Supplemental material

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Supplementary Materials

Supplementary Methods

Propensity scores were calculated for use as weights within the inverse probability weighted Cox proportional hazards models[1]. These propensity scores were estimated separately for treatment cohorts within the 1) all inflammatory joint diseases, and 2) RA cohorts. Note that due to low number of events, and balance not being achieved, between treatment cohort analyses using inverse propensity score weighting was not performed in the other IJD cohort. Propensity scores were also calculated separately when comparing the csDMARD to the b/tsDMARD groups in each of the three inflammatory joint disease cohorts.

Multinomial logistic (for the estimation of propensity scores within the six DMARD cohorts), and logistic regression models (for the estimation of propensity score within the csDMARD/b-tsDMARD cohorts) were fitted. All models contained the same covariates: history of cancer, diabetes, heart failure, ischemic heart disease, hospitalisation listing infection, lung disease, stroke, venous thromboembolic events, kidney failure, and surgery, age, sex, disease duration, DAS28, an indicator variable specifying whether the individual had received a different b/tsDMARD in the 180 days before start of follow-up, the number of previous b/tsDMARDs, days in hospital (both in the previous 10 years, and 1 year), region of domicile, educational level, civil status, and country of birth. See Supplementary Table 4 for definitions and the functional form of each of the covariates included in the propensity score model. The models additionally contained interactions between age and a history of lung disease, a history of lung disease and cancer, and age and region.

Stabilised inverse probability of treatment weights[2] were calculated from the propensity scores predicted from these models and were were additionally restricted to be no larger than the 99% and no smaller than the 1% centile of the distribution to further avoid extreme weight. The standardised mean bias[3] was used to determine whether balance had been reached when using stabilized weights; these are presented in Supplementary Tables 6-8. Subsequent Cox proportional hazards models used the robust sandwich estimator to calculate standard errors.

[1] Austin PC. The performance of different propensity score methods for estimating marginal hazard ratios. Stat. Med 2012:32(12) 2837-2849. doi: 10.1002/sim.5705

[2] Pezzi A, Cavo M, Biggeri A et al. Inverse probability weighting to estimate causal effect of a singular phase in a multiphase randomized clinical trial for multiple myeloma. BMC Medical Research Methodology 2016:16(150). doi: 10.1186/.s12874-016-0253-9

[3] Zhang Z, Kim HJ, Lonjon G et al. Balance diagnostics after propensity score matching. Ann Transl Med 2019:(1)16. doi:10.21037/atm.2018.12.10

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Supplementary Analysis: Risks in patients on sulfasalazine

To assess risks for the outcomes under study specifically in patients on sulfasalazine, we have performed additional ad-hoc analyses, contrasting patients with any IJD on sulfasalazine monotherapy (N=4675) to patients on any csDMARD therapy (excluding sulfasalazine monotherapy, but including combination therapies of which sulfasalazine may form a part, N=28621), using the same analytic approach as for the other treatment comparisons.

In this select group of patients, absolute risks for the outcomes were in the same range as the other DMARD cohorts. We noted no increased risk for hospitalization for any cause (HR=1.08, 0.97-1.21, n exposed events: 381), increased point estimates for hospitalization listing COVID-19 (HR=1.52, 95% 1.05-2.20, n exposed events: 37), admission to ICU (HR=1.97 (95% CI 0.64-6.11, n exposed events: 4), but no increased risks for death from any cause (HR=0.96, 95% CI 0.70-1.31, n exposed events: 46, and no increased risks of death from COVID-19 (HR=0.97, 95% CI 0.40.2.32, n exposed events: 6).

Supplementary Table 1. Data sources included in the study

Swedish Rheumatology Quality Register (SRQ)	A nationwide longitudinal clinically integrated register operated by The Swedish Society for Rheumatology, started in 1996. Patients with RA and other rheumatologic diseases are registered in the SRQ by the treating rheumatologist. SRQ contains information about disease activity and additional information such as treatment and smoking status. SRQ covers 95% of all patients with RA treated with b/tsDMARD s in Sweden.
Swedish Patient Register (NPR)	A national register maintained by The National Board of Health and Welfare. Hospital discharges from inpatient care and patients visits in non-primary outpatient care, have been registered, since 1964 and 2001 respectively. Diagnoses are coded according to the Swedish version of the International Classification of Disease (ICD). The coverage of the inpatient part is close to 100%, for the outpatient part, the overall coverage is around 80% (higher for public than for private care-providers).
Prescribed Drug Register (PDR)	A national register maintained by The National Board of Health and Welfare. It contains information about all drugs dispensed on prescription in Sweden and is linked to the personal identification number since 2005. The coverage is close to 100%.
Swedish Population Register	A national register maintained by Swedish Tax agency. Contains information such as home district, civil status and migration data.
Longitudinal database for insurance and labor market-studies (LISA)	A national register maintained by Statistics Sweden. It contains information about sick leave, parental leave and employment status in Sweden from 1990
Cause of Death Register	The Cause of Death Register is a national register containing information on date and cause of death (underlying and contributory) for all deceased residents, including deaths among Swedish residents who died abroad. The register was started in 1952, and the data is considered complete since 1961. From that year and onward, cause of death is missing for less than 0.5% of deceased individuals, and in 2002, a validation study estimated that only 3.3% had any errors at the three digit level of the ICD-coded underlying cause of death
Swedish Intensive Care Quality Register (SIRS)	A national clinical register containing clinical information on patients admitted to intensive care from 2008 onwards. (https://www.icuregswe.org/en)

Supplementary Table 2: ICD10 and ATC codes used to define cohorts

Inflammatory joint disease cohort definitions		DMARD treatment cohort definitions*	
Disease	**ICD10 code**	**DMARD**	**ATC code**
Rheumatoid arthritis	M05, M06	csDMARD	L04AX01, A07EC01, L04AD01, P01BA01, M01CB01, L04AA06, L04AX03, L01AA01, P01BA02, J01AA08, L04AA13, M01CC01
Psoriatic arthritis	M070, M071, M073, L405	TNFi	L04AB04, L04AB05, L04AB01, L04AB06, L04AB02
Ankylosing spondylitis	M45	Abatacept	L04AA24
Other spondyloarthropathies	M460, M461, M468, M469	Tocilizumab	L04AC07
Juvenile idiopathic arthritis	M08, M09	Rituximab	L01XC02
		JAKi	L04AA29, L04AA37, L04AA44

*As recorded in the Prescribed Drug Register

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Supplementary Table3. Characteristics of Swedish residents with chronic inflammatory arthritis in Sweden March 1st, 2015-2019 combined and averaged, and their matched general population comparator subjects.

	RA	Other IJD	All inflammatory joint disease	General population
Average yearly individuals	52149	52127	104276	464819
Average yearly deaths	808	269	1077	2547
Age, Median (IQR)	68 (56-76)	54 (42-66)	61 (48-72)	59 (46-70)
Females	72%	51%	62%	62%
Time since diagnosis, median (IQR)	9.0 (4.0-14.0)	8.0 (4.0-13.0)	9.0 (4.0-13.0)	-
Comorbidities				
History of cancer	5%	4%	4%	4%
History of diabetes	13%	10%	11%	9%
History of heart failure	4%	2%	3%	2%
History of IHD	8%	4%	6%	3%
History of infections	7%	4%	5%	2%
History of lung diseases	11%	6%	9%	4%
History of kidney failure	3%	2%	3%	1%
History of stroke	4%	2%	3%	2%
History of joint surgery	19%	7%	13%	5%
History of VTE	1.2%	0.7%	1.0%	0.5%
Highest achieved education				
<9 years	18%	7%	13%	10%
9-12 years	55%	60%	58%	55%
12+ years	26%	33%	30%	35%
Civil status: Married	50%	48%	49%	48%
Born in Sweden (%)	88%	90%	89%	85%
Hospitalisation days past year, median (IQR)	6 (3-13)	4 (2-9)	5 (3-11)	4 (2-9)
Hospitalisation days: 10 years up to 1 year prior, median (IQR)	4 (0-14)	2 (0-7)	3 (0-10)	0 (0-5)

Supplementary Table 4: Description of covariates included in the propensity score estimation model.

