Time to start disease modifying drugs for adults with seropositive rheumatoid arthritis: results of the first year of the national New Zealand Rheumatology Association (NZRA) audit

William J Taylor, Nicola Dalbeth, Tracey Kain, Douglas White, Rebecca Grainger, Vicki Quincey

ABSTRACT

AIM: This audit describes variation in the time from referral to starting disease modifying drug (DMARD) for people with newly diagnosed seropositive rheumatoid arthritis (RA), how frequently this was within the recommended 6 weeks and whether regional, service-level or patient-level factors were associated with this variation.

METHOD: Rheumatologists submitted data on new patients with a new diagnosis of rheumatoid factor and/or cyclic-citrullinated peptide antibody positive RA. The association between visit funding, ethnicity, socio-economic deprivation, rurality, local specialist staffing levels and the time to DMARD treatment was assessed using Cox proportional-hazard models.

RESULTS: Data were collected on 355 patients over 12 months. Overall, 64.8% of patients commenced DMARD treatment within 6 weeks of referral and this was associated with rheumatologist FTE per 100,000 population (adjusted HR 2.47, 95%CI 1.27–4.81; p=0.008) and the rurality (Geographic Classification of Health [GCH]) of the patient (for R2 compared to U1 adjusted HR 0.20, 95%CI 0.09–0.43; p<0.001). There was no association between time to DMARD and ethnicity or socio-economic deprivation.

CONCLUSION: There was significant variation in time to DMARD treatment, mainly related to variation in rheumatologist staffing levels and patient rurality. Rheumatologist staffing levels of 1.0 FTE/100,000 population was associated with 80% of patients meeting the recommended 6-week time to DMARD treatment.

Rheumatoid arthritis (RA) is a persistent, immune-mediated inflammatory arthritis characterised by joint pain and swelling, which untreated frequently causes bone and joint destruction, and significant disability. RA may be associated with serious systemic manifestations such as scleritis, interstitial lung disease or cutaneous vasculitis. It is not common, affecting 0.4% of the population in industrialised countries, and is possibly less common in Aotearoa New Zealand, with an estimated prevalence of 0.27% and incidence 16/100,000 person-years.[1] In recent decades, the management of RA has been revolutionised by three main factors: early intervention with disease modifying drugs (DMARDs), availability of highly targeted immune-modulating therapy (especially monoclonal antibody technology) and a strategy of treatment escalation to attain low disease activity. DMARDs are distinguished from symptomatic treatment in their ability to prevent joint damage, as well as by treating inflammation effectively, and are typically slow in their onset of effect.

Early DMARD treatment has been associated with a greater degree of disease control,[2] reduction in need for subsequent orthopaedic surgery[3] and greater likelihood of drug-free remission.[4] These observations have led to management recommendations such as those developed by the United Kingdom (UK) National Institute for Health and Care Excellence (NICE): adults with early inflammatory arthritis should be commenced on DMARD therapy within 6 weeks of referral.[5] This recommendation has also been endorsed by patients and rheumatologists in Aotearoa New Zealand.[6,7]

The British Society for Rheumatology (BSR) began an ongoing prospective audit programme

that has been reporting on such standards since about 2019.[8] Its focus is on potential inflammatory arthritis rather than rheumatoid arthritis, for which the evidence of benefit of early intervention is strongest. The most recent BSR report of about 14,000 patients with suspected early inflammatory arthritis (EIA) reported that 56% of about 5,000 patients with RA pattern EIA are commenced on conventional synthetic DMARD (csDMARD) treatment with 6 weeks of referral, and that this benchmark has remained stable over time.

In Aotearoa New Zealand, it has previously been shown that achievement of the BSR/NICE practice standards are infrequent, but this study was confined to Wellington.[9] The New Zealand Rheumatology Association (NZRA) decided to initiate a low resource and low clinician-burden national audit that aimed to determine the extent to which rheumatology services (including private practices) were meeting the standard of commencing csDMARD therapy within 6 weeks of referral for patients with rheumatoid factor and/or anti-citrullinated peptide antibody positive rheumatoid arthritis. The NZRA audit was also designed to collect data that could assess factors that might explain service-level, patient-level and geographical variation in wait-time from referral to commencement of csDMARD. This manuscript reports data from the first year of the NZRA audit.

