



Mental health and quality of life for people with rheumatoid arthritis or ankylosing spondylitis in Aotearoa New Zealand following the COVID-19 national lockdown

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Abstract

The aim of this study was to investigate the effects of lockdown on the mental health (anxiety and depression) and quality of life (QOL) of people with rheumatoid arthritis (RA) and ankylosing spondylitis (AS) in the context of the COVID-19 pandemic and public health measures instituted at a national level by the New Zealand Government. The present cohort was 104 individuals with RA (73.1%) and AS (26.9%) who had previously completed surveys for the Patient Opinion Real-Time Anonymous Liaison (PORTAL) project in 2018. Participants completed an online survey between July and September 2020 assessing their experiences over the first national COVID-19 lockdown in New Zealand (March–May, 2020). Fear of SARS-CoV-2 infection, baseline anxiety, and being younger in age were all predictors of participants' current anxiety levels. Current QOL scores were significantly lower than prior to lockdown and were predicted by baseline QOL and current depression. No variables predicted current depression other than baseline levels. The COVID-19 pandemic appears to have had an impact on QOL and anxiety levels, but not depression for people with RA and AS in New Zealand. These novel findings imply that appropriate screening of mental health issues should be included in planning within the ongoing COVID-19 pandemic and for future pandemics to optimise the wellbeing of people with RA and AS.

Keywords Anxiety · Depression · Infection · Quality of life · Cohort study

The scale of the COVID-19 pandemic is unprecedented in living memory and has posed many challenges to the health-care provision. Hospitals and healthcare facilities have been placed under extraordinary pressure, with routine care of patients with chronic conditions often being delayed and placing vulnerable individuals at risk of more severe outcomes [1–3]. Despite promising treatment regimens and

vaccines, public health measures (e.g., social distancing, mask wearing, quarantining, and closing of international borders) are still the best means of controlling the spread of SARS-CoV-2 infection [4]. While public health measures restricted the primary health challenges posed by COVID-19, the unpredictability and uncertainty of the pandemic has contributed to secondary mental health issues within the general population (e.g., increased rates of depression and anxiety) [5]. Early studies suggested high levels of concern for individuals on immunosuppressive medications meaning the mental health effects of COVID-19 will likely be exacerbated for people with rheumatic disease (RD) [6].

In New Zealand, community transmission of SARS-CoV-2 infection was rising exponentially by mid-March 2020 causing the government to implement a nationwide lockdown referred to as Alert Level 4 (the top of four levels of action) [7]. An elimination strategy was pursued and by June 8 New Zealand moved to Alert Level 1, allowing typical social interactions but with caution [7]. Thus, 103 days after the first case was identified the first wave of

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the pandemic had been limited to 1569 infections, a prevalence of 3 in 10,000 [7]. Subsequent outbreaks have been tackled by localised implementation of higher alert levels, testing, tracing, and isolation [8]. Daily life has, however, returned to near normal in New Zealand.

Strict public health measures are of importance for people with RD as the underlying inflammatory disease and immunosuppressing medications, especially corticosteroids and biologic therapies, place these individuals at greater risk of contracting infections and subsequent severe outcomes [3, 9–11]. Emerging evidence, however, suggests treatment with biologic therapies may not substantially increase the risk of adverse outcomes of SARS-CoV-2 infection [12]. Regardless of medication use, preliminary data have suggested higher mortality rates in RD individuals [13], with higher rates of hospitalisation, intensive care admission, and ventilation early in the pandemic [14]. In particular, rates of venous thromboembolism and myocardial infarctions appear to be higher among RD individuals infected with SARS-CoV-2 [13]. These negative outcomes may be driven by higher rates of comorbidities associated with worse outcomes of SARS-CoV-2 infection, particularly obesity, hypertension, and cardiovascular disease [14].

Despite mental health issues being under-reported [9, 15], individuals with RD demonstrate increased rates of anxiety (16%) and depression (33%) compared to the general population [9, 16, 17]. One goal of RD treatments is to minimise the level of psychological distress experienced [18–20]; however, anxiety and depression are still correlated with a decreased health-related QOL for people with RD [18, 19]. One explanation for this may be that self-management of RD symptoms are constrained in those experiencing depression [15].

