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Comanagement with rheumatology and prescription biologics filled during pregnancy in women with rheumatic diseases: a retrospective analysis of US administrative claims data

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ABSTRACT

Objectives To evaluate comanagement with rheumatology and biological prescriptions filled during pregnancy among women with axial spondyloarthritis (axSpA), rheumatoid arthritis (RA) or psoriatic arthritis (PsA) and to examine factors associated with receiving comanagement with rheumatology during pregnancy.

Design A retrospective analysis of US claims data.

Setting Commercially insured enrollees using data from the 2013–2018 IBM MarketScan Commercial Claims and Encounters Database.

Participants We identified 4131 pregnant women aged ≤55 years from the 2013–2018 IBM MarketScan Commercial Claims and Encounters Database with an International Classification of Disease, 9th Revision/10th Revision codes for RA, axSpA or PsA, with continuous enrolment at ≥3 months before the date of the last menstrual period (LMP) (index date) and throughout pregnancy.

Primary outcomes Filled biologics (prescriptions and infusions) claims were categorised by 90 days before the LMP and trimester, as were primary care, obstetrician and rheumatological claims.

Results The prevalence of axSpA, RA and PsA was 0.7%, 0.2% and 0.04% among reproductive age women. The average maternal age was 32.7 years (SD 5.7). During pregnancy, 9.1% of those with axSpA (n=2,410) and 56.4% of those with RA/PsA (n=1,721) had a rheumatological claim. Biologics claims were less common among those with axSpA (90 days before LMP: 1.6%, during pregnancy: 1.1%) than those with RA/PsA (90 days before LMP: 11.9%, during pregnancy: 6.9%). Medications during pregnancy included corticosteroids (axSpA: 0.3%, RA/PsA: 2.2%), non-biological disease-modifying antirheumatic drugs (axSpA: 0.2%, RA/PsA: 1.7%), non-steroidal anti-inflammatory drugs (axSpA: 0.2%, RA/PsA: 1.3%) and opioids (axSpA: 0.2%, RA/PsA: 0.6%). Established rheumatological care and biologics claims during the 90 days before LMP showed good prediction accuracy for receiving comanagement with rheumatology during pregnancy (axSpA: area under the receiver operator curve (AUC) 0.73, RA/PsA: AUC 0.70).

Conclusion Comanagement with rheumatology during pregnancy occurs infrequently, especially for women with axSpA. Biologics claims during pregnancy may not align with published guidelines. Future research is warranted to improve comanagement with rheumatology during pregnancy.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study evaluates comanagement with rheumatology and use of biologics among pregnant women with axial spondyloarthritis (axSpA), rheumatoid arthritis (RA) and psoriatic arthritis (PsA).
⇒ Potential misclassification for the exact timing of pregnancy is possible, given that the validated algorithms are used to estimate date of the last menstrual period.
⇒ The ranges of positive predictive value using the diagnostic algorithms are varied for case ascertainment of rheumatological diseases.
⇒ Despite one of the largest databases being used to evaluate commercially insured US women with axSpA, RA and PsA, clinical characteristics such as symptom and disease severity are lacking.

INTRODUCTION

Axial spondyloarthritis (axSpA), rheumatoid arthritis (RA) and psoriatic arthritis (PsA), the most prevalent forms of chronic immune-mediated inflammatory arthritis, affect 0.9%–1.4%,[1 2] 0.5%–1%[3] and 0.25%[4] adults in the USA. These conditions occur more frequently in women during their childbearing ages.[2 5] A recent Canadian study estimated a 0.2% prevalence of RA and a 0.8% prevalence of axSpA among reproductive age women.[5] The potential impact of pregnancy on disease activity among rheumatic conditions could be varied.[6–9] Increased disease activity during pregnancy in women with axSpA and RA is associated with adverse maternal and fetal

outcomes including hypertensive disorders in pregnancy (10.5%), preterm deliveries (13.5%), caesarean sections (33.9%) and small for gestational age infants (15.6%).[5 7 10–12]

To improve pregnancy outcomes for women with axSpA, RA or PsA, it is imperative to control disease activity using medications compatible with pregnancy.[11 13–15] Recommendations regarding use of biologics during pregnancy are inconsistent across major rheumatology organisations and the American College of Gynaecology (ACOG)[12 16–19] (online supplemental table S1). The US Food and Drug Administration considers that biologics (category B/C drugs, online supplemental table S2) are not safe for use during pregnancy and recommends their use only when the potential maternal benefits outweigh fetal risks, including birth defects, immune system abnormalities and neonatal deaths.[20 21] Obstetricians (OBs) and primary care providers (PCPs) may lack the confidence to appropriately manage rheumatic diseases before, during and after pregnancy, including timing and planning of pregnancies and controlling disease activity.[22 23] Thus, the shared care model with rheumatologists prior to conception and throughout pregnancy is recommended.[24]

Data that document the extent to which women have shared care with rheumatologists, receive infusions or fill prescriptions for biologics throughout pregnancy for axSpA, RA and PsA are limited. Using one of the largest, national medical claims/encounters databases of commercially insured people from 2013 to 2018, this study sought to (1) describe demographic and clinical characteristics of pregnant women by underlying rheumatological disease (axSpA, RA and PsA); (2) evaluate prescriptions filled or infusion/procedure claims for biologics among pregnant women with axSpA, RA and PsA; and (3) identify factors associated with receiving comanagement with rheumatology during pregnancy.