Method

In September 2022, members of the NZRA were invited to submit anonymised data within a few weeks of seeing each new patient with RF and/or anti-CCP positive patients with RA. Nearly all specialist rheumatologists and rheumatology advanced trainees in Aotearoa New Zealand are believed to be members of the NZRA. Patients were excluded if they had previously been seen by a rheumatologist and diagnosed with RA, but there were no other exclusion criteria. Data were entered by clinicians into a secure REDCap online data form hosted by the University of Otago.[10,11] Overall ethics approval was obtained from the University of Otago Human Ethics Committee (Health) and individual sites obtained locality approval according to local requirements (HD22/053). Patients were not required to give formal consent for aggregation of their anonymised information, as this study was considered to be primarily a quality improvement activity.

Waiting time was calculated as the number of days between the referral date (date received by the rheumatology service provider) and the date of the first specialist appointment (FSA). Instances of reversed dates (referral date occurring after FSA date) were identified and resolved.

One benchmark standard was assessed as the main performance indicator: commencement of a DMARD within 6 weeks of referral. This is the NICE QS33 Statement 2 from the 2020 update.[8] We assessed the following potential factors that might be associated with wait times: private versus Te Whatu Ora – Health New Zealand provided clinical service, Te Whatu Ora – Health New Zealand district and region, capacity of Te Whatu Ora – Health New Zealand employed specialist rheumatologists, rurality of patients' residence (GCH), socio-economic status (New Zealand Index of Deprivation [NZDep] 2018), age, gender and ethnicity of patients.

The number of full-time equivalent (FTE) rheumatologist Senior Medical Officers (SMO) employed by Te Whatu Ora – Health New Zealand for each region and district service was determined in 2022 by the NZRA as part of a submission to Te Whatu Ora – Health New Zealand,[12] and is also expressed as FTE/100,000 total population:

- Northern 13.71, 0.71 FTE/100,000
- Te Manawa Taki 6.75, 0.66 FTE/100,000
- Central 5.95, 0.61 FTE/100,000
- Te Waipounamu 8.1, 0.67 FTE/100,000

The Aotearoa New Zealand specialist healthcare system is mainly taxpayer funded through Te Whatu Ora – Health Zealand, which is divided into four regional groups of services: Northern (mainly Auckland and extending to the northern part of the North Island), Te Manawa Taki (from Hamilton southwards to include Tauranga and New Plymouth), Central (Wellington and extending northwards to include Palmerston North, Whanganui and Hawke's Bay) and Te Wai Pounamu (the South Island). Patients generally access specialist care such as rheumatology services through referral from primary care. Specialist services are free from the patient perspective, but primary care services are only partly subsidised by Te Whatu Ora – Health New Zealand. In addition, healthcare can be funded through private health insurance or direct patient out-of-pocket funding.

The total FTE for Aotearoa New Zealand is 34.51, 0.67 FTE/100,000, which is less than the 1 FTE/100,000 staffing level recommended by the NZRA.[12]

Table 1: Demographic and disease characteristics.

Variable		N/355 (%)
Female sex		264 (74)
Clinic funding by Te Whatu Ora – Health New Zealand		286 (80)
Domicile of patient, Te Whatu Ora – Health New Zealand region	Northern	123 (34)
	Te Manawa Taki	54 (15)
	Central	64 (18)
	Te Waipounamu	114 (32)
Duration of symptoms	<3 months	109 (30)
	3 to 12 months	175 (49)
	>12 months	71 (20)
Ethnicity	European	204 (57)
	Asian	52 (14)
	Pacific peoples	37 (10)
	Māori	31 (8)
	Other	31 (8)
NZDep2018 quintile	1 (most deprived)	59 (16)
	2	89 (25)
	3	71 (20)
	4	68 (19)
	5 (least deprived)	66 (18)
Rurality (GCH)	U1 (most urban)	232 (65)
	U2	48 (13)
	R1	54 (15)
	R2	16 (5)
	R3 (most rural)	3 (1)
	Not identified	2 (1)

The Geographic Classification of Health (GCH) consists of five geographically defined categories, from "Urban 1" to "Urban 2" based on population size, and from "Rural 1" to "Rural 3" based on population size and drive time to the closest major, large, medium and small urban areas.[13] NZDep2018 and GCH codes were generated by reference to concordance tables of these indexes against Statistical Area 1 2018 (SA1-2018) code. The SA1-2018 code is an output geography that allows the release of more detailed information about population characteristics than is available at the meshblock level. Built by joining meshblocks, SA1s have an ideal size range of 100–200

residents, and a maximum population of about 500.[14]

Time to csDMARD commencement was modelled using survival analysis. Patients who were not commenced on a DMARD at their first specialist appointment were right censored. Univariate Cox proportional-hazard regression models were used to consider the influence of several potential explanatory factors: service at district and regional level, rheumatologist FTE per population size, patient age, gender, ethnicity, small area deprivation (NZDep2018 quintile) and rurality (GCH code). A multivariable Cox proportional model with all these variables was also used assess the independent effect of these factors. SPSS (IBM SPSS Statistics, Version 29) was used for the statistical analysis.