Variable	Description
Comorbidity	
History of cancer	History of cancer recorded within 5 years prior to cohort entry. Data retrieved from the Cancer Register. Indicator variable (Y/N). Note that information on cancer diagnoses recorded in the Swedish Cancer Register was only available until December 31st 2018.
History of diabetes	History of diabetes recorded in the 10 years recorded prior to cohort entry. Defined as a record in the National Patient Register (inpatient and outpatient components, ICD10: E10-E11) or dispensation of treatment (ATC: A10) in the Prescribed Drug Register. Indicator variable (Y/N).
History of heart failure	History of heart failure recorded in the 5 years recorded prior to cohort entry. Defined as record in National Patient Register (inpatient component, ICD10: I50). Indicator variable (Y/N).
History of ischemic heart disease.	History of ischemic heart disease recorded in the 5 years recorded prior to cohort entry. Defined as record in National Patient Register (inpatient component, ICD10: I20-I25). Indicator variable (Y/N).
History of hospitalised infections	History of infections recorded in the 2 years prior to cohort entry. Defined as recorded in National Patient Register (inpatient component, ICD10: A00-B99, D73.3, E06.0, E32.1, G00-G02, G04.2, G05-G07, H00.0, H44.0, H60.0-H60.3, H66-H67, H70, I30.1, I40.0, J00-J22, J32, J34.0, J36, J38.3, J39.0-J39.1, J44.0, J85, J86, K04.4, K04.6, K04.7, K10.2, K11.3, K12.2, K14.0, K57.0, K57.2, K57.4, K57.8, K61, K63.0, K65.0, K65.1, K65.2, K65.9, L00-L08, L30.3, M00-M01, M46.2-M46.5, M60.0, M65.0, M71.0, M71.1, M72.6, M86, N10, N11, N12, N13.6, N15.1, N15.9, N30.0 N30.8, N34.0, N41.2, N43.1, N45.2, N45.3, N45.4, N48.2, N61, N70, N73, N75.1). Indicator variable (Y/N).
History of lung disease	History of lung disease other than infectious pneumonia recorded in the 5 years recorded prior to cohort entry. Defined as record in National Patient Register (inpatient and outpatient components, ICD10: J40-J94). Indicator variable (Y/N).
History of kidney failure	History of kidney failure recorded in the 5 years recorded prior to cohort entry. Defined as record in National Patient Register (inpatient and outpatient components, ICD10:N17-N19). Indicator variable (Y/N).
History of stroke	History of stroke recorded in the 5 years recorded prior to cohort entry. Defined as record in National Patient Register (inpatient and outpatient components, ICD10:I50-I69).

	Indicator variable (Y/N).
History of joint surgery	History of joint surgery recorded in the 10 years prior to cohort entry. Defined as record in National Patient Register (inpatient and outpatient components, operational codes: NGB, NFB, NBB, NHB, NHC, NHE, NHF, NHG, 8423, 8424, 8426, 8419, 8437, 8436, 8420, 8421, 8422, 8400-8415). Indicator variable (Y/N).
History of venous thrombotic event	History of VTE recorded in the 5 years recorded prior to cohort entry. Defined as record in National Patient Register (inpatient component, ICD10:I82, I26). Indicator variable (Y/N).
Health-care resource utilisation	
Hospital days in the previous year	The number of days spent in hospital during the 365 days prior to cohort entry. Data obtained from the inpatient component of the National Patient Register. Categorised into 0, 1-3, and 4+ days.
Hospital days in the previous 10 years	The number of days spent in hospital during the period 10 years to 365 days prior to cohort entry. Data obtained from the inpatient component of the National Patient Register. Categorised into 0, 1-6, and 7+ days.
Socioeconomics	
Education	Highest education achieved as recorded in the year prior to cohort entry. Data obtained from the Longitudinal integrated database for health insurance and labour market studies (LISA). Note that education information was only available to 2018 in LISA so the value in 2018 was assumed for any subsequent years. Categorised into: 1= <9 years 2=9-12years 3=12years+
Civil status	Civil status recorded in the year prior to cohort entry. Data obtained from LISA, Note that civil status information was only available to 2017 in LISA so the value in 2017 was assumed for any subsequent years. Categorised into married/partner, or single.
Country of birth	Country of birth obtained from the Total Population Register categorised as Sweden, rest of Europe, and rest of world.
Disease-related	
DAS28	DAS28 value (ESR) from most recent rheumatology visit recorded in the SRQ within one year prior to start of follow-up. Categorised into remission (<2.6), low (2.6-3.1), moderate (3.2- 5.1), high (5.2+), and missing.
Disease duration	Disease duration in years, taken as the difference between the diagnosis date (defined using the disease selection definition and data in the National Patient register) and entry to cohort. Categorised as <2, 2-4, 5-9, 10+ years.

Treatment-related	
Number of previous b/tsDMARDs	Number of previous b/tsDMARDs prior to the treatment that caused entry to cohort. Identified by combining the PDR and SRQ. Categorised as 0, 1-2, 3+.
b/tsDMARD recorded in the previous 180 days	Identifies if a different b/tsDMARD was recorded in the previous 180 days prior to start. Indicator variable (Y/N).
Concomitant steroid use*	Dispensation of steroids (ATC: H02AB06) recorded in the Prescribed Drug Register in the 90 days prior to cohort entry.
Concomitant csDMARD use*	Concomitant csDMARD use defined as dispensation of csDMARD recorded in the Prescribed Drug Register within the 120 days prior to cohort entry where the dispensation occurs after the order date of the treatment defining the exposure cohort (ATC codes: L04AX01, A07EC01, L04AD01, P01BA01, M01CB01, L04AA06, L04AX03, L01AA01, P01BA02, J01AA08, L04AA13, M01CC01)

*Variables included in weighted Cox model not propensity score estimation model

Supplementary Table 5. Characteristics of Swedish residents with chronic inflammatory joint diseases (RA, PsA, AS, SpA and JIA) according to their DMARD treatment status on March 1st 2020.

	csDMARD*	TNFi	Abatacept	Tocilizumab	Rituximab	JAKi	All b/tsDMARDs combined
Individuals	33296	22070	1324	1037	2180	1725	28336
Age at entry, median (IQR)	67 (55-75)	54 (42-66)	65 (54-73)	62 (50-72)	68 (58-75)	60 (49-69)	57 (44-68)
Female	65%	58%	79%	79%	77%	79%	62%
Time since diagnosis, median (IQR)	8.9 (4.5-14.7)	9.6 (4.8-15.5)	12.1 (6.4-17.6)	11.8 (6.8-17.4)	13.8 (8.9-18.2)	11.0 (5.7-16.9)	10.3 (5.3-16.1)
DAS28ESR at most recent visit during last 12 months (if any)							
Median (IQR)	2.6 (1.9-3.4)	2.4 (1.7-3.3)	3.1 (2.4-4.3)	1.8 (1.1-3.2)	2.9 (2.1-3.9)	3.3 (2.5-4.4)	2.5 (1.8-3.6)
Remission	52%	56%	32%	65%	43%	30%	52%
Low	19%	16%	21%	10%	18%	15%	16%
Moderate	26%	24%	36%	17%	31%	40%	27%
High	4%	4%	10%	8%	8%	15%	6%
No visit with complete DAS28 data	76%	66%	56%	59%	49%	54%	63%
N previous b/tsDMARDs (median) (IQR)	0.0 (0.0-0.0)	0.0 (0.0-1.0)	1.0 (1.0-2.0)	1.0 (0.0-2.0)	1.0 (0.0-2.0)	2.0 (1.0-3.0)	0.0 (0.0-1.0)
On other bDMARD in past 180 days (%)	1%	5%	16%	16%	10%	16%	7%
Concomitant therapies							
csDMARDs	100%	37%	42%	31%	37%	31%	37%
Steroids	22%	14%	37%	33%	31%	34%	19%
Comorbidities							