Previous infectious disease outbreaks, such as the 2003 Severe Acute Respiratory Syndrome (SARS) epidemic, caused an increase in PTSD, depression, and avoidant behaviours (e.g., reducing exposure to public spaces) [4, 5, 21, 22]. The scale of the COVID-19 pandemic is unlike any previous infectious disease, with over 4.0 million deaths globally (as of the 8th of July 2021) [23]. In turn, healthcare professionals are treating a subsequent pandemic of mental health issues [22, 24, 25], where women and older individuals are the most affected [5, 21, 26].

Prior to the pandemic, social isolation was known to be strongly correlated with higher rates of premature mortality and detrimental health outcomes for people with RD [9, 17, 20, 25, 26]. In the current context, lockdown measures were associated with increased levels of parental stress, particularly for women [27]. Social support is the strongest protective factor against feelings of distress, loneliness, and parental stress [4, 26, 27]; however, the ability to access this support was severely compromised by the institution of social distancing protocols during the pandemic. There

is conflicting evidence concerning the relationship between distress and disease course in those with RD [28, 29]. One study demonstrated 60% of RD patients experienced flares following stressful events [28]. It is expected the pandemic will increase disease flares, due to greater levels of distress driven by COVID-19-related fears such as perceived risk of SARS-CoV-2 infection, actual risk of infection, or the action of being tested for the virus [30, 31].

COVID-19 related stressors were amplified for individuals taking hydroxychloroquine, which was highlighted by the media to be an effective cure for SARS-CoV-2 infection despite no statistically significant empirical evidence [32, 33]. Global shortages of hydroxychloroquine resulted in RD individuals not only having concerns regarding the risks of immunosuppression but also concerns and frustration around an inability to obtain their usual medications [32, 34]. Unsurprisingly, a Canadian study found 60% of rheumatologists had been contacted by patients worried about COVID-19 [35].

Before the pandemic, telehealth promoted wellbeing through increasing accessibility and ease of use [36, 37]. Importantly, telehealth was equally as beneficial as in-person consultations [36], and yet only 4.1% actively used online services [38]. It is likely that lockdown brought digital inequality to light, with those who had limited accessibility to the internet, or a reduced electronic literacy subject to greater levels of distress [39].

Community transmission has been significantly reduced in New Zealand, although local outbreaks have occurred sporadically since June 2020. This provides a unique opportunity to study the impact beyond the pressures of an initial national lockdown and high transmission rates, which may inform the landscape in other countries in the future. The present study invited Patient Opinion Real-Time Anonymous Liaison (PORTAL) participants to complete an online survey which aimed to explore whether anxiety, depression, and QOL after lockdown are predicted by (1) mental health, (2) demographics, (3) medical and physical wellbeing, and (4) COVID-19 related variables. It was hypothesised the strongest predictors of mental health and QOL would be COVID-19-related factors.

Patients and methods

Participants were recruited in 2015 or 2018 for the PORTAL project through their rheumatologists in major population centres of New Zealand: Auckland, Wellington, Dunedin, or Hamilton. Eligibility for the PORTAL study included: being 18 years old or older, having access to email/the internet, and having a confirmed diagnosis from a healthcare professional for their RA or AS. Participants completed an online survey created through Qualtrics from July to September

2020 following the national lockdown (March–May 2020). The survey included an information sheet and consent form followed by questions about demographics, COVID-19 experience, fears and concerns, mental health, pain, fatigue, and a disability index. Individuals who had not completed a baseline survey (from 2018) were excluded from the study ($n = 18$). As a result, the present sample consisted of 104 participants, which was an adequate size for the statistical analyses conducted. The Southern Health and Disability Ethics Committee of New Zealand approved this study (15/STH/95/AM04).”

Measures

Demographic Measures. Participants self-reported their age, gender (female, male or gender diverse), ethnicity, education level, relationship status, employment, benefits, disease duration, comorbid physical and mental health conditions, living situation and the number of people under and above 18 years old they were living with during lockdown.

COVID-19 Measures. Participants self-reported whether they had a COVID-19 test, their subsequent test result, if someone close to them had contracted SARS-CoV-2 infection, their COVID-19 fear, perceived personal risk of infection, opinions on the response by the government and healthcare sectors, changes in treatment and medication prescriptions, financial changes, actions carried out to minimise risk and COVID-19 fears. The ‘COVID-19 Fears Questionnaire for Chronic Medical Conditions’ [40] comprised of 15 questions answered through a five-point Likert scale assessing one’s perceived likelihood of certain consequences related to COVID-19 happening to themselves. The higher an individual’s score, the greater their perceived fears concerning COVID-19 (Cronbach’s $\alpha = 0.926$ in the present sample).