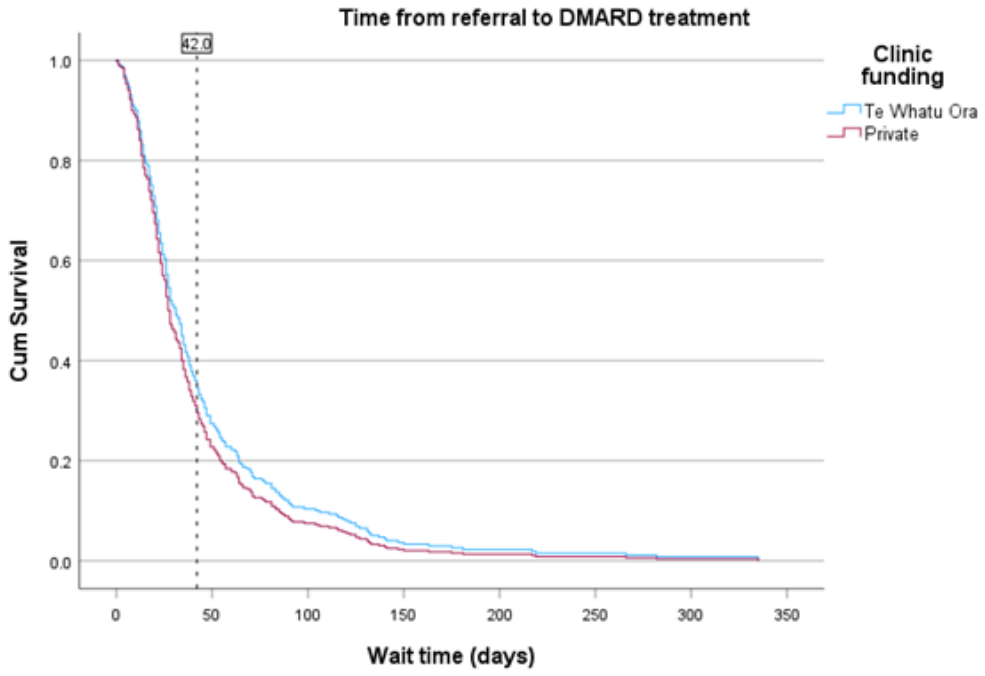
Results

By 31 August 2023, 59 rheumatologists or advanced trainees from 68 clinic locations had registered for the audit and 47 clinicians had entered data on at least one patient. In total, data were available for 355 patients. Demographic and disease characteristics of these patients are shown in Table 1. The mean age (median, inter-quartile range and range) was 54.2 years (57, 36 to 78, 16 to 88). Nearly all patients (335/355, 94.4%) commenced a DMARD at the time of the first specialist appointment. Cases from the most rural areas (R3) and small urban centres (U2) were slightly under-represented compared to the whole population: U1 63% cf 65%, U2 13.5% cf 18%, R1 15% cf 12%, R2 4.5% cf 5.7%, R3 0.85% cf 1.2%.

The overall median time to DMARD treatment was 28 days (range 0 to 335), see Figure 1. There was no significant difference in the proportion receiving DMARD treatment by 6 weeks for patients seen in the public sector (185/286, 64.7%) and in the private sector (45/69, 65.2%). Within the public sector patients, wait-times to DMARD were longer in the Central and Te Waipounamu regions of Te Whatu Ora – Health New Zealand than in Northern and Te Manawa Taki (Cox regression HR, 95%CI: Central 0.67, 0.47–0.94; Te Waipounamu 0.69, 0.51–0.94; Te Manawa Taki 1.13, 0.78–1.65; Northern REF) (Figure 2).