History of cancer	4%	1%	2%	1%	5%	2%	2%
History of diabetes	14%	9%	15%	11%	15%	12%	10%
History of heart failure	4%	1%	4%	2%	4%	2%	2%
History of IHD	6%	3%	7%	3%	8%	5%	4%
History of infections	6%	3%	9%	5%	10%	8%	4%
History of lung diseases	9%	6%	16%	10%	17%	11%	8%
History of kidney failure	3%	2%	3%	3%	3%	2%	2%
History of stroke	4%	2%	3%	2%	3%	2%	2%
History of joint surgery	14%	12%	25%	24%	26%	22%	15%
History of VTE	1%	1%	1%	1%	2%	1%	1%
Highest acheived education							
<9 years	14%	5%	11%	8%	11%	7%	6%
9-12 years	59%	59%	58%	60%	60%	59%	59%
12+ years	27%	36%	31%	32%	29%	33%	35%
Civil status, married	51%	49%	52%	49%	50%	49%	49%
Born in Sweden	89%	88%	88%	88%	84%	86%	88%
N hospitalisation days in past 365 days**, median (IQR)	5.0 (3.0-11.0)	4.0 (2.0-7.0)	5.0 (3.0-12.0)	4.0 (3.0-7.0)	5.0 (3.0-11.0)	5.0 (3.0-12.0)	4.0 (2.0-8.0)
N hospitalisation days the 10 years prior, up to 1 year prior**, median (IQR)	2.0 (0.0-9.0)	2.0 (0.0-6.0)	5.0 (0.0-14.0)	4.0 (0.0-12.0)	6.0 (1.0-18.0)	4.0 (0.0-13.0)	2.0 (0.0-8.0)

*Defined as methotrexate, sulfasalazine, anti-malarials, and leflunomide. ** of those with a hospitalisation

Supplementary Table 6. Characteristics of Swedish residents with chronic inflammatory joint diseases (RA only) according to their DMARD treatment status on March 1st 2020.

	csDMARD*	TNFi	Abatacept	Tocilizumab	Rituximab	JAKi	All b/tsDMARDs combined
Individuals	22904	10463	1221	942	2150	1384	16160
Age at entry (median), IQR	70 (60-77)	62 (51-71)	66 (56-74)	63 (53-72)	68 (58-75)	62 (52-71)	64 (52-72)
Female	71%	75%	80%	79%	77%	81%	76%
Time since diagnosis, median (IQR)	8.9 (4.4-14.8)	11.1 (5.9-16.7)	12.2 (6.6-17.7)	12.0 (6.9-17.5)	13.8 (9.0-18.3)	11.7 (6.2-17.4)	11.6 (6.4-17.1)
DAS28ESR at most recent visit during last 12 months (if any)							
Median (IQR)	2.6 (1.9-3.4)	2.6 (1.9-3.6)	3.0 (2.4-4.3)	1.9 (1.1-3.3)	2.9 (2.1-3.9)	3.3 (2.5-4.4)	2.7 (2.0-3.8)
Remission	51%	49%	33%	64%	43%	31%	46%
Low	19%	17%	21%	10%	18%	15%	17%
Moderate	26%	29%	36%	17%	32%	40%	30%
High	4%	5%	11%	9%	8%	14%	7%
No. visit with complete DAS28 data	72%	59%	56%	58%	49%	53%	57%
N previous b/tsDMARDs (median) (IQR)	0.0 (0.0-0.0)	0.0 (0.0-1.0)	1.0 (0.0-2.0)	1.0 (0.0-2.0)	1.0 (0.0-2.0)	2.0 (1.0-3.0)	0.0 (0.0-1.0)
On other bDMARD in past 180 days (%)	1%	5%	16%	16%	10%	16%	8%
Concomitant therapies							
csDMARDs	100%	51%	43%	31%	37%	32%	46%
Steroids	26%	21%	38%	33%	31%	36%	26%
Comorbidities							

History of cancer	5%	1%	2%	1%	5%	2%	2%
History of diabetes	14%	10%	15%	11%	15%	12%	11%
History of heart failure	4%	2%	4%	2%	4%	2%	2%
History of IHD	7%	4%	8%	3%	8%	5%	5%
History of infections	6%	4%	9%	5%	10%	8%	6%
History of lung diseases	11%	7%	17%	10%	17%	12%	10%
History of kidney failure	3%	2%	3%	3%	3%	2%	2%
History of stroke	4%	2%	4%	2%	4%	2%	2%
History of joint surgery	16%	19%	25%	24%	26%	25%	21%
History of VTE	1%	1%	1%	1%	2%	2%	1%
Highest acheived education							
<9 years	18%	9%	11%	8%	11%	8%	9%
9-12 years	57%	57%	58%	60%	60%	59%	57%
12+ years	26%	35%	31%	32%	29%	33%	33%
Civil status, married	51%	52%	53%	52%	50%	50%	52%
Born in Sweden	88%	87%	88%	87%	84%	85%	87%
N hospitalisation days in past 365 days**, median (IQR)	5.0 (3.0-11.0)	4.0 (2.0-8.0)	5.0 (3.0-12.0)	4.0 (3.0-7.0)	5.0 (3.0-11.0)	5.0 (3.0-11.0)	5.0 (3.0-9.0)
N hospitalisation days the 10 years prior, up to 1 year prior**, median (IQR)	3.0 (0.0-10.0)	2.0 (0.0-7.0)	5.0 (0.0-15.0)	4.0 (0.0-12.0)	6.0 (1.0-18.0)	4.0 (0.0-13.0)	3.0 (0.0-10.0)

*Defined as methotrexate, sulfasalazine, anti-malarials, and leflunomide. ** of those with a hospitalization

Supplementary Table 7. Characteristics of Swedish residents with chronic inflammatory joint diseases (PsA, AS,SpA and JIA only) according to their DMARD treatment status on March 1st 2020.