The Quality of Life Scale is a validated 16-statement questionnaire that assessed one’s QOL through 5 different domains: personal relationships, social and community activities, material and physical wellbeing, personal development, and recreation [41]. Each statement is answered on a seven-point scale (from 1 = terrible to 7 = delighted). Participants’ summed scores are calculated and can range from 16 to 112. Higher scores are indicative of a better overall QOL (Cronbach’s $\alpha = 0.844$ in the present sample).

The Hospital Anxiety and Depression Scale (HADS) is a 14-statement questionnaire that examines 2 aspects of mental health: anxiety (Cronbach’s $\alpha = 0.884$ in the present sample) and depression (Cronbach’s $\alpha = 0.817$ in the present sample) [42]. All statements are answered according to a four-point scale from 0 (not at all) to 3 (nearly all the time). The summed scores are calculated from seven statements for each construct (anxiety and depression) and range from

0 to 21, with higher scores indicating an increased risk for severe depression or anxiety.

Fatigue. Two questions assessed participants’ level of fatigue and interference due to fatigue over the past 7 days [43]. Participants answered both questions according to an 11-point scale ranging from 0 (no fatigue/interference) to 10 (severe fatigue/interference).

Pain. One question also assessed pain, with participants recording on an 11-point scale the severity of their pain over the past 7 days [43]. Scores of 0 correlated with no pain, while scores of 10 was as bad as can be.

The Health Assessment Questionnaire (HAQ) Disability Index comprises of eight subsections: dressing, arising, eating, walking, hygiene, reach, grip, and activities, with each subsection containing two or three questions [44]. All questions were answered according to a four-point scale, with answers ranging from 0 (without any difficulty) to 3 (unable to do so) (Cronbach’s $\alpha = 0.935$ in the present sample). Additional questions ask about one’s need for aids, devices, and assistance with different activities. The eight subsection scores are summed and divided by eight to give the overall disability index for each participant. The higher an individual’s score, the greater the level of one’s disability.

Statistical analyses

The data were analysed using SPSS (version 25). A hierarchical linear multiple regression was conducted for each mental health outcome (anxiety, depression, and QOL). For all regressions, the baseline scores of the mental health construct in question were entered in step one, followed by demographic variables in step two, medical and physical wellbeing variables in step three and finally COVID-19-related variables in step four. The QOL regression differed, as current anxiety and depression variables were also included in step one to test specific hypotheses about their impact on QOL. Before interpreting the results of the hierarchical linear multiple regressions, all assumptions (independence, linearity, homoscedasticity, and multicollinearity) were assessed and met. Outliers had insignificant leverage and influence; hence, all points were included in the analyses. All beta values will be recorded for the regression analyses to demonstrate how the outcome variables (anxiety, depression, and quality of life) change per one-unit increase in the predictor variables included within each step.

Results

General characteristics. Demographic and descriptive information for the sample is presented in Tables 1 and 2. Twenty-seven participants identified as male and 77 as female. The participants’ ages ranged from 27 years old

Table 1 Demographic and health characteristics of the sample ($n = 104$)

Demographics	Mean (SD) n (%)
Age	56.51 (12.48)
Gender	
Male	27 (26.0%)
Female	77 (74.0%)
Living status	
With children ≤ 18 years old	29 (28.2%)
Without children	74 (71.8%)
Primary rheumatic disease	
Rheumatoid arthritis	76 (73.1%)
Ankylosing spondylitis	28 (26.9%)
Medication*	
Hydroxychloroquine	21 (20.2%)
Biologic DMARDs	50 (48.1%)
Other DMARDs	72 (69.2%)

*Not mutually exclusive

to 85 years old, with a mean age of 56.51 years old. The majority of participants had RA (73.1%), and all others had AS (26.9%). Twenty percent of participants had been prescribed hydroxychloroquine. The average number of disease flares participants experienced over lockdown was 3.58. Twenty-eight percent of participants reported living with children 18 years old or younger over lockdown. The average anxiety score from the sample declined from 2018 (baseline) ($M = 5.88$, $SD = 4.12$) to the survey after lockdown ($M = 5.55$, $SD = 4.23$) and depression scores remained stable ($M = 3.82$, $SD = 3.12$ to $M = 3.80$, $SD = 3.39$), and neither change reached statistical significance ($t(100) = 1.006$, $p = 0.317$ and $t(101) = 0.075$, $p = 0.940$, respectively). QOL scores decreased from 78.74 ($SD = 14.18$) to 73.17 ($SD = 17.66$), which was statistically significant ($t(99) = -4.00$, $p < 0.001$).