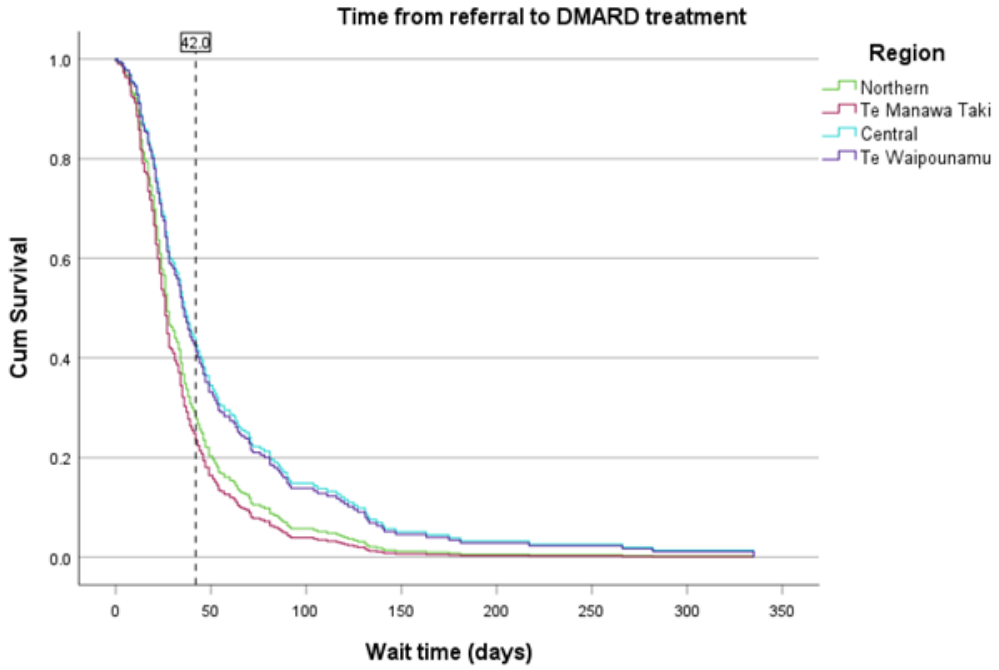
Overall, 64.8% of patients were started on a DMARD within 6 weeks of referral (NICE QS33 Statement 2, 2020). The service with the longest wait-time had the lowest SMO FTE (0.36/100,000 population). There was a roughly linear relationship between proportion of patients commencing

Figure 1: Time to DMARD treatment for patients treated within Te Whatu Ora – Health New Zealand compared to those in the private sector.



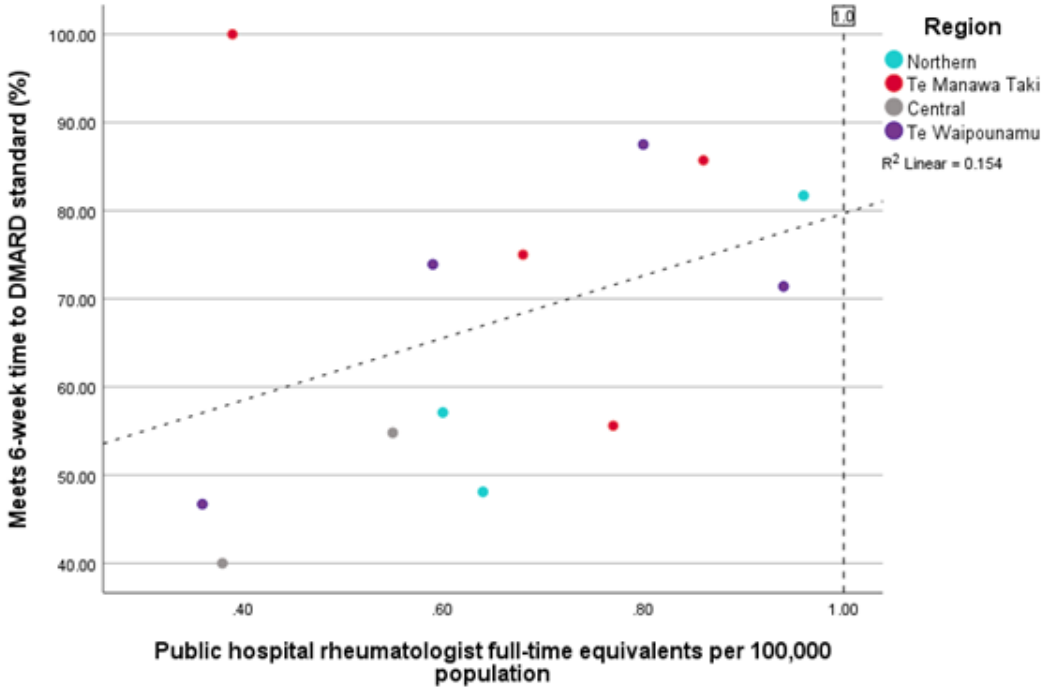
The vertical line at *wait time = 42 days* shows the proportion of patients not commencing DMARD treatment by 6 weeks.