	csDMARD*	TNFi	Abatacept	Tocilizumab	Rituximab	JAKi	All b/tsDMARDs combined
Individuals	10392	11607	103	95	30	341	12176
Age at entry (median), IQR	59 (47-69)	48 (37-58)	47 (29-58)	30 (24-56)	47 (27-62)	51 (37-60)	48 (36-58)
Female	51%	43%	71%	78%	80%	70%	44%
Time since diagnosis, median (IQR)	8.9 (4.7-14.4)	8.4 (4.1-14.1)	9.3 (4.6-15.5)	9.2 (5.6-16.8)	10.2 (6.2-15.1)	8.1 (4.3-14.7)	8.4 (4.1-14.1)
DAS28ESR at most recent visit during last 12 months (if any)							
Median (IQR)	2.5 (1.8-3.3)	2.1 (1.5-3.0)	3.2 (2.5-4.1)	1.0 (0.8-2.2)	4.8 (2.2-5.3)	3.4 (2.6-4.8)	2.2 (1.5-3.1)
Remission	54%	66%	28%	83%	33%	28%	64%
Low	19%	14%	21%	3%	11%	15%	14%
Moderate	25%	18%	46%	14%	22%	39%	20%
High	3%	3%	5%	0%	33%	18%	3%
No visit with complete DAS28 data	84%	72%	62%	69%	70%	57%	71%
N previous b/tsDMARDs (median) (IQR)	0.0 (0.0-0.0)	0.0 (0.0-1.0)	2.0 (1.0-3.0)	2.0 (1.0-3.0)	1.0 (1.0-3.0)	2.0 (1.0-3.0)	0.0 (0.0-1.0)
On other bDMARD in past 180 days (%)	1%	5%	22%	15%	23%	15%	6%
Concomitant therapies							
csDMARDs	100%	25%	26%	22%	23%	28%	25%
Steroids	11%	8%	27%	28%	23%	30%	9%
Comorbidities							

History of cancer	3%	1%	0%	1%	3%	2%	1%
History of diabetes	13%	8%	8%	5%	13%	13%	9%
History of heart failure	2%	1%	1%	0%	3%	1%	1%
History of IHD	5%	2%	4%	1%	3%	3%	2%
History of infections	4%	2%	5%	3%	7%	9%	3%
History of lung diseases	6%	4%	13%	7%	20%	6%	5%
History of kidney failure	2%	2%	4%	2%	3%	2%	2%
History of stroke	2%	1%	2%	0%	0%	1%	1%
History of joint surgery	10%	6%	17%	21%	13%	11%	7%
History of VTE	1%	0%	0%	2%	3%	1%	0%
Highest acheived education							
<9 years	7%	2%	6%	3%		3%	3%
9-12 years	63%	61%	66%	58%	70%	63%	61%
12+ years	31%	37%	28%	39%	30%	34%	37%
Civil status, married	51%	46%	39%	24%	43%	45%	45%
Born in Sweden	92%	89%	92%	94%	90%	93%	89%
N hospitalisation days in past 365 days**, median (IQR)	4.0 (2.0-8.0)	3.0 (2.0-6.0)	2.0 (2.0-6.0)	5.0 (3.0-6.0)	10.0 (2.0-46.0)	4.0 (3.0-19.0)	3.0 (2.0-6.0)
N hospitalisation days the 10 years prior, up to 1 year prior**, median (IQR)	2.0 (0.0-7.0)	0.0 (0.0-5.0)	4.0 (0.0-9.0)	5.0 (2.0-13.0)	5.0 (2.0-11.0)	4.0 (0.0-11.0)	0.0 (0.0-5.0)

*Defined as methotrexate, sulfasalazine, anti-malarials, and leflunomide. ** of those with a hospitalisation

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Supplementary Table 8: Standardised mean differences from propensity score weighting for all variables included in the csDMARD vs. b/tsDMARD analyses.

	All inflammatory diseases				RA				Other IJD			
	csDMARD		b/tsDMARD		csDMARD		b/tsDMARD		csDMARD		b/tsDMARD	
	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted
Age												
<55	-0.453	-0.045	0.453	0.045	-0.312	-0.035	0.312	0.035	-0.528	-0.046	0.528	0.046
55-64	-0.052	0.000	0.052	0.000	-0.143	-0.009	0.143	0.009	0.108	0.012	-0.108	-0.012
65-69	0.061	0.001	-0.061	-0.001	-0.026	-0.005	0.026	0.005	0.191	0.013	-0.191	-0.013
70-74	0.152	0.008	-0.152	-0.008	0.065	0.001	-0.065	-0.001	0.267	0.013	-0.267	-0.013
75-79	0.202	0.011	-0.202	-0.011	0.148	0.007	-0.148	-0.007	0.249	0.014	-0.249	-0.014
80-84	0.229	0.022	-0.229	-0.022	0.213	0.019	-0.213	-0.019	0.208	0.033	-0.208	-0.033
85+	0.252	0.050	-0.252	-0.050	0.268	0.052	-0.268	-0.052	0.144	0.037	-0.144	-0.037
bDMARD previous 180 days	-0.344	-0.069	0.344	0.069	-0.399	-0.083	0.399	0.083	-0.267	-0.048	0.267	0.048
Civil status	-0.039	0.001	0.039	-0.001	0.017	0.012	-0.017	-0.012	-0.114	-0.015	0.114	0.015
Country of birth												
Sweden	0.043	0.007	-0.043	-0.007	0.031	-0.002	-0.031	0.002	0.094	0.034	-0.094	-0.034
Europe	0.000	0.003	0.000	-0.003	-0.012	0.001	0.012	-0.001	-0.009	-0.003	0.009	0.003
Rest of world	-0.067	-0.015	0.067	0.015	-0.035	0.003	0.035	-0.003	-0.132	-0.048	0.132	0.048
DAS28												
Remission	-0.178	-0.021	0.178	0.021	-0.143	-0.021	0.143	0.021	-0.276	-0.021	0.276	0.021
Low	-0.055	-0.006	0.055	0.006	-0.084	-0.012	0.084	0.012	-0.042	0.003	0.042	-0.003
Moderate	-0.132	-0.001	0.132	0.001	-0.193	-0.012	0.193	0.012	-0.074	0.017	0.074	-0.017
High	-0.095	0.001	0.095	-0.001	-0.132	-0.007	0.132	0.007	-0.055	0.006	0.055	-0.006
Missing	0.270	0.019	-0.270	-0.019	0.312	0.032	-0.312	-0.032	0.294	0.006	-0.294	-0.006

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Disease duration												
<2 years	0.051	-0.022	-0.051	0.022	0.141	-0.017	-0.141	0.017	-0.073	-0.020	0.073	0.020
2-4 years	0.078	0.000	-0.078	0.000	0.154	0.011	-0.154	-0.011	-0.019	-0.015	0.019	0.015
5-9 years	0.043	0.005	-0.043	-0.005	0.069	0.005	-0.069	-0.005	0.023	0.004	-0.023	-0.004
10+ years	-0.126	0.009	0.126	-0.009	-0.252	-0.002	0.252	0.002	0.039	0.020	-0.039	-0.020
Education												
<9 years	0.253	0.025	-0.253	-0.025	0.239	0.029	-0.239	-0.029	0.201	0.022	-0.201	-0.022
9-12 years	-0.009	0.000	0.009	0.000	-0.015	-0.005	0.015	0.005	0.032	0.002	-0.032	-0.002
12+ years	-0.159	-0.017	0.159	0.017	-0.167	-0.016	0.167	0.016	-0.120	-0.012	0.120	0.012
Female	0.045	-0.002	-0.045	0.002	-0.120	-0.008	0.120	0.008	0.138	0.000	-0.138	0.000
Hospital days (prev 10 years)												
0	-0.023	-0.016	0.023	0.016	0.050	-0.007	-0.050	0.007	-0.080	-0.024	0.080	0.024
1-6	-0.047	-0.001	0.047	0.001	-0.066	-0.008	0.066	0.008	-0.011	0.009	0.011	-0.009
7+	0.071	0.019	-0.071	-0.019	0.011	0.015	-0.011	-0.015	0.108	0.018	-0.108	-0.018
Hospital days (previous year)												
0	-0.080	-0.008	0.080	0.008	-0.054	-0.004	0.054	0.004	-0.077	-0.008	0.077	0.008
1-3	0.009	-0.001	-0.009	0.001	-0.001	-0.006	0.001	0.006	0.012	0.004	-0.012	-0.004
4+	0.092	0.011	-0.092	-0.011	0.066	0.010	-0.066	-0.010	0.091	0.006	-0.091	-0.006
Comorbidities												
Cancer	0.164	0.017	-0.164	-0.017	0.150	0.015	-0.150	-0.015	0.174	0.021	-0.174	-0.021
Diabetes	0.109	0.015	-0.109	-0.015	0.077	0.012	-0.077	-0.012	0.150	0.021	-0.150	-0.021
Heart failure	0.126	0.022	-0.126	-0.022	0.108	0.022	-0.108	-0.022	0.132	0.017	-0.132	-0.017
IHD	0.116	0.012	-0.116	-0.012	0.091	0.009	-0.091	-0.009	0.135	0.014	-0.135	-0.014