Predictors of anxiety. As detailed in Table 3, baseline anxiety accounted for 45.2% of the variability in current anxiety. This proportion of variance was statistically significant, $F(1, 96) = 79.193$, $p < 0.001$. The inclusion of demographic variables in step two, accounted for a statistically significant proportion (4.5%) of the variance in current anxiety, $F(3, 93) = 2.801$, $p = 0.044$. Within these demographic variables, age reached significance, $\beta = -0.192$, $p = 0.044$. Medical and physical wellbeing variables (step three) accounted for another 2.0% of the variance in current anxiety, $F(3, 90) = 1.260$, $p = 0.293$, and no variables in this step had a significant contribution to the variance in current anxiety. In step four, COVID-19-related variables accounted for 11.7% of variance in anxiety which reached statistical significance, $F(2, 88) = 14.133$, $p < 0.001$. This was a result of COVID-19 fear, $\beta = 0.395$, $p < 0.001$, demonstrating higher levels of fear predicted an increase in anxiety.

Predictors of depression. Baseline depression accounted for 43.4% of the variability in current depression, which was a statistically significant proportion, $F(1, 97) = 74.276$, $p < 0.001$ (Table 4). The addition of demographic variables did not account for a significant proportion of variance in current depression, $F(3, 94) = 1.264$, $p = 0.291$. The medical and physical wellbeing block and COVID-19-related block did not reach statistical significance either; $F(3, 91) = 0.924$, $p = 0.433$ and $F(2, 88) = 1.720$, $p = 0.185$, respectively. However, gender did reach significance within these two blocks ($\beta = -0.179$, $p = 0.043$ and $\beta = -0.207$, $p = 0.021$). A subsequent t-test demonstrated there was not a statistically or clinically significant difference between males ($M = 3.7037$) and females ($M = 3.9091$) when depression scores were examined outside of the regression model ($t(102) = -0.270$, $p = 0.788$).

Predictors of QOL. The mental health variables of step one accounted for a statistically significant proportion of the variance in current QOL, 58.7%, $F(3, 95) = 45.028$, $p < 0.001$ (Table 5). Within this step, both baseline QOL and current depression reached statistical significance

Table 2 Physical and mental wellbeing scores of the sample

	Minimum	Maximum	Mean	Standard deviation
HAQ (current)	0.0	3.0	1.0	0.8
COVID-19 fear	0.0	55.0	13.2	11.0
COVID-19 actions carried out to reduce risk	0.0	7.0	3.0	1.1
Anxiety (HADS) Sum (baseline)	0.0	17.0	5.9	4.1
Anxiety (HADS) Sum (current)	0.0	20.0	5.6	4.3
Depression (HADS) Sum (baseline)	0.0	13.0	3.8	3.1
Depression (HADS) Sum (current)	0.0	17.0	3.9	3.4
QOL (baseline)	28.0	108.0	78.8	14.4
QOL (current)	17.0	106.0	73.2	17.5
Disease duration	2.0	55.0	18.4	11.7

Table 3 Hierarchical regression coefficients for predictors of anxiety ($n=98$)