Figure 2: Time to DMARD treatment by Te Whatu Ora – Health New Zealand region of patient residence.



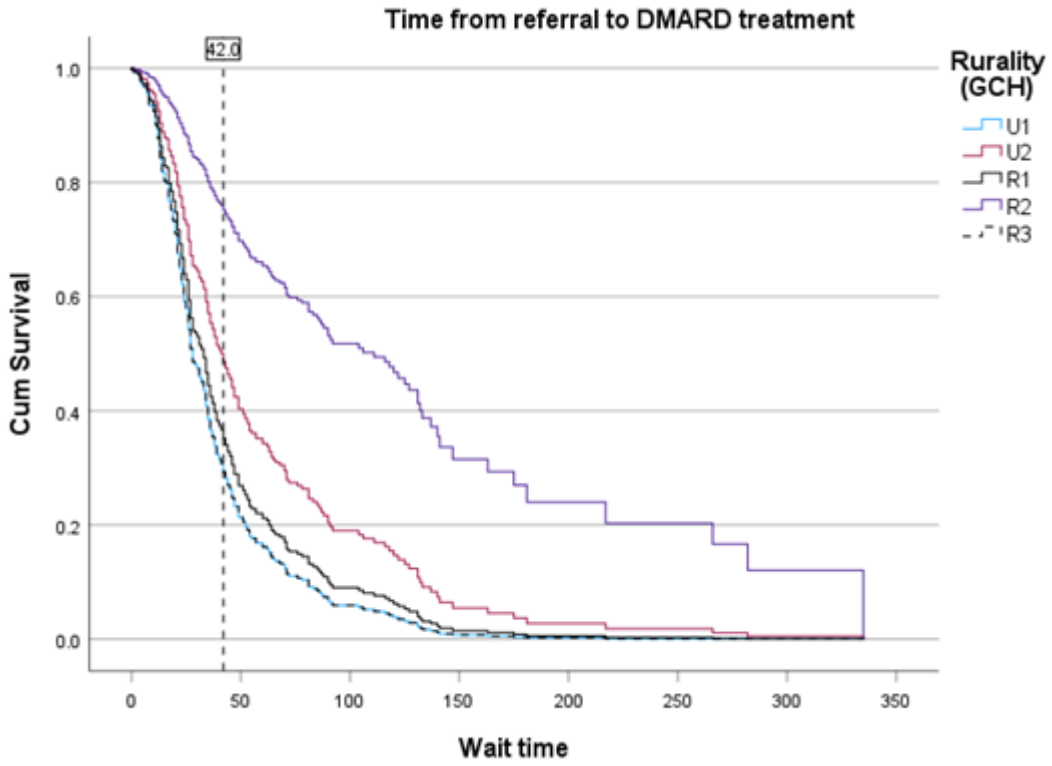
The vertical line at *wait time = 42 days* shows the proportion of patients not commencing DMARD treatment by 6 weeks. Only patients seen through Te Whatu Ora – Health New Zealand clinics are included.

Figure 3: Variation in proportion of patients commencing DMARD by 6 weeks, by specialist rheumatologist staffing levels.



Each data point represents a particular district rheumatology service, which are coloured according to Te Whatu Ora – Health New Zealand region in which the service is based. The vertical line at FTE/100,000 = 1.0 suggests that at this level of staffing, 80% of patients would be started on DMARD therapy by 6 weeks. Only patients seen through Te Whatu Ora – Health New Zealand clinics are included.

Figure 4: Time to DMARD treatment by rurality of patient residence.



The vertical line at *wait time = 42 days* shows the proportion of patients not commencing DMARD treatment by 6 weeks. Only patients seen in Te Whatu Ora – Health New Zealand clinics were included. Note that the lines for U1 and R3 are superimposed.