Infections	0.057	0.013	-0.057	-0.013	0.030	0.006	-0.030	-0.006	0.073	0.019	-0.073	-0.019
Kidney failure	0.043	0.007	-0.043	-0.007	0.039	0.006	-0.039	-0.006	0.038	0.008	-0.038	-0.008
Lung disease	0.059	0.004	-0.059	-0.004	0.029	-0.001	-0.029	0.001	0.062	0.007	-0.062	-0.007
Stroke	0.100	0.007	-0.100	-0.007	0.094	0.006	-0.094	-0.006	0.078	0.005	-0.078	-0.005
Joint surgery	-0.016	0.010	0.016	-0.010	-0.118	0.005	0.118	-0.005	0.106	0.013	-0.106	-0.013
VTE	0.045	0.008	-0.045	-0.008	0.041	0.007	-0.041	-0.007	0.033	0.002	-0.033	-0.002
N previous biologics												
0	0.721	0.040	-0.721	-0.040	0.819	0.045	-0.819	-0.045	0.574	0.036	-0.574	-0.036
1-2	-0.620	-0.039	0.620	0.039	-0.686	-0.040	0.686	0.040	-0.518	-0.039	0.518	0.039
3+	-0.292	-0.007	0.292	0.007	-0.365	-0.016	0.365	0.016	-0.183	0.003	0.183	-0.003
Region												
North	0.083	0.006	-0.083	-0.006	0.081	0.002	-0.081	-0.002	0.086	0.010	-0.086	-0.010
South	0.015	0.003	-0.015	-0.003	0.009	0.003	-0.009	-0.003	0.021	-0.001	-0.021	0.001
Southeast	0.093	0.014	-0.093	-0.014	0.091	0.020	-0.091	-0.020	0.099	0.006	-0.099	-0.006
Stockholm	-0.176	-0.016	0.176	0.016	-0.161	-0.021	0.161	0.021	-0.209	-0.007	0.209	0.007
Uppsala/ Örebro	0.012	-0.001	-0.012	0.001	0.021	-0.003	-0.021	0.003	0.007	-0.002	-0.007	0.002
West	0.008	-0.002	-0.008	0.002	-0.007	0.003	0.007	-0.003	0.037	-0.003	-0.037	0.003

Supplementary Table 9: Standardised mean differences from propensity score weighting for all variables included in the treatment comparison between specific DMARDs, RA only

	csDMARD		TNFi		Abatacept		Tocilizumab		Rituximab		JAKi	
	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted
Age												
<55	-0.312	-0.038	0.348	0.034	0.012	0.108	0.163	0.062	-0.083	-0.060	0.218	0.025
55-64	-0.143	-0.001	0.113	0.003	0.092	-0.051	0.108	0.051	0.023	-0.010	0.174	0.018
65-69	-0.026	-0.003	0.006	0.004	0.042	-0.005	0.022	-0.040	0.056	0.022	0.010	-0.002
70-74	0.065	0.005	-0.073	0.008	0.003	-0.062	-0.016	-0.035	0.055	0.012	-0.119	-0.020
75-79	0.148	0.003	-0.161	-0.012	-0.006	-0.011	-0.086	0.028	0.025	0.022	-0.098	0.007
80-84	0.213	0.013	-0.198	-0.023	-0.125	0.034	-0.128	0.001	-0.012	0.011	-0.153	-0.007
85+	0.268	0.046	-0.236	-0.038	-0.092	-0.023	-0.208	-0.132	-0.091	0.027	-0.187	-0.045
bDMARD previous 180 days	-0.399	-0.077	0.106	0.048	0.642	0.076	0.680	0.096	0.346	0.058	0.663	0.064
Civil status	0.017	0.001	-0.027	-0.017	-0.037	-0.028	-0.007	-0.030	0.035	0.079	0.017	0.027
Country of birth												
Sweden	0.031	0.009	-0.001	0.007	0.020	-0.047	-0.007	0.006	-0.098	0.001	-0.083	-0.071
Europe	-0.012	-0.008	-0.004	-0.009	-0.022	0.068	-0.029	-0.065	0.071	0.029	0.037	0.050
Rest of world	-0.035	-0.004	0.006	0.001	-0.003	-0.015	0.049	0.078	0.063	-0.040	0.085	0.048
DAS28												
Remission	-0.143	-0.020	0.125	0.014	-0.062	0.023	0.280	0.020	0.146	0.029	-0.066	-0.020
Low	-0.084	-0.011	0.048	0.014	0.140	0.057	-0.081	-0.036	0.137	-0.007	0.043	-0.024
Moderate	-0.193	-0.014	0.098	-0.005	0.216	0.027	-0.087	-0.010	0.234	0.050	0.322	0.044
High	-0.132	-0.008	0.009	-0.007	0.214	-0.010	0.132	0.012	0.164	0.037	0.356	0.045
Missing	0.312	0.032	-0.186	-0.013	-0.217	-0.061	-0.162	0.005	-0.376	-0.061	-0.272	-0.013
Disease duration												
<2 years	0.141	-0.023	-0.062	0.020	-0.129	0.105	-0.176	-0.050	-0.252	-0.076	-0.027	0.110
2-4 years	0.154	0.010	-0.080	-0.014	-0.080	0.029	-0.135	-0.018	-0.241	-0.020	-0.108	0.029