Step	Predictors	Current anxiety (HADS)				
		B	Standard error	β	P	ΔR^2
1	Baseline anxiety (HADS)	0.694	0.078	0.672	<0.001***	0.452***
2	Demographics					0.045*
	Baseline anxiety (HADS)	0.660	0.082	0.640	<0.001***	
	Age	−0.064	0.031	−0.192	0.044*	
	Gender	−0.449	0.710	−0.048	0.529	
	Living with children ≤ 18 years old	0.320	0.841	0.035	0.705	
3	Medical and physical wellbeing					0.020
	Baseline anxiety (HADS)	0.645	0.083	0.625	<0.001***	
	Age	−0.070	0.032	−0.209	0.032*	
	Gender	−1.079	0.800	−0.114	0.181	
	Living with children ≤ 18 years old	0.442	0.842	0.048	0.600	
	Rheumatoid arthritis diagnosis	0.160	0.783	0.017	0.839	
	Disability index (HAQ)	0.684	0.451	0.128	0.133	
	Hydroxychloroquine	0.840	0.787	0.082	0.289	
4	COVID-19 related					0.117***
	Baseline anxiety (HADS)	0.486	0.079	0.471	<0.001***	
	Age	−0.030	0.029	−0.089	0.311	
	Gender	−1.164	0.712	−0.123	0.106	
	Living with children ≤ 18 years old	0.818	0.748	0.089	0.277	
	Rheumatoid arthritis diagnosis	0.027	0.695	0.003	0.969	
	Disability Index (HAQ)	0.372	0.401	0.070	0.356	
	Hydroxychloroquine	0.362	0.721	0.035	0.617	
	COVID-19 fear	0.153	0.031	0.395	<0.001***	
	COVID-19 actions	0.182	0.273	0.048	0.506	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

($p < 0.001$) with β -values of 0.455 and -0.456 , respectively. These two variables, baseline QOL and current depression, remained significant throughout the regression model. The inclusion of demographic variables accounted for an additional 1.7% of variance in QOL, but this was not statistically significant, $F(3, 92) = 1.330$, $p = 0.269$. Steps three and four did not reach statistical significance with 0.4% of variance, $F(3, 89) = 0.266$, $p = 0.849$ for medical and physical wellbeing, and 0.5% of variance, $F(2, 87) = 0.535$, $p = 0.588$ for COVID-19 related variables.

Discussion

The present study demonstrated that fears associated with SARS-CoV-2 infections were predictive of anxiety levels for individuals with RA and AS following the first nationwide lockdown in New Zealand. Despite a return to near normal life in New Zealand, where a COVID-19 eradication policy has been successful, this novel finding suggests the COVID-19 pandemic has resulted in heightened health concerns negatively impacting the anxiety status of people with RA and AS, but not their depression status. The distinction

between the effect of COVID-19-related factors on these mental health outcomes is important for rheumatologists to acknowledge and account for in holistic care reflecting the pandemic.

As expected, baseline anxiety accounted for the largest risk of current anxiety, as those who are already predisposed to being anxious are likely to have this predisposition throughout their life [45]. Another important risk factor, however, was that COVID-19 fear also predicted anxiety. COVID-19 fear encompassed several parameters including: perceived risk of infection, theoretical outcomes from being infected, effects on family, and mental health. This likely reflects ongoing media reports highlighting a greater risk of severe outcomes for immunocompromised individuals with the SARS-CoV-2 infection [46]. Ultimately, this could form the basis of engagement with the media to ensure that whilst people are informed about COVID-19, there is recognition that highlighting the risks to the vulnerable is unhelpful and negatively impacts the mental health of this group.

It was hypothesised that participants may incorporate recommended preventative behaviours, such as social distancing, to reduce their perceived risk and increase the perception of control to limit their anxiety. However, this was

Table 4 Hierarchical regression coefficients for predictors of depression ($n=99$)

Step	Predictors	Current depression (HADS)				
		B	Standard error	B	<i>P</i>	ΔR^2
1	Baseline depression (HADS)	0.713	0.083	0.659	<0.001***	0.434***
2	Demographics					0.022
	Baseline depression (HADS)	0.742	0.085	0.686	<0.001***	
	Age	−0.030	0.025	−0.108	0.242	
	Gender	−0.896	0.593	−0.118	0.134	
	Living with children ≤ 18 years old	−0.077	0.692	−0.010	0.911	
3	Medical and physical wellbeing					0.016
	Baseline depression (HADS)	0.691	0.092	0.638	<0.001***	
	Age	−0.033	0.026	−0.121	0.206	
	Gender	−1.354	0.661	−0.179	0.043*	
	Living with children ≤ 18 years old	0.033	0.697	0.004	0.962	
	Rheumatoid arthritis diagnosis	0.253	0.658	0.033	0.701	
	Disability index (HAQ)	0.623	0.405	0.143	0.127	
	Hydroxychloroquine	0.042	0.666	0.005	0.950	
4	COVID-19 related					0.020
	Baseline depression (HADS)	0.676	0.094	0.625	<0.001***	
	Age	−0.024	0.028	−0.087	0.392	
	Gender	−1.565	0.667	−0.207	0.021*	
	Living with children ≤ 18 years old	0.083	0.703	0.011	0.906	
	Rheumatoid arthritis diagnosis	0.156	0.657	0.021	0.813	
	Disability index (HAQ)	0.530	0.405	0.122	0.195	
	Hydroxychloroquine	0.162	0.686	0.020	0.814	
	COVID-19 fear	0.019	0.029	0.062	0.504	
	COVID-19 actions	0.368	0.261	0.121	0.162	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