DMARD by 6 weeks and rheumatologist SMO FTE, with about 15% of the variance in DMARD start by 6 weeks explained by rheumatologist SMO FTE (Figure 3). Removal of the top left outlier greatly increases the strength of the association (59% of variance explained). The regression line suggested that 80% of patients could be seen within 6 weeks when the specialist rheumatologist staffing levels are at recommended levels of 1 FTE per 100,000 population. Rheumatologist SMO FTE level was significantly associated with time to DMARD treatment (Cox regression HR 2.00, 1.09–3.67; p=0.025). There was no association between time to DMARD treatment and ethnicity or socio-economic deprivation (NZDep2018 quintiles).

Patients living in more rural areas appeared to wait longer for DMARD treatment, although the very small numbers of patients from the GCH category of R3 (most rural) made interpretation difficult. The GCH category was significantly associated with the likelihood of commencing DMARD category (Cox model -2 log likelihood 2,506; Chi-square 21.0, df 4; p<0.001) with patients in R2 (HR, 95% CI 0.23, 0.11–0.49) and U2 (HR, 95% CI 0.59, 0.41–0.84) waiting longer than the most urban patients (Figure 4).

A multivariable model (Table 2) confirmed these findings, with rurality and SMO FTE remaining the only factors associated with time to DMARD treatment.

Discussion

This national audit shows that there is significant variation in how long it takes for patients referred, and subsequently diagnosed, with seropositive rheumatoid arthritis to commence DMARD treatment. The most important factors associated with this variation were specialist rheumatologist staffing levels and patients living in more rural areas. Once seen by a rheumatologist almost all patients were commenced on a DMARD, suggesting high quality management occurs fairly consistently once patients are seen.

There is significant geographic variation in specialist rheumatologist staffing levels across

Table 2: Multivariable Cox proportional-hazard model* for factors that might be associated with time from referral to starting DMARD treatment. Only patients seen through Te Whatu Ora – Health New Zealand clinics are included.

Variable		HR (95% CI)	P-value
Rheumatologist FTE/100,000 population		2.47 (1.27 to 4.81)	0.008
Ethnicity (p=0.42)	Non-Māori/non-Pacific peoples (n=219)	Reference	
	Māori (n=29)	0.93 (0.59 to 1.47)	0.76
	Pacific peoples (n=36)	0.76 (0.51 to 1.14)	0.19
NZDep2018 quintile (p=0.51)	Categories not shown		
Rurality (GCH, p<0.001)	U1 (n=183)	Reference	
	U2 (n=41)	0.61 (0.41 to 0.90)	0.01
	R1 (n=46)	0.86 (0.62 to 1.21)	0.39
	R2 (n=11)	0.20 (0.09 to 0.43)	<0.001
	R3 (n=3)	0.90 (0.27 to 3.04)	0.86
Gender	Male (n=68)	1.06 (0.79 to 1.42)	0.71
Age (decades)		0.94 (0.87 to 1.02)	0.12

* Overall model -2 log likelihood 249, p<0.001.

Aotearoa New Zealand, ranging from 0.36 FTE/100,000 population to 0.96 FTE/100,000 population. Unsurprisingly, this inequity contributes to a large proportion of the variance observed in waiting times. A relationship between staffing levels and waiting time has also been observed in the National Early Inflammatory Arthritis Audit of the UK. Aotearoa New Zealand levels of specialist rheumatologist capacity (0.67 FTE per 100,000) are much lower than in Belgium (2.39), USA (2.40), Australia (1.34–2.37)[15] and the UK (0.90–1.24).[16] The BSR[16] and Australian Rheumatology Association[15] recommend 1.25–1.67 FTE/100,000 and 2 FTE/100,000 respectively for sufficient specialist rheumatologist staffing. The NZRA have recommended rather more modest rheumatologist staffing levels of 1 FTE/100,000. According to the findings of this audit, this level of specialist capacity would improve time to DMARD treatment such that 80% of patients would commence DMARD treatment by 6 weeks. It should also be noted that publicly funded rheumatology services in New Zealand are constrained to seeing people with inflammatory diseases only, in contrast to other countries; this is clearly because of very low numbers of specialist rheumatologists in Aotearoa New Zealand. Unfortunately, the number of specialist rheumatologists only minimally increased between 2011 and 2018.[17]

In comparison to the BSR *National Early Inflammatory Arthritis Audit* report to March 2023, which showed that only 56% of patients with early inflammatory arthritis commenced DMARD treatment within 6 weeks in the UK, Aotearoa New Zealand services overall perform quite well, with 67.8% of patients with seropositive RA commencing DMARD treatment within 6 weeks, despite many fewer rheumatologists. This is likely because Aotearoa New Zealand rheumatology services are restricted in their scope to inflammatory diseases and do not accept referrals for non-inflammatory musculoskeletal conditions.