5-9 years	0.069	0.004	-0.037	-0.012	-0.086	0.002	0.008	0.024	-0.094	0.025	-0.062	-0.014
10+ years	-0.252	0.003	0.125	0.009	0.205	-0.081	0.190	0.021	0.399	0.035	0.149	-0.071
Education												
<9 years	0.239	0.025	-0.208	-0.021	-0.087	-0.049	-0.175	-0.038	-0.082	-0.014	-0.178	0.029
9-12 years	-0.015	-0.006	-0.011	0.009	0.010	0.032	0.062	0.007	0.056	-0.014	0.032	-0.022
12+ years	-0.167	-0.013	0.171	0.006	0.056	0.002	0.067	0.022	0.002	0.026	0.101	0.002
Female	-0.120	-0.024	0.053	0.005	0.155	0.067	0.141	-0.001	0.088	0.030	0.183	0.044
Hospital days (previous 10 years)												
0	0.050	0.000	0.090	0.025	-0.209	-0.049	-0.111	-0.039	-0.293	-0.107	-0.166	0.080
1-6	-0.066	-0.013	0.071	0.008	0.017	0.029	0.011	-0.010	0.005	0.007	0.032	0.020
7+	0.011	0.012	-0.160	-0.033	0.199	0.023	0.104	0.049	0.298	0.104	0.140	-0.101
Hospital days (previous year)												
0	-0.054	-0.002	0.128	0.026	-0.087	-0.052	0.081	-0.011	-0.157	-0.096	-0.088	0.055
1-3	-0.001	-0.013	-0.034	-0.002	0.057	-0.018	-0.026	0.048	0.090	0.060	0.030	-0.001
4+	0.066	0.012	-0.128	-0.031	0.060	0.077	-0.077	-0.023	0.119	0.069	0.083	-0.066
Comorbidities												
Cancer	0.150	0.013	-0.162	-0.011	-0.068	0.014	-0.140	-0.049	0.073	0.037	-0.088	-0.072
Diabetes	0.077	0.012	-0.111	-0.020	0.071	0.019	-0.055	0.044	0.060	0.032	-0.024	-0.066
Heart failure	0.108	0.020	-0.138	-0.024	0.055	0.029	-0.077	-0.007	0.053	0.023	-0.053	-0.067
IHD	0.091	0.012	-0.117	-0.013	0.071	0.034	-0.128	0.021	0.069	0.035	-0.050	-0.109
Infections	0.030	0.008	-0.104	-0.027	0.117	0.040	-0.053	0.037	0.154	0.061	0.082	-0.050
Kidney failure	0.039	-0.002	-0.064	-0.027	0.036	0.036	-0.001	0.148	0.059	0.089	-0.035	-0.096
Lung disease	0.029	-0.016	-0.145	-0.027	0.219	0.129	-0.006	-0.004	0.251	0.114	0.054	-0.008
Stroke	0.094	0.008	-0.090	-0.007	0.001	-0.008	-0.071	-0.005	0.002	0.054	-0.112	-0.089
Joint surgery	-0.118	0.009	0.013	-0.011	0.191	-0.027	0.153	-0.012	0.214	0.016	0.167	0.009
VTE	0.041	0.011	-0.063	-0.012	0.010	-0.019	-0.043	-0.010	0.037	0.007	0.037	0.000

| N previous biologics												
0	0.819	0.052	-0.248	-0.020	-1.168	-0.064	-1.161	-0.085	-0.814	-0.051	-1.319	-0.072
1-2	-0.686	-0.043	0.294	0.017	0.925	0.072	0.931	0.068	0.676	0.037	0.688	0.050
3+	-0.365	-0.024	-0.040	0.009	0.610	-0.003	0.587	0.043	0.372	0.033	1.309	0.050
Region												
North	0.081	0.007	-0.077	0.006	0.068	0.016	-0.146	-0.131	-0.023	0.005	-0.062	-0.017
South	0.009	0.013	0.027	0.006	0.043	-0.084	0.138	0.087	-0.223	-0.093	-0.011	0.023
Southeast	0.091	0.031	-0.049	-0.004	-0.109	-0.066	-0.113	-0.086	-0.117	-0.017	-0.008	-0.068
Stockholm	-0.161	-0.038	0.093	-0.003	0.087	0.052	-0.011	0.050	0.309	0.060	0.074	0.134
Uppsala/ Örebro	0.021	-0.011	-0.043	0.002	-0.026	0.020	0.063	0.018	0.054	0.012	-0.007	0.024
West	-0.007	0.005	0.026	-0.007	-0.069	0.064	0.009	0.014	-0.024	0.037	-0.004	-0.124

Supplementary Table 10. Standardised mean differences from propensity score weighting for all variables included in the comparison between specific DMARDs, all inflammatory joint diseases

	csDMARD		TNFi		Abatacept		Tocilizumab		Rituximab		JAKi	
	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted
Age												
<55	-0.312	-0.038	0.348	0.034	0.012	0.108	0.163	0.062	-0.083	-0.060	0.218	0.025
55-64	-0.143	-0.001	0.113	0.003	0.092	-0.051	0.108	0.051	0.023	-0.010	0.174	0.018
65-69	-0.026	-0.003	0.006	0.004	0.042	-0.005	0.022	-0.040	0.056	0.022	0.010	-0.002
70-74	0.065	0.005	-0.073	0.008	0.003	-0.062	-0.016	-0.035	0.055	0.012	-0.119	-0.020
75-79	0.148	0.003	-0.161	-0.012	-0.006	-0.011	-0.086	0.028	0.025	0.022	-0.098	0.007
80-84	0.213	0.013	-0.198	-0.023	-0.125	0.034	-0.128	0.001	-0.012	0.011	-0.153	-0.007
85+	0.268	0.046	-0.236	-0.038	-0.092	-0.023	-0.208	-0.132	-0.091	0.027	-0.187	-0.045
bDMARD previous 180 days	-0.399	-0.077	0.106	0.048	0.642	0.076	0.680	0.096	0.346	0.058	0.663	0.064
Civil status	0.017	0.001	-0.027	-0.017	-0.037	-0.028	-0.007	-0.030	0.035	0.079	0.017	0.027
Country of birth												
Sweden	0.031	0.009	-0.001	0.007	0.020	-0.047	-0.007	0.006	-0.098	0.001	-0.083	-0.071
Europe	-0.012	-0.008	-0.004	-0.009	-0.022	0.068	-0.029	-0.065	0.071	0.029	0.037	0.050
Rest of world	-0.035	-0.004	0.006	0.001	-0.003	-0.015	0.049	0.078	0.063	-0.040	0.085	0.048
DAS28												
Remission	-0.143	-0.020	0.125	0.014	-0.062	0.023	0.280	0.020	0.146	0.029	-0.066	-0.020
Low	-0.084	-0.011	0.048	0.014	0.140	0.057	-0.081	-0.036	0.137	-0.007	0.043	-0.024
Moderate	-0.193	-0.014	0.098	-0.005	0.216	0.027	-0.087	-0.010	0.234	0.050	0.322	0.044
High	-0.132	-0.008	0.009	-0.007	0.214	-0.010	0.132	0.012	0.164	0.037	0.356	0.045
Missing	0.312	0.032	-0.186	-0.013	-0.217	-0.061	-0.162	0.005	-0.376	-0.061	-0.272	-0.013
Disease duration												
<2 years	0.141	-0.023	-0.062	0.020	-0.129	0.105	-0.176	-0.050	-0.252	-0.076	-0.027	0.110
2-4 years	0.154	0.010	-0.080	-0.014	-0.080	0.029	-0.135	-0.018	-0.241	-0.020	-0.108	0.029