not evident in the present study. This contradicts previous research which demonstrated preventative behaviours are more common for participants with a higher level of general anxiety [47]. Low levels of initial uptake of these behaviours on a population level may have influenced this. Future research could explore the reasons why participants took specific actions, whether such actions act as a buffer against anxiety, and which actions are perceived by participants to be the most effective at minimising risk of infection.

When examining depression, the gender variable reached statistical significance. However, the difference between the genders in terms of clinical significance was small. This finding contradicts previous meta-analyses which have shown women to be at higher risk of depression, especially those who are older and have chronic health conditions [48]. Such observations are intriguing, and the reasons for this is unclear. Ultimately, it appears that the various COVID-19-related factors affect women and men similarly, which is important for rheumatologists to appreciate to ensure all patients are assessed equally for mental health distress.

During lockdowns, parents are expected to home-school their children in addition to carrying out their own work, therefore it was predicted that the rates of parental stress

would rise [27]. However, this variable did not account for a significant proportion of variance in anxiety, depression, or QOL, suggesting that the presence of children at home over lockdown did not have an impact on mental wellbeing for those with RA and AS in this sample. Future research could delve deeper into whether specific living conditions, other than children, had protective or detrimental effects on one's mental health.

When mental health variables were removed from the QOL regression, participants' HAQ scores reached statistical significance, suggesting a higher disability score predicts a lower QOL. Previous research demonstrated light exercise is positively associated with vitality in those with rheumatoid arthritis [30] and with lockdown confining individuals to a 2 km radius around their home, the opportunities for exercise were limited. The present study did not assess the amount of exercise an individual conducted over lockdown, and so data obtained cannot determine whether reduced exercise exacerbated an individual's pain and fatigue (increasing their level of disability and reducing their QOL). The association between these variables could be of interest in future research. Additionally, higher depression scores were also a significant predictor of a decreased QOL, as the presence

Table 5 Hierarchical regression coefficients for predictors of quality of life ($n = 99$)¹

Step	Predictors	Current Quality of Life				
		B	Standard error	β	P	ΔR^2
1	Mental health					0.587***
	Baseline quality of life (QOL)	0.538	0.087	0.455	<0.001***	
	Current anxiety (HADS)	0.070	0.346	0.017	0.841	
	Current depression (HADS)	- 2.299	0.473	- 0.456	<0.001***	
2	Demographics					0.017
	Baseline quality of life (QOL)	0.475	0.093	0.402	<0.001***	
	Current anxiety (HADS)	0.020	0.386	0.005	0.959	
	Current depression (HADS)	- 2.352	0.487	- 0.466	<0.001***	
	Age	- 0.012	0.119	- 0.009	0.921	
	Gender	- 3.136	2.603	- 0.082	0.232	
	Living with children \leq 18 years old	3.925	3.122	0.106	0.212	
3	Medical and physical wellbeing					0.004
	Baseline quality of life (QOL)	0.464	0.096	0.393	<0.001***	
	Current anxiety (HADS)	0.014	0.392	0.003	0.972	
	Current depression (HADS)	- 2.271	0.504	- 0.450	<0.001***	
	Age	- 0.019	0.124	- 0.014	0.880	
	Gender	- 2.497	2.973	- 0.066	0.403	
	Living with children \leq 18 years old	3.629	3.179	0.098	0.257	
	Rheumatoid arthritis diagnosis	1.069	2.862	0.028	0.710	
	Disability index (HAQ)	- 1.466	1.805	- 0.066	0.419	
Hydroxychloroquine	0.314	2.918	0.008	0.915		
4	COVID-19 related					0.005
	Baseline quality of life (QOL)	0.463	0.097	0.392	<0.001***	
	Current anxiety (HADS)	- 0.260	0.494	- 0.065	0.600	
	Current depression (HADS)	- 2.174	0.522	- 0.431	<0.001***	
	Age	- 0.006	0.126	- 0.004	0.964	
	Gender	- 2.945	3.047	- 0.077	0.336	
	Living with children \leq 18 years old	3.865	3.224	0.104	0.234	
	Rheumatoid arthritis diagnosis	0.764	2.902	0.020	0.793	
	Disability index (HAQ)	- 1.695	1.829	- 0.077	0.357	
	Hydroxychloroquine	0.457	3.033	0.011	0.881	
	COVID-19 fear	0.110	0.150	0.073	0.467	
COVID-19 actions	0.650	1.163	0.043	0.578		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