METHODS

This study relies on a deidentified insurance claims database.

Data source

We used data from the IBM MarketScan Commercial Claims and Encounters Database (2013–2018), the largest national medical claims and encounters database composed of data from commercially insured individuals in the USA. It contains deidentified data from individual-level enrolment files, demographics, inpatient admissions, outpatient services and outpatient pharmacy prescription claims.[25]

Patient and public involvement

Patients or the public were not involved in the design, conduct, reporting or dissemination plans of our research.

Study design

Figure 1 outlines the design features of this retrospective cohort study. Key to this study was the identification of pregnant women (online supplemental table S3) and estimation of the date of last menstrual period (LMP) (index date) and pregnancy trimesters[26–28] (online supplemental table S4). Two algorithms (using International Classification of Disease, 9th Revision (ICD-9) codes[26] and International Classification of Disease, 10th Revision (ICD-10) codes[28]) identified pregnant women. The trimesters were classified as follows: the first trimester as days 0–89, the second trimester as days 90–179 and the third trimester as days 180 through delivery (figure 1).

Study sample

Using diagnostic algorithms for case ascertainment of rheumatological diseases,[29–31] we identified women with a claim for axSpA, RA or PsA (online supplemental table S5) between 1 January 2013 and 31 March 2018 if they had (1) at least one diagnosis of axSpA, RA or PsA that occurred during an inpatient visit; (2) at least two outpatient diagnoses of axSpA, RA or PsA on different dates at least 7 days apart; (3) at least one outpatient diagnosis of axSpA, RA or PsA and at least one dispensing of a disease-modifying antirheumatic drug (DMARD); or (4) at least one outpatient diagnosis of the disease that was confirmed by a rheumatologist.

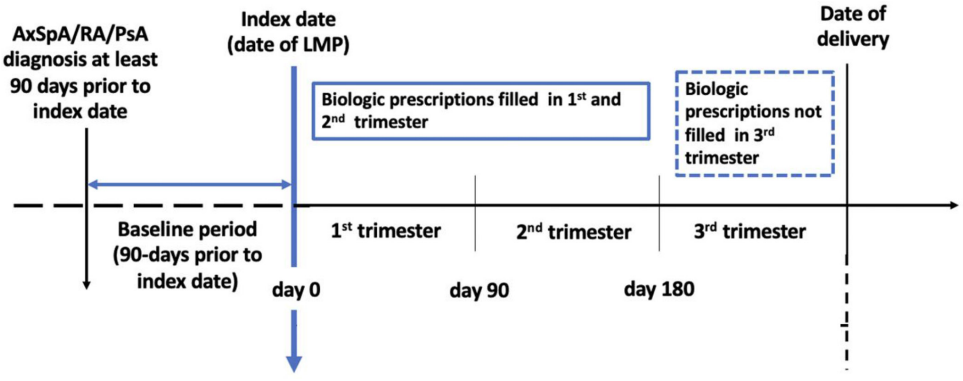

Figure 1 Overall study design. axSpA, axial spondyloarthritis; LMP, last menstrual period; PsA, psoriatic arthritis; RA, rheumatoid arthritis.