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5-9 years	0.069	0.004	-0.037	-0.012	-0.086	0.002	0.008	0.024	-0.094	0.025	-0.062	-0.014
10+ years	-0.252	0.003	0.125	0.009	0.205	-0.081	0.190	0.021	0.399	0.035	0.149	-0.071
Education												
<9 years	0.239	0.025	-0.208	-0.021	-0.087	-0.049	-0.175	-0.038	-0.082	-0.014	-0.178	0.029
9-12 years	-0.015	-0.006	-0.011	0.009	0.010	0.032	0.062	0.007	0.056	-0.014	0.032	-0.022
12+ years	-0.167	-0.013	0.171	0.006	0.056	0.002	0.067	0.022	0.002	0.026	0.101	0.002
Female	-0.120	-0.024	0.053	0.005	0.155	0.067	0.141	-0.001	0.088	0.030	0.183	0.044
Hospital days (previous 10 years)												
0	0.050	0.000	0.090	0.025	-0.209	-0.049	-0.111	-0.039	-0.293	-0.107	-0.166	0.080
1-6	-0.066	-0.013	0.071	0.008	0.017	0.029	0.011	-0.010	0.005	0.007	0.032	0.020
7+	0.011	0.012	-0.160	-0.033	0.199	0.023	0.104	0.049	0.298	0.104	0.140	-0.101
Hospital days (previous year)												
0	-0.054	-0.002	0.128	0.026	-0.087	-0.052	0.081	-0.011	-0.157	-0.096	-0.088	0.055
1-3	-0.001	-0.013	-0.034	-0.002	0.057	-0.018	-0.026	0.048	0.090	0.060	0.030	-0.001
4+	0.066	0.012	-0.128	-0.031	0.060	0.077	-0.077	-0.023	0.119	0.069	0.083	-0.066
Comorbidities												
Cancer	0.150	0.013	-0.162	-0.011	-0.068	0.014	-0.140	-0.049	0.073	0.037	-0.088	-0.072
Diabetes	0.077	0.012	-0.111	-0.020	0.071	0.019	-0.055	0.044	0.060	0.032	-0.024	-0.066
Heart failure	0.108	0.020	-0.138	-0.024	0.055	0.029	-0.077	-0.007	0.053	0.023	-0.053	-0.067
IHD	0.091	0.012	-0.117	-0.013	0.071	0.034	-0.128	0.021	0.069	0.035	-0.050	-0.109
Infections	0.030	0.008	-0.104	-0.027	0.117	0.040	-0.053	0.037	0.154	0.061	0.082	-0.050
Kidney failure	0.039	-0.002	-0.064	-0.027	0.036	0.036	-0.001	0.148	0.059	0.089	-0.035	-0.096
Lung disease	0.029	-0.016	-0.145	-0.027	0.219	0.129	-0.006	-0.004	0.251	0.114	0.054	-0.008
Stroke	0.094	0.008	-0.090	-0.007	0.001	-0.008	-0.071	-0.005	0.002	0.054	-0.112	-0.089
Joint surgery	-0.118	0.009	0.013	-0.011	0.191	-0.027	0.153	-0.012	0.214	0.016	0.167	0.009
VTE	0.041	0.011	-0.063	-0.012	0.010	-0.019	-0.043	-0.010	0.037	0.007	0.037	0.000

N previous biologics												
0	0.819	0.052	-0.248	-0.020	-1.168	-0.064	-1.161	-0.085	-0.814	-0.051	-1.319	-0.072
1-2	-0.686	-0.043	0.294	0.017	0.925	0.072	0.931	0.068	0.676	0.037	0.688	0.050
3+	-0.365	-0.024	-0.040	0.009	0.610	-0.003	0.587	0.043	0.372	0.033	1.309	0.050
Region												
North	0.081	0.007	-0.077	0.006	0.068	0.016	-0.146	-0.131	-0.023	0.005	-0.062	-0.017
South	0.009	0.013	0.027	0.006	0.043	-0.084	0.138	0.087	-0.223	-0.093	-0.011	0.023
Southeast	0.091	0.031	-0.049	-0.004	-0.109	-0.066	-0.113	-0.086	-0.117	-0.017	-0.008	-0.068
Stockholm	-0.161	-0.038	0.093	-0.003	0.087	0.052	-0.011	0.050	0.309	0.060	0.074	0.134
Uppsala/ Örebro	0.021	-0.011	-0.043	0.002	-0.026	0.020	0.063	0.018	0.054	0.012	-0.007	0.024
West	-0.007	0.005	0.026	-0.007	-0.069	0.064	0.009	0.014	-0.024	0.037	-0.004	-0.124