¹When this regression was run without including anxiety and depression, the HAQ variable reached statistical significance

of depression can impair one’s ability to effectively manage medications, causing fluctuations in chronic disease control [9, 15].

Rapid rollout of telehealth and electronic resources were beneficial throughout lockdown [49]. The current patient sample, however, may have been self-selecting as a group with good access to IT/internet and higher electronic literacy. Many individuals in New Zealand, especially those in areas with lower socioeconomic deciles, may not have had access to online healthcare at home, and this would likely exacerbate isolation and health inequality during lockdown [50]. A more representative sample inclusive of a wide range

of socioeconomic deciles may have allowed the present study to assess whether digital inequality was present.

Despite intensive media coverage of severe effects for those on immunosuppressing medications, whether an individual was taking hydroxychloroquine did not account for a significant portion of variance in anxiety, depression, or QOL. This suggests that in the present study medication use was not a factor informing COVID-19 distress. The availability of hydroxychloroquine was notably compromised by the promotion of this medication early in the pandemic as a potential treatment for COVID-19 based on limited data [33, 35]. In the present sample only two participants experienced

challenges in accessing this medication suggesting shortages of hydroxychloroquine were not commonplace in New Zealand.

A limitation of the present study was the reliance on self-report-questionnaires to ascertain aspects of treatment and patient opinions. Although we included variables about prescribed medications we did not gauge medication adherence, and this may differ in response to concerns about personal risk of SARS-CoV-2 infection. Another limitation is that participants were self-selecting with a third of invited participants not responding to the invitation. The survey was advertised as taking half an hour to complete, which means individuals with polarised experiences during lockdown (either extremely positive or negative) may have had greater incentive to take part in this study. Therefore, future research could include this survey at the same time as a patient's regular check-up as a way to ensure responses are more representative of the wide range of experiences for those with RD. This approach could also allow for further details about disease activity and medication adherence to be collected in addition to the measure of functional disability we included.

The major strength of the present study was the well-defined PORTAL cohort which was of an appropriate sample size for these analyses and provided better engagement than might be achieved otherwise. In addition, the use of an existing cohort meant we were able to compare current mental health data before and during COVID-19, which is a strength compared to cross-sectional research being conducted about the impact of the pandemic and allowed for novel exploration of changes over time. Furthermore, direct comparisons were evaluated between the average anxiety, depression, and QOL scores in 2018 and 2020 (post-lockdown). Future research could attempt to replicate these novel findings in other cohorts from other countries to assess for similar COVID-19-related factors influencing psychological outcomes for those with RA and AS.

In conclusion, the current study adds to existing research by presenting early data to suggest that even when the pandemic has come under control, psychological effects from fear of infection may have lasting effects on mood which could in turn influence the perception and severity of RD. Rheumatologists need to be informed of these novel findings to ensure treatments reflect the effects of the COVID-19 pandemic.

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Declarations

Conflict of interest All authors declare no conflict of interest.