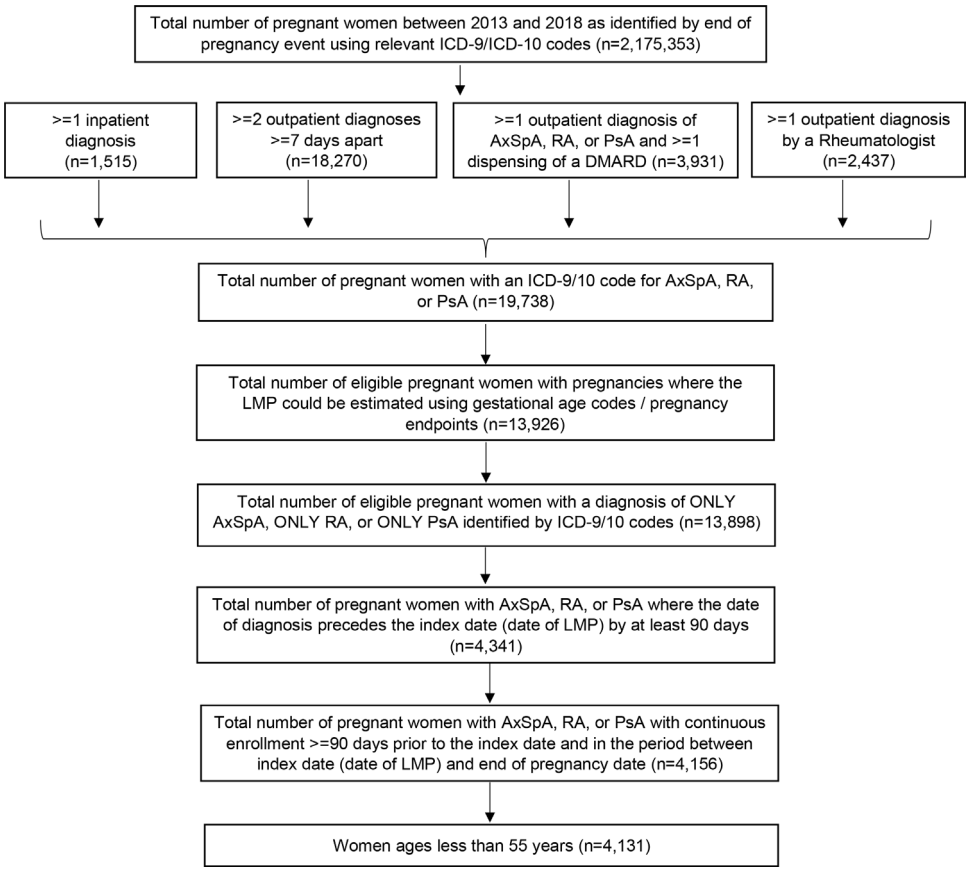

Figure 2 Flowchart of identifying axSpA, RA and PsA cases. axSpA, axial spondyloarthritis; ICD-9, International Classification of Disease, 9th Revision; ICD-10, International Classification of Disease, 10th Revision; LMP, last menstrual period; PsA, psoriatic arthritis; RA, rheumatoid arthritis.

Figure 2 shows the inclusion/exclusion criteria used and the eligible sample. From the sample of women with a pregnancy end date between 1 January 2013 and 31 December 2018 (n=2,175,353), we identified 19 738 with axSpA, RA or PsA. After applying the exclusion criteria, the remaining 4,131 women comprised the final analytical sample. Further information on inclusion/exclusion criteria and study design is displayed in the online supplemental Methods, Appendix).

Comanagement with rheumatology during pregnancy

Comanagement with rheumatology during pregnancy was defined as one/more encounters between the patient and a rheumatologist between her LMP date and the end of pregnancy. According to the ACR guidelines, regular communication between the patient and her rheumatologist and care coordination during pregnancy is crucial to prevent adverse pregnancy outcomes.[24]

Treatment with biological agents before and during pregnancy

Biologics included tumour necrosis factor alpha (TNF-α) inhibitors (adalimumab, certolizumab, etanercept, golimumab and infliximab) and non-TNF-α inhibitors (abatacept, anakinra, ixekizumab, rituximab, secukinumab, tocilizumab and ustekinumab). The prescriptions filled were identified using National Drug Codes (NDCs) and infusions were identified using Healthcare Common Procedure Coding System (HCPCS) codes (online supplemental table S6). Based on the dispensing date of an individual prescription or infusion administered for a biologic, four binary variables were created to indicate prescriptions filled or infusions administered during the baseline period (90-day lookback period from index date), and during the first, second and third trimesters (online supplemental table S7).

Other medications used to manage axSpA, RA and PSA symptoms

Binary variables (yes/no) for prescriptions filled for non-biological DMARDs (azathioprine, cyclophosphamide, cyclosporine, hydroxychloroquine, leflunomide, methotrexate, mycophenolate mofetil and sulfasalazine), non-steroidal anti-inflammatory drugs (NSAIDs) (aspirin, celecoxib, diclofenac, ibuprofen, indomethacin, ketoprofen, meloxicam, naproxen, piroxicam and sulindac), corticosteroids (dexamethasone, hydrocortisone, methylprednisolone, prednisone and triamcinolone) and opioids (codeine, hydrocodone, morphine, oxycodone, pentazocine, propoxyphene and tramadol) were determined for each of the following time periods: (1) within the 90 days before LMP (baseline period), (2) first trimester, (3) second trimester, (4) third trimester and (5) any time during pregnancy. For prescriptions filled

Table 1 Baseline demographic and clinical characteristics of pregnant women with axSpA, RA and PsA