Supplementary Figure 1. Total number of deaths per day due to COVID-19 in Sweden, reported by The Public Health Agency of Sweden (Folkhälsomyndigheten, https://experience.arcgis.com/experience/09f821667ce64bf7be6f9f87457ed9aa, accessed 9th December 2020). Note that here, deaths due to COVID-19 are defined as any death that occurs within 30 days after a confirmed COVID-19 infection.
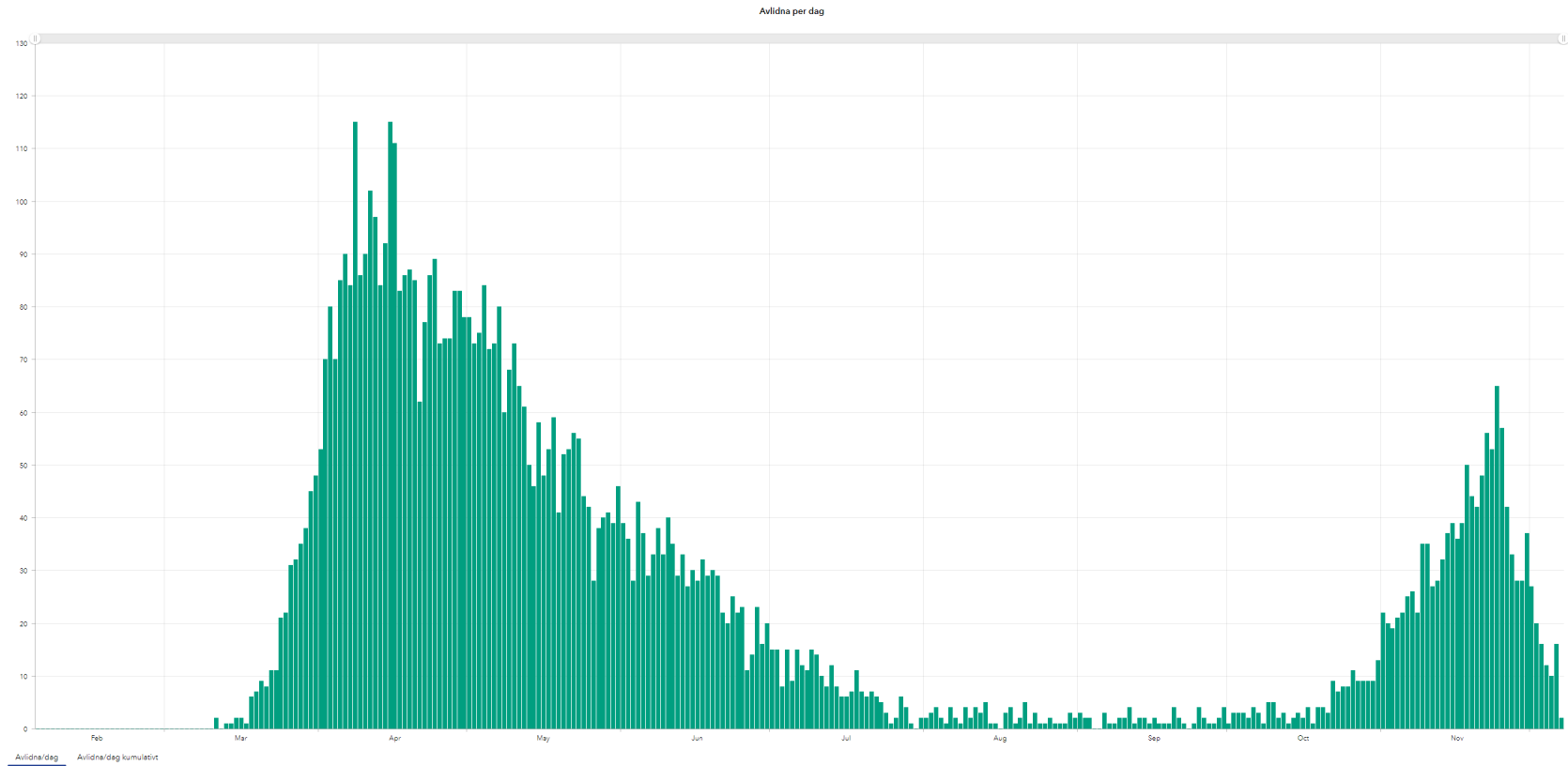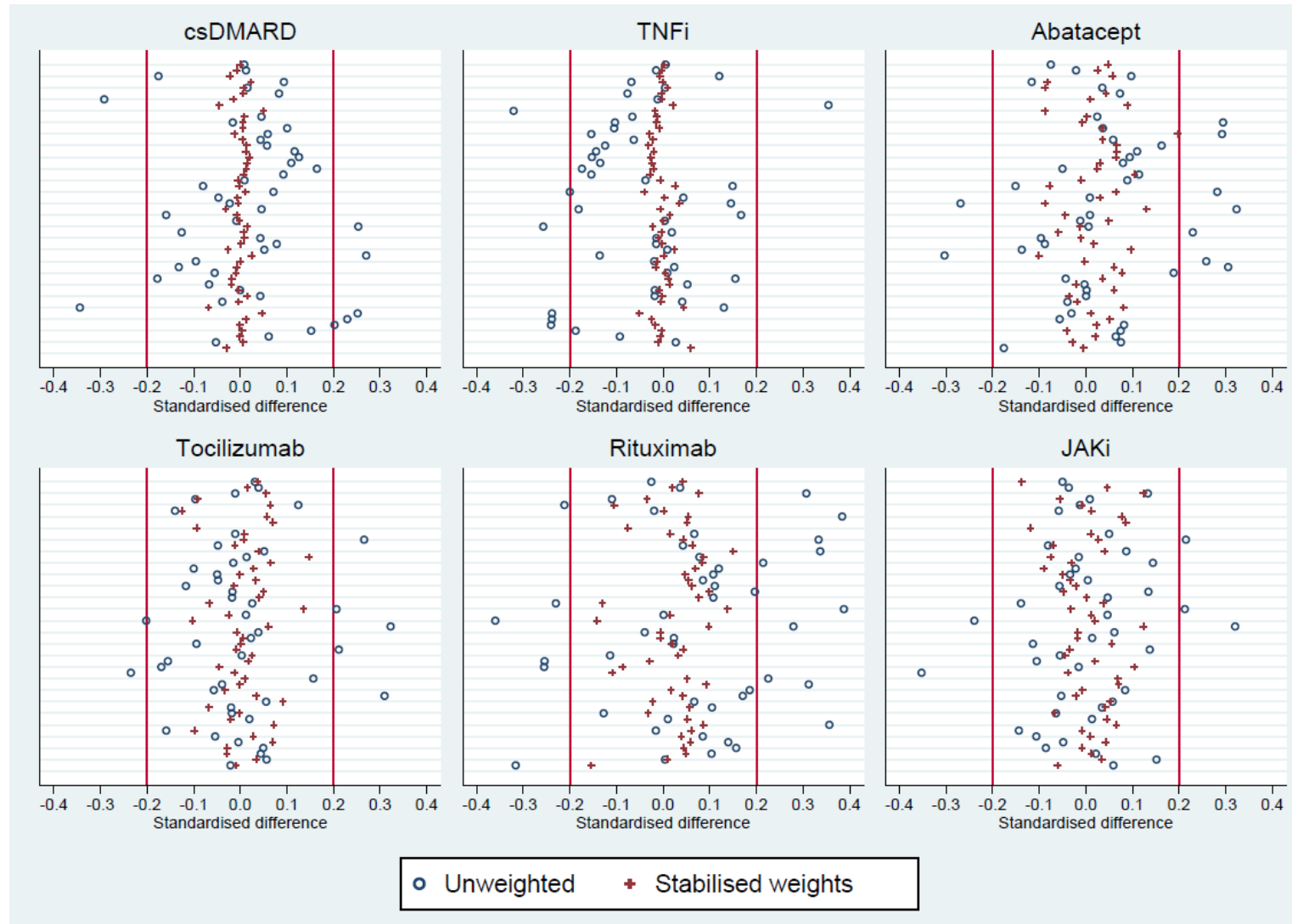
Supplementary Figure 2. Standardised mean differences from propensity score weighting for all variables included in the comparison between specific csDMARDs and bDMARDs, for all inflammatory joint diseases (IJD), RA, and other IJD.
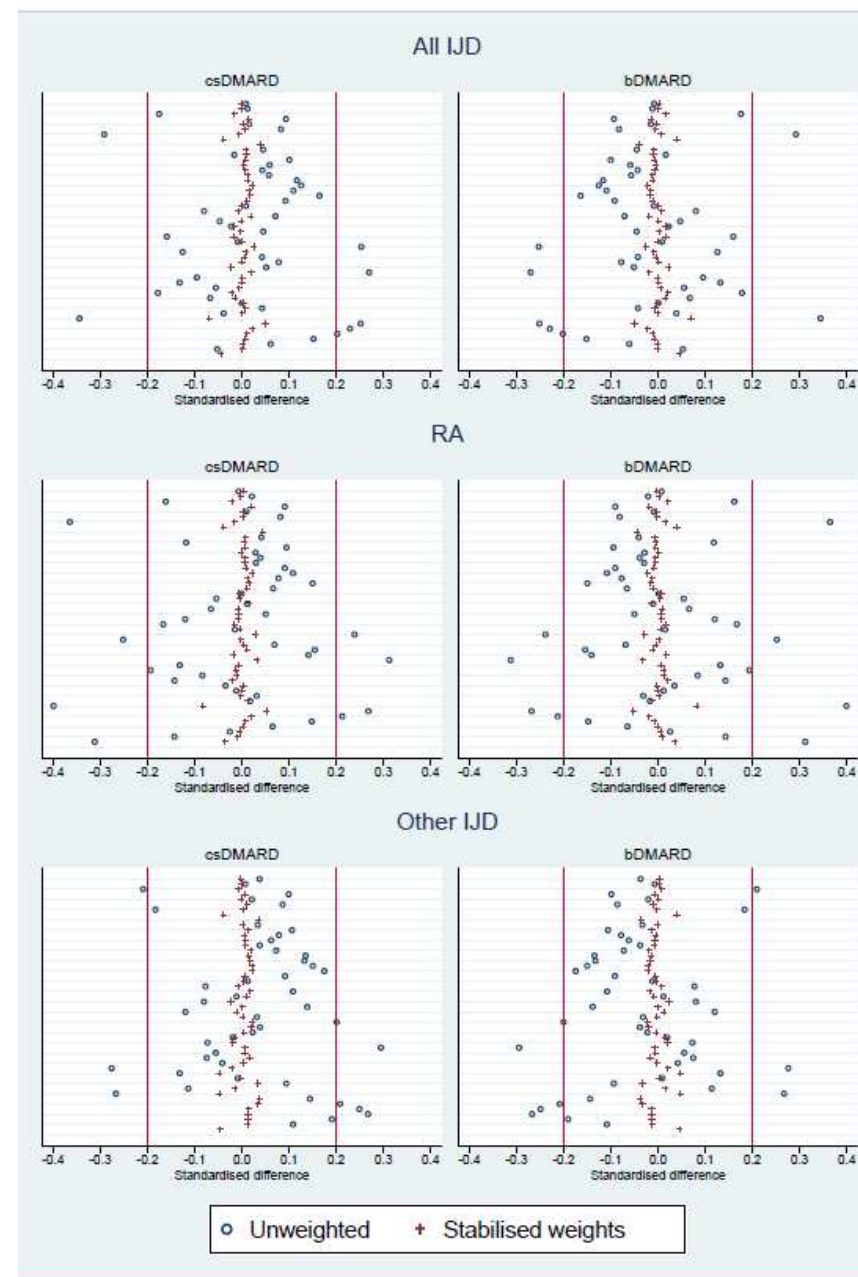
Supplementary Figure 3. Standardised mean differences from propensity score weighting for all variables included in the comparison between DMARDs cohorts, for all patients with inflammatory joint diseases

Supplemental material

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Supplementary Figure 4. Standardised mean differences from propensity score weighting for all variables included in the comparison between DMARDs cohorts, for RA patients