Even accounting for local specialist rheumatologist capacity, patients with new seropositive RA who live in rural areas waited longer for their first specialist appointment and commencement of DMARD treatment. The category R2 is defined as a 60- to 90-minute drive from a major urban

area and a 25- to 60-minute drive from a medium urban area. Although only 6% of the population live in this category (R2), they waited significantly longer than patients who live in major urban areas (adjusted Cox regression HR 0.20 [0.09–0.43]). Only 11 patients were living in R2 and even fewer in R3, so the estimates of effect are very imprecise. Hopefully, further planned data collection will help clarify the effect of rurality. Although this audit is not able to distinguish why rural patients wait longer, plausible reasons include the additional time required and cost to travel to regional hospitals, lack of public transport and the difficulties with taking sufficient time off work to attend appointments.

We did not observe a significant association between ethnicity and waiting times, although the point estimates suggested that Māori patients and Pacific peoples patients may have slightly longer waiting times to commence DMARD therapy. Again, additional data collection and greater numbers of Māori patients and Pacific peoples patients may allow more confidence in these estimates. Although not a main objective of the audit, we do note that the proportion of Māori referred with seropositive RA and therefore included in the audit is much lower than expected (8.4% compared to 16% population proportion of Māori), whereas this was not the case for Pacific peoples patients. It is unclear whether Māori develop RA less frequently, are referred less often or whether the younger age structure of the Māori population has a major influence (RA incidence tends to peak in older age groups).

There are some limitations to this audit. Although all rheumatologists in Aotearoa New Zealand were invited to participate, not all did. Some regions of Aotearoa New Zealand were especially under-represented and the overall recruitment of patients with newly diagnosed seropositive RA was less than would be predicted by the epidemiology of RA. Over the 12 months, 560 patients would be expected to develop seropositive RA compared to 355 (63%) who were included in audit. Furthermore, the data collection was kept to a minimum to reduce clinician burden; this meant that some issues could not be explored in depth.

Another limitation is that prioritisation or triage grading data were not collected. It is likely that patients who are triaged as more urgent are indeed seen more quickly, and we have previously shown that within a single rheumatology service, an "urgent" grading of the referral was associated with a shorter waiting time to first specialist assessment.[18] It is possible that the outlier in Figure 3 was able to achieve shorter waiting times than would be expected for the service's staffing level by making seropositive RA much more of a priority than other services. It would be of interest for future audits to adjust for referral priority grading.

There are other plausible explanations for the Figure 3 outlier, although these cannot be verified from the data gathered in this study. The main possibilities are selection bias (only those patients who were seen quickly were included), imprecise estimates because of small numbers of cases at this particular site (only seven cases) or service-specific strategies such as dedicated early inflammatory arthritis clinics.

We are hopeful that further data collection and promotion of the audit among rheumatologists will prompt greater participation, but ultimately these data ought to be easily available from Te Whatu Ora – Health New Zealand administrative datasets. At the current time, useful outpatient activity, especially diagnostic and treatment coding, is infrequently available from routinely collected administrative data. Gaps in routinely available administrative outpatient data should be an important focus for Te Whatu Ora – Health New Zealand in order to address equitable access to planned care. Specialist SMO groups will be invaluable partners in identifying data domains of key clinical importance.

This study has shown that lower than acceptable specialist rheumatologist staffing levels in Aotearoa New Zealand are associated with delays in commencing effective treatment for people with newly diagnosed rheumatoid arthritis. Te Whatu Ora – Health New Zealand needs to commission additional specialist SMO posts in rheumatology, particularly in districts with <0.6 FTE/100,000 with some urgency but aim for at least 1 FTE/100,000 in all districts over time. These staffing levels would achieve commencement of DMARD therapy in time frames that promote best patient outcomes.

COMPETING INTERESTS
The authors declare that they have no conflicts of interest.