Patient characteristics	axSpA (n=2,410)	RA (n=1,418)	PsA (n=303)	RA/PsA (n=1,721)
Maternal age (years), mean (SD)	32.6 (5.6)	32.7 (6.0)	33.9 (5.2)	32.9 (5.9)
Maternal age at LMP (%)				
15–24	7.7	9.7	5.0	8.8
25–34	56.7	54.1	50.5	53.5
≥35	35.6	36.3	44.6	37.7
Region (%)				
Northeast	15.3	20.6	22.3	20.9
North central	20.7	17.8	19.6	18.1
South	49.2	44.5	42.5	44.2
West	14.9	17.1	15.6	16.8
Employment status of primary beneficiary (%)				
Active full-time	71.6	69.3	74.3	70.1
Active part-time/retiree	4.3	4.3	5.0	4.4
Other/unknown*	24.1	26.5	20.8	25.5
Health plan type (%)				
Health maintenance organisation	9.0	13.2	10.5	12.7
Preferred provider organisation	59.1	56.6	64.4	58.0
Consumer directed/highly deductible health plan	24.0	21.1	17.6	20.5
Other†	7.9	9.1	7.5	8.8
Relationship to beneficiary (%)				
Primary beneficiary	54.9	51.2	54.1	51.7
Spouse	36.9	38.8	40.3	39.1
Other dependent	8.3	10.0	5.6	9.2
≥1 pre-existing comorbidities (%)‡	7.4	12.8	8.9	12.1
Outpatient healthcare use in 90 days before LMP				
Rheumatologist visits (%)				
0	94.6	69.7	71.0	69.9
1	4.3	24.3	25.0	24.5
≥2	1.1	6.0	4.0	5.6
OB visits (%)				
0	74.5	73.8	73.6	73.8
1	18.1	16.0	15.8	15.9
2–5	6.7	9.2	9.9	9.3
>5	0.8	1.1	0.7	1.0
PCP visits (%)				
0	59.1	59.3	61.7	59.7
1	23.0	21.7	18.8	21.2
≥2	18.0	19.0	19.5	19.1
OB/PCP visits (%)				
Only OB visits	14.5	15.1	13.9	14.9
Only PCP visits	29.9	29.6	25.7	28.9
OB and PCP visits	11.0	11.1	12.5	11.3
Emergency room visits (%)				
0	94.7	94.0	95.1	94.2
1	4.2	4.6	4.6	4.6
≥2	1.1	1.4	0.3	1.2
Urgent care visits (%)				
0	97.1	96.9	97.7	97.0
1	1.5	1.7	0.7	1.5
≥2	1.5	1.4	1.7	1.5

Percentages may not total 100% due to rounding.
*Other/unknown includes long-term disability, Continuation of Health Coverage (COBRA) continuee, surviving spouse/dependent and other/unknown.
†Other includes basic, comprehensive, Exclusive Provider Organizatio (EPO), Point of service plan (POS) and POS with capitation.
‡From inpatient/outpatient claims in the 90 days prior to LMP, calculated using Quan's comorbidity index.
axSpA, axial spondyloarthritis; LMP, last menstrual period; OB, obstetrician; PCP, primary care physician; PsA, psoriatic arthritis; RA, rheumatoid arthritis.

during each trimester, if the prescription was filled during one first trimester but the amount of drug supplied overlapped into the next trimester, the single prescription was counted as having been filled in both trimesters.

Other relevant covariates

Demographic and clinical characteristics included maternal age at conception (15–24, 25–34 and ≥35 years), geographical region (northeast, north central, south and west), employment status of the primary beneficiary (active full-time, active part-time/retiree and other/unknown), health insurance plan type (health maintenance organisation (HMO), preferred provider organisation (PPO), consumer-directed health plan (CDHP)/high deductible health plan (HDHP) and others (online supplemental table S8)), and relationship to the primary beneficiary (employee, spouse and other dependent). The variations of sociodemographic and health care-related characteristics may be associated with how patients interact with the healthcare system and management of the disease.[32–34] A binary variable to indicate the presence of comorbidities was derived based on the Quan's comorbidity index score[35–37] using medical comorbidities identified with ICD-9/ICD-10 codes from inpatient/outpatient claims during the baseline period. Information on healthcare use including healthcare providers visits, emergency room (ER) visits (0, 1 and ≥2) and urgent care visits (0, 1 and ≥2) was identified during the baseline and pregnancy periods (online supplemental tables S9, S10). Outpatient healthcare provider visits evaluated included those with a rheumatologist (0, 1 and ≥2), a PCP (0, 1 and ≥2) or an OB (0, 1, 2–5 and >5). We also reported on the proportion of patients visiting only a PCP, only an OB, both or neither during the baseline period. PCP visits (0, 1 and ≥2) and OB visits (0, 1, 2–5, 6–9, 10–13 and ≥14) during pregnancy were explored. Since biologics are prescribed primarily by rheumatologists,[32] we created a four-level variable: (1) prescription for a biologic but without any rheumatologist visits, (2) rheumatologist visit but no biologic prescription, (3) both and (iv) neither during the baseline period.

Table 2 Healthcare use during pregnancy among those with AxSpA, RA, PSA

	axSpA (n=2,410)	RA (n=1,418)	PsA (n=303)	RA/PsA (n=1,721)
Rheumatologist visits (%)				
0	90.9	43.1	46.2	43.6
1	2.4	9.7	10.2	9.8
≥2	6.7	47.2	43.6	46.6
Obstetrician visits (%)				
0	2.2	2.8	3.6	3.0
1	4.6	4.3	5.6	4.5
2–5	40.6	38.1	37.0	37.9
6–9	29.1	29.4	27.7	29.1
10–13	13.1	12.8	12.5	12.7
≥14	10.4	12.6	13.5	12.8
Primary care visits (%)				
0	20.4	16.4	18.2	16.7
1	15.3	13.3	14.9	13.5
≥2	64.3	70.4	67.0	69.8
Emergency room visits (%)				
0	70.5	68.0	66.0	67.6
1	16.6	17.2	22.1	18.1
≥2	13.0	14.8	11.9	14.3
Urgent care visits (%)				
0	87.8	86.6	87.5	86.8
1	4.2	4.8	4.0	4.7
≥2	8.1	8.6	8.6	8.6

axSpA, axial spondyloarthritis; PsA, psoriatic arthritis; RA, rheumatoid arthritis.

