings.
- Patients may be stopping their RA medications without consulting their rheumatologists.