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REFERENCES
1. Finckh A, Gilbert B, Hodkinson B, et al. Global epidemiology of rheumatoid arthritis. Nat Rev Rheumatol. 2022;18(10):591-602. doi: 10.1038/s41584-022-00827-y.
2. van der Linden MP, le Cessie S, Raza K, et al. Long-term impact of delay in assessment of patients with early arthritis. Arthritis Rheum. 2010;62(12):3537-46. doi: 10.1002/art.27692.
3. Feldman DE, Bernatsky S, Houde M, et al. Early consultation with a rheumatologist for RA: does it reduce subsequent use of orthopaedic surgery? Rheumatology (Oxford). 2013;52(3):452-9. doi: 10.1093/rheumatology/kes231.
4. van Nies JA, Tsonaka R, Gaujoux-Viala C, et al. Evaluating relationships between symptom duration and persistence of rheumatoid arthritis: does a window of opportunity exist? Results on the Leiden early arthritis clinic and ESPOIR cohorts. Ann Rheum Dis. 2015;74(5):806-12. doi: 10.1136/annrheumdis-2014-206047.
5. NICE National Institute for Health and Care Excellence. Rheumatoid arthritis in over 16s QS33 [Internet]. UK: NICE; 2013 [cited 2023 Nov 24]. Available from https://www.nice.org.uk/guidance/qs33
6. Ngan Kee R, Milne V, Dalbeth N, Grainger R. Patient participation in defining best-practice rheumatology service provision in Aotearoa New Zealand: a qualitative study with service consumers. BMC Rheumatol. 2023;7(1). doi: 10.1186/s41927-022-00319-2.
7. Gibbs HN, Grainger R. A Delphi exercise with rheumatologists to identify consensus on essential components of a rheumatology service in district health boards of Aotearoa New Zealand. N Z Med J. 2022;135:27-36.
8. Galloway J, Ledingham J, Price E, et al. National Early Inflammatory Arthritis Audit (NEIAA) State of the Nation Report 2023 [Internet]. London (UK): British Society for Rheumatology; 2023 [cited 2023 Nov 24]. Available from https://www.rheumatology.org.uk/improving-care/audits/neiaa
9. Farquhar HJ, Taylor WJ. Care of patients with early

inflammatory arthritis in the Wellington region according to the British Society of Rheumatology's best practice tariff standards. N Z Med J. 2021;134(1533):71-79.
10. Harris PA, Taylor R, Thielke R, et al. Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009;42(2):377-81. doi: 10.1016/j.jbi.2008.08.010.
11. Harris PA, Taylor R, Minor BL, et al. The REDCap consortium: Building an international community of software platform partners. J Biomed Inform. 2019;95:103208. doi: 10.1016/j.jbi.2019.103208.
12. Quincey V, Milne V, Kain T. Rheumatology Services in Aotearoa New Zealand – A Way forward. A report prepared for Te Whatu Ora Health New Zealand. New Zealand Rheumatology Association; 2022.
13. Nixon G, Whitehead J, Davie G, et al. Developing the geographic classification for health, a rural-urban classification for New Zealand health research and policy: A research protocol. Aust J Rural Health. 2021;29(6):939-46. doi: 10.1111/ajr.12778.
14. Statistics New Zealand. ANZLIC Metadata for statistical area 1 2018 [Internet]. Wellington (NZ): Statistics New Zealand Tatauranga Aotearoa; 2017 [cited 2023 Nov 24]. Available from https://www.stats.govt.nz
15. ARA Workforce Needs Analysis Working group. ARA Workforce Report [Internet]. NSW (AU): Australian Rheumatology Association; 2023 [cited 2023 Nov 24]. Available from: https://rheumatology.org.au/Portals/2/Documents/Public/About%20the%20ARA/News%20and%20media/ARA%20Workforce%20Doc_DIGITAL_compressed.pdf?ver=2023-02-16-164318-850
16. British Society for Rheumatology. Rheumatology workforce: a crisis in numbers [Internet]. London (UK): British Society for Rheumatology; 2021 [cited 2023 Nov 24]. Available from https://www.rheumatology.org.uk/Portals/0/Documents/Policy/Reports/BSR-workforce-report-crisis-numbers.pdf?ver=2021-06-16-165001-470
17. Harrison AA, Tugnet N, Taylor WJ. A survey of the New Zealand rheumatology workforce. N Z Med J 2019;132(1507):70-6.
18. Robinson PC, Taylor WJ. Decreasing time to treatment in rheumatoid arthritis: review of delays in presentation, referral and assessment. Int J Clin Rheumatol. 2011;6(2):173-87. doi: 10.2217/IJR.11.7.