Analysis

Descriptive analyses evaluated baseline demographic and clinical characteristics. Based on these findings and input from rheumatologists, we combined RA/PsA and considered axSpA separately for the remainder of the analyses. We described the proportion of pregnant women with a rheumatologist visit during pregnancy, and with medications prescribed and filled or infusions administered by drug class (ie, biologics, non-biological DMARDs, NSAIDs, corticosteroids and opioids) during the baseline period, first, second and third trimesters, and throughout pregnancy. To evaluate factors associated with comanagement with rheumatology during pregnancy, a multivariable logistic model was used adjusting for demographic and clinical covariates, and healthcare use in the baseline period. The area under the receiver operator curve (AUC) was computed for (1) model with a single predictor (established rheumatologist visits or claims for biologics during the baseline period) and (2) the fully adjusted logistic model. An AUC of 0.50–0.59 was considered poor, 0.60–0.69 fair, 0.70–0.79 good, and 0.80 and above, excellent.[38] Baseline use of biologics was highly correlated with use of other medications to manage axSpA, RA and PsA. We did not include baseline use of other medications in the model because of multicollinearity concerns.

RESULTS

Among women of reproductive age (n=2,175,353), the prevalence of axSpA, RA and PsA was 0.7%, 0.2% and 0.04%, respectively. Among women included in this study, the mean age was 32.7 years with SD 5.7 years, and 47.1% were from the southern part of the USA. Regarding health insurance, 58.6% were enrolled in PPO plans, while 10% were enrolled in HMO plans and 22.5% were enrolled in CDHP/HDHP. Use of healthcare services, including PCP visits, ER visits and urgent care visits, was similar among pregnant women with axSpA, RA and PsA during the baseline period (table 1) and throughout pregnancy (table 2), except for the rheumatologist visits in axSpA patents. Among patients with axSpA, 5.4% and 9.1% had visited a rheumatologist within the 90 days before LMP or during pregnancy, whereas 30.1% and 56.4% of women with RA/PsA had a visit to a rheumatologist during that time.

Biological prescriptions were filled by 1.6% of women with axSpA and by 11.9% of women with RA/PsA within the 90 days before LMP (table 3). Other medications filled during the baseline period included corticosteroids (axSpA: 0.8%, RA/PsA: 4.4%), non-biological DMARDs (axSpA: 0.4%, RA/PsA: 4.1%), NSAIDs (axSpA: 0.3%, RA/PsA: 3.8%) and opioids (axSpA: 0.2%, RA/PsA: 1.1%). During pregnancy, 1.1% of patients with axSpA and 6.9% of patients with RA/PsA filled prescriptions for biologics (online supplemental figure S1). The use of other medications was rare among patients with axSpA (<0.5%) during pregnancy. In the RA/PsA group, the proportions of patients who filled prescrptions for biologics during the first, second and third trimesters were 6.5%, 4.2% and 2.6%, respectively. Few had filled prescriptions for corticosteroids (2.2%), DMARDs (1.7%) or NSAIDs (1.3%) during pregnancy.

Factors associated with comanagement with rheumatology during pregnancy

Overall, 9.1% of patients with axSpA had a rheumatological claim during pregnancy. Table 4 shows that for health insurance type, patients with axSpA with HMO plans (adjusted OR (aOR) 1.91, 95% CI 1.09 to 3.36) and CDHP/HDHP (aOR 1.75, 95% CI 1.18 to 2.60) were more likely to have visited a rheumatologist during pregnancy compared with those with PPO plans. Regarding receipt of rheumatological care and/or biologics claims among women with axSpA in the 90 days before LMP, those with rheumatologist visits only (aOR 43.84, 95% CI 27.45 to 70.04) and those with biologics claims only (aOR 9.09, 95% CI 3.5 to 23.56) were more likely to have comanagement with rheumatology during pregnancy. While care by a rheumatologist with biological prescriptions filled during the baseline period alone yielded an AUC of 0.72,

Table 3 Medications use before and during pregnancy among those with AxSpA or RA/PsA

Medication	Timing of prescription dispensation (s)				
	90 days before LMP	Anytime during pregnancy	First trimester	Second trimester	Third trimester
axSpA (n=2410)					
Biological DMARDs (%)	1.6	1.1	1.0	0.8	0.5
Conventional synthetic DMARDs (%)	0.4	0.2	0.2	0.2	0.04
NSAIDs (%)	0.3	0.2	0.2	0.1	0
Corticosteroids (%)	0.8	0.3	0.3	0.1	0.04
Opioids (%)	0.2	0.2	0.1	0.1	0.1
RA/PsA (n=1721)					
Biological DMARDs (%)	11.9	6.9	6.6	4.4	2.6
Conventional synthetic DMARDs (%)	4.1	1.9	1.1	1.1	0.5
NSAIDs (%)	3.8	1.3	1.1	0.6	0.3
Corticosteroids (%)	4.4	2.2	1.2	1.4	1.1
Opioids (%)	1.1	0.6	0.1	0.3	0.4

axSpA, axial spondyloarthritis; DMARD, disease-modifying antirheumatic drug; LMP, last menstrual period; NSAID, non-steroidal anti-inflammatory drug; PsA, psoriatic arthritis; RA, rheumatoid arthritis.

the AUC of the final logistic regression model adjusted for all covariates was 0.77.

During pregnancy, 56.4% of women with RA/PsA saw a rheumatologist. Table 5 shows that having comanagement with rheumatology during pregnancy was associated positively with claims for biologics and/or rheumatologist visits within the 90 days before LMP (aOR (both biologics and rheumatological claims) 19.77, 95% CI 9.02 to 43.34; aOR (biological claims) 1.74, 95% CI 1.13 to 2.66; aOR (rheumatological claims) 11.45, 95% CI 8.17 to 16.06). For women with RA/PsA, evidence of rheumatology and biological claims during the baseline period showed good prediction accuracy for having comanagement with rheumatology during pregnancy (AUC 0.70), while the fully adjusted model yielded an AUC of 0.71.

DISCUSSION

In our claims database, 0.91% of women of reproductive age had either axSpA, RA or PsA. Claims for biologics within the 90 days before LMP and during pregnancy were low in the RA/PsA subgroup and extremely uncommon among those with axSpA.

Planned pregnancies lead to better maternal and fetal outcomes.[23 39–41] Considering that axSpA, RA and PsA are associated with an increased risk of complications during pregnancy,[39 42] involving a rheumatologist in the discussion of plans of conception should enhance care and help to reduce the risk of pregnancy complications.[39 43] The American College of Rheumatology recommends that (1) all patients with rheumatological diseases be evaluated for disease activity, (2) medication changes be discussed and (3) risk counselling with a rheumatologist occur 3–6 months prior to conception or at the time of initial assessment of pregnancy.[24] Our study found that only 5.4% women with axSpA and 30.1% women with RA/PsA visited a rheumatologist in the 90 days before LMP. During pregnancy, while only 9.1% of women with axSpA were seen by a rheumatologist, 56.9% of women with RA and 53.8% of women with PsA visited a rheumatologist during pregnancy. This is consistent with findings from the BARMER Sickness Fund data in Germany showing that 43.5% of women with rheumatological diseases had comanagement with rheumatology during pregnancy.[40]

One possible explanation for the lack of involvement by rheumatologists during the time immediately before and during pregnancy could be the shortage of rheumatologists in the USA.[44–46] A 2021 study documented that patients in the USA waited at least 4 months for an appointment with a rheumatologist.[45] Only half of the rheumatologists in the USA provide routine family planning counselling services to women of childbearing age.[47] A possible reason for this could be that there is no adequate time to provide such counselling during appointments that typically last ~15 min.[40]

As expected, majority of women had claims for visits to OBs and/or PCPs who provide them with routine obstetrical care.[48] The ACOG guidelines for the use of antirheumatic medications during this critical phase are vague. Providers may be unfamiliar with or may lack confidence to appropriately manage rheumatic diseases before and during pregnancy.[22 23] PCPs may not feel comfortable providing family planning counselling to women with rheumatological diseases,[49] and some believe that counselling about the teratogenic potential of drugs used to manage rheumatological diseases should be given by rheumatologists.[50] Research from studies in reproductive age women with RA has shown suboptimal use of contraception among those using teratogenic DMARDs.[51 52]

Table 4 Factors associated with rheumatologist involvement during pregnancy in women with axSpA

	% Visiting a rheumatologist during pregnancy	Crude OR (95% CI)	Adjusted OR (95% CI)
Maternal age at LMP (years)			
18–24	8.7	0.99 (0.58 to 1.71)	2.42 (0.83 to 7.04)
25–34	8.7	Ref	Ref
≥35–44	9.8	1.14 (0.85 to 1.53)	1.13 (0.79 to 1.63)
Region			
Northeast	11.9	Ref	Ref
North central	7.8	0.63 (0.40 to 0.99)	0.66 (0.38 to 1.16)
South	8.1	0.67 (0.46 to 0.98)	0.71 (0.44 to 1.14)
West	11.6	1.00 (0.64 to 1.58)	1.06 (0.60 to 1.87)
Employment status of primary beneficiary			
Active full-time	9.8	1.29 (0.62 to 2.70)	1.78 (0.65 to 4.84)
Active part-time/retirees	7.8	Ref	Ref
Other/unknown*	7.2	0.93 (0.42 to 2.03)	1.29 (0.45 to 3.74)
Health plan type			
Health maintenance organisation	12.6	1.86 (1.18 to 2.92)	1.91 (1.09 to 3.36)
Preferred provider organisation	7.2	Ref	Ref
Consumer directed/high deductible health plan	12.2	1.78 (1.29 to 2.45)	1.75 (1.18 to 2.60)
Other†	10.1	1.45 (0.86 to 2.42)	1.14 (0.59 to 2.21)
Relationship to beneficiary			
Primary beneficiary	8.9	Ref	Ref
Spouse	9.8	1.11 (0.83 to 1.48)	1.06 (0.74 to 1.52)
Other dependent	7.0	0.77 (0.44 to 1.37)	0.34 (0.11 to 1.11)
Pre-existing comorbidities‡	11.2	1.29 (0.79 to 2.09)	0.80 (0.43 to 1.51)
During the 90 days before LMP			
OB and PCP visits			
No OB/PCP visit	8.3	Ref	Ref
OB visit but no PCP visit	6.3	0.75 (0.46 to 1.21)	0.82 (0.46 to 1.47)
PCP visit but no OB visit	10.0	1.23 (0.89 to 1.71)	1.52 (1.02 to 2.26)
OB and PCP visits	13.5	1.73 (1.15 to 2.62)	1.51 (0.89 to 2.56)
Rheumatologist visits and biological claims			
None	5.2	Ref	Ref
Rheumatologists visit only	68.1	39.14 (25.28 to 60.61)	43.84 (27.45 to 70.04)
Biological claims only	33.3	9.15 (3.62 to 23.10)	9.09 (3.50 to 23.56)
Both	100	Not estimable	Not estimable

The multivariable logistic models were adjusted for demographic and clinical covariates (maternal age, region, employment status of beneficiary, health plan type, relationship to beneficiary and pre-existing comorbidities) and healthcare use in the baseline period (OB and PCP visits, rheumatologist visits and biologics use).
*Other/unknown includes long-term disability, COBRA continuee, surviving spouse/dependent and other/unknown.
†Other includes basic, comprehensive, EPO, POS and POS with capitation.
‡From inpatient/outpatient claims in the 90 days prior to LMP, calculated using Quan's comorbidity index.
axSpA, axial spondyloarthritis; LMP, last menstrual period; OB, obstetrician; PCP, primary care physician; ref, reference.

In addition to the inconsistencies in the international guidelines on medications during pregnancy, we also observed that the majority of patients with axSpA did not have rheumatologist visit before and during pregnancy. Lack of a pre-pregnancy visit could result in worsening of axSpA symptoms and avoidance of anti-inflammatory therapy because of concerns about anti-inflammatory drug use during pregnancy.[53] As such, coordination of care between rheumatologists, OBs and PCPs is crucial to ensuring optimal pregnancy outcomes in women with rheumatological conditions.

Our findings showed that the rate of prescriptions for biologics, non-biological DMARDs, NSAIDs, steroids and opioids was reduced during pregnancy compared with baseline use. Similar trends have been observed in studies evaluating the use of antirheumatic medications in pregnant women with inflammatory rheumatological diseases including psoriasis and inflammatory bowel disease.[6 54 55] This

Table 5 Factors associated with rheumatologist involvement during pregnancy in women with RA/PsA

	% Visiting a rheumatologist during pregnancy	Crude OR (95% CI)	Adjusted OR (95% CI)
Maternal age at LMP (years)			
18–24	46.7	0.65 (0.46 to 0.92)	1.34 (0.66 to 2.72)
25–34	57.3	Ref	Ref
≥35–44	57.3	1.00 (0.82 to 1.23)	1.05 (0.84 to 1.33)
Region			
Northeast	56.8	Ref	Ref
North central	55.8	0.94 (0.69 to 1.27)	1.05 (0.74 to 1.49)
South	58.9	1.06 (0.82 to 1.37)	1.13 (0.84 to 1.51)
West	52.1	0.80 (0.59 to 1.10)	0.87 (0.60 to 1.24)
Employment status of primary beneficiary			
Active full-time	57.6	0.79 (0.49 to 1.28)	0.74 (0.43 to 1.29)
Active part-time/retirees	63.2	Ref	Ref
Other/unknown*	51.8	0.63 (0.38 to 1.04)	0.61 (0.34 to 1.10)
Health plan type			
Health maintenance organisation	51.9	0.80 (0.60 to 1.08)	0.87 (0.62 to 1.23)
Preferred provider organisation	56.9	Ref	Ref
Consumer directed/high deductible health plan	60.1	0.67 (0.90 to 1.48)	1.22 (0.92 to 1.62)
Other*	55.1	0.95 (0.67 to 1.35)	0.91 (0.61 to 1.36)
Relationship to beneficiary			
Primary beneficiary	57.3	Ref	Ref
Spouse	58.3	1.04 (0.85 to 1.28)	1.12 (0.88 to 1.41)
Other dependent	42.8	0.56 (0.40 to 0.78)	0.42 (0.21 to 0.85)
Pre-existing comorbidities†	59.1	1.14 (0.85 to 1.53)	1.02 (0.72 to 1.46)
During the 90 days before LMP			
OB and PCP visits			
No OB/PCP visit	56.5	Ref	Ref
OB visit but no PCP visit	64.1	1.37 (1.03 to 1.84)	1.07 (0.76 to 1.49)
PCP visit but no OB visit	51.4	0.82 (0.65 to 1.02)	0.71 (0.54 to 0.92)
OB and PCP visits	58.5	1.09 (0.79 to 1.49)	0.98 (0.68 to 1.41)
Rheumatologist visits and biological claims			
None	41.1	Ref	Ref
Rheumatologists visit only	88.6	11.14 (8.03 to 15.44)	11.45 (8.17 to 16.06)
Biologic claims only	54.1	1.69 (1.12 to 2.56)	1.74 (1.13 to 2.66)
Both	92.5	17.56 (8.46 to 36.47)	19.77 (9.02 to 43.34)

The multivariable logistic models were adjusted for demographic and clinical covariates (maternal age, region, employment status of beneficiary, health plan type, relationship to beneficiary and pre-existing comorbidities) and healthcare use in the baseline period (OB visits and PCP visits, rheumatologist visits and biologics use).
*Other/unknown includes long-term disability, COBRA continuee, surviving spouse/dependent and other/unknown.
*Other includes basic, comprehensive, EPO, POS and POS with capitation.
†From inpatient/outpatient claims in the 90 days prior to LMP, calculated using Quan's comorbidity index.
.LMP, last menstrual period; OB, obstetrician; PCP, primary care physician; PsA, psoriatic arthritis; RA, rheumatoid arthritis.

could be attributed to inconsistencies in guideline recommendations made by various rheumatology organisations. The ACR recommends stopping tumour necrosis factor (TNF) inhibitors early in the third trimester,[24] The European Alliance of Associations for Rheumatology (EULAR) recommends stopping TNF inhibitors at 20 weeks,[18] whereas the ACOG considers these as low-risk therapies to initiate or continue during pregnancy.[12] Another explanation could be the changes in healthcare coverage found among women around the time of pregnancy.[56] A 2009 study reported that among women with private insurance before pregnancy, 21.3% transitioned to Medicaid coverage at delivery, and 1.4% were uninsured.[56] Though we included women with continuous enrolment within the MarketScan database for medical and pharmacy coverage before and throughout pregnancy, it is possible that women may have changed insurers over the course of pregnancy.

Though guidelines from ACR and EULAR strongly recommend the use of certain medications for the effective management of rheumatological diseases during pregnancy,[18 24] the mother's decision to take medicines during pregnancy is complex and driven by multiple factors. Women are concerned about the safety of medications that they take during pregnancy, but most fail to recognise the impact of untreated inflammatory arthritis on pregnancy outcomes.[40 57]

Strengths and limitations

Our study included only commercially insured women in the USA, and findings may not be generalisable to those with public insurance or no health insurance.[33 58] Though we were comprehensive in our strategy to identify pregnant women with rheumatological diseases using both inpatient and outpatient claims, pregnancies may have been missed or misclassified.[59] The date of LMP was estimated using validated algorithms,[27 28 60] but misclassification of the timing of pregnancy was possible. There were 5812 pregnancies occurring in women with rheumatological diseases that we could not include due to lack of information required to classify the timing of pregnancy. Since we used diagnostic algorithms for case ascertainment, our study relies heavily on the accuracy of coding for axSpA, RA and PsA in claims databases. Additionally, the positive predictive value for diagnostic codes, even with algorithms, is not high (~60% to 90%).[27 29 59] Information on clinical variables to evaluate symptom burden and disease severity is lacking in claims data. Prescription fills were used to assess medication exposure. Aside from infusions, prescription claims do not confirm that medications were taken by the patient.

Despite these limitations, our study has some notable strengths. The longitudinal nature of the data allowed us to examine biological claims during pregnancy. The retrospective claims database provided a large sample size which permitted the examination of patterns of medication use and healthcare use in this vulnerable population.

Our findings show that less than half of women with axSpA, RA and PsA see a rheumatologist during pregnancy, and fewer are taking biological medications used to treat their inflammatory arthritis. Use of biologics to treat women with these conditions during pregnancy does not necessarily align with guideline recommendations. Yet, during pregnancy, many women with inflammatory arthritis are not being seen by rheumatologists who are arguably the most appropriate clinicians to guide women in making treatment decisions during pregnancy, given their extensive knowledge of and experience prescribing these medications. Patient awareness must be recognised to provide effective disease management during pregnancy. Future research on this understudied topic is warranted to understand how to increase the involvement of rheumatologists in the care of pregnant women with rheumatological diseases.

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Contributors DS, KLL and SL proposed and designed the study. DS drafted initial manuscript. DS and KLL designed the study's analytical strategy. DS, JB and SL conducted the analysis. SL is acting as the guarantor for the overall content of the manuscript. All authors supervised the study, critically evaluated the study design, read and edited the manuscript, and approved the final manuscript submitted.

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Ethics approval This study involves human participants and was approved by the UMass Chan Medical School Institutional Review Board (IRB, approval number H00018231).The IRB determined that the proposed activity is not human subject research, as defined by Department of Health and Human Services (DHHS) and Food and Drug Administration regulations. IRB review and approval by this organisation is not required. As the study was conducted using a secondary analysis of existing datasets, we did not obtain informed consent from participants. Patient data included were deidentified.

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