References

- Baker MG, Kvalsvig A, Verrall AJ, Telfar-Barnard L, Wilson N (2020) New Zealand's elimination strategy for the COVID-19 pandemic and what is required to make it work. *N Z Med J* 133(1512):10–14
- Jefferies S, French N, Gilkison C, Graham G, Hope V, Marshall J et al (2020) COVID-19 in New Zealand and the impact of the national response: a descriptive epidemiological study. *Lancet Public Heal* 5(11):e612–e623. [https://doi.org/10.1016/S2468-2667\(20\)30225-5](https://doi.org/10.1016/S2468-2667(20)30225-5)
- Kourbeti IS, Ziakas PD, Mylonakis E (2014) Biologic therapies in rheumatoid arthritis and the risk of opportunistic infections: a meta-analysis. *Clin Infect Dis* 58(12):1649–1657. <https://doi.org/10.1093/cid/ciu185>
- Usher K, Bhullar N, Jackson D (2020) Life in the pandemic: Social isolation and mental health. *J Clin Nurs* 29(15–16):2756–2757. <https://doi.org/10.1111/jocn.15290>
- Rajkumar RP (2020) COVID-19 and mental health: a review of the existing literature. *Asian J Psychiatr* 52:102066. <https://doi.org/10.1016/j.ajp.2020.102066>
- George M, Venkatachalam S, Banerjee S, Baker J, Merkel P, Curtis D et al (2020) Concerns and health-related behaviors during the COVID-19 pandemic in patients with or without autoimmune rheumatic disease in a large physician network [abstract]. *Arthritis Rheumatol* 72(suppl 10):4
- Baker MG, Wilson N, Anglemyer A (2020) Successful elimination of Covid-19 transmission in New Zealand. *N Engl J Med* 383(e56):1–3. <https://doi.org/10.1056/NEJMc2025203>
- Robert A (2020) Lessons from New Zealand's COVID-19 outbreak response. *Lancet Public Health* 5(11):e569–e570. [https://doi.org/10.1016/S2468-2667\(20\)30237-1](https://doi.org/10.1016/S2468-2667(20)30237-1)
- Zartaloudi A, Koutelekos I, Polikandrioti M, Stefanidou S, Koukoularis D, Kyriasi E (2020) Anxiety and depression in primary care patients suffering of rheumatoid diseases. *Psychiatriki* 31(2):140–147
- Listing J, Strangfeld A, Kary S, Rau R, Von Hinueber U, Stoyanova-Scholz M et al (2020) Infections in patients with rheumatoid arthritis treated with biologic agents. *Arthritis Rheumatol* 52(11):3403–3412. <https://doi.org/10.1002/art.21386>
- Zheng YY, Ma YT, Zhang JY, Xie X (2020) COVID-19 and the cardiovascular system. *Nat Rev Cardiol* 17(5):259–260. <https://doi.org/10.1038/s41569-020-0360-5>
- Sood A, Galestani A, Murthy V, Gonzalez E, Mukaila R (2020) COVID-19 infection among patients with rheumatic disease on biologic & targeted therapies: a systematic review [abstract]. *Arthritis Rheumatol* 72(suppl 10):1
- Ahmed S, Gasparyan AY, Zimba O (2021) Comorbidities in rheumatic diseases need special consideration during the COVID-19 pandemic. *Rheumatol Int* 41:243–256. <https://doi.org/10.1007/s00296-020-04764-5>
- D'Silva K, Jorge A, Lu N, Zhang Y, Wallace Z, Choi H (2020) Outcomes of Coronavirus Disease 2019 infection among patients living with rheumatic diseases: a matched cohort study

- from a US multi-center research network [abstract]. *Arthritis Rheumatol* 325:25–27
15. Hill CL, Gill T, Taylor AW, Daly A, Grande ED, Adams RJ (2007) Psychological factors and quality of life in arthritis: a population-based study. *Clin Rheumatol* 26(7):1049–1054. <https://doi.org/10.1007/s10067-006-0439-3>
 16. Anyfanti P, Gavriilaki E, Pырpasopoulou A, Triantafyllou G, Triantafyllou A, Chatzimichailidou S et al (2016) Depression, anxiety, and quality of life in a large cohort of patients with rheumatic diseases: common, yet undertreated. *Clin Rheumatol* 35(3):733–739. <https://doi.org/10.1007/s10067-014-2677-0>
 17. Kool MB, Geenen R (2012) Loneliness in patients with rheumatic diseases: the significance of invalidation and lack of social support. *J Psychol* 146(1–2):229–241. <https://doi.org/10.1080/00223980.2011.606434>
 18. Strand V, Singh JA (2007) Improved health-related quality of life with effective disease-modifying antirheumatic drugs: evidence from randomized controlled trials. *Am J Manag Care* 13(SUPPL. 9):239–254
 19. Isik A, Koca SS, Ozturk A, Mermi O (2007) Anxiety and depression in patients with rheumatoid arthritis. *Clin Rheumatol* 26(6):872–878. <https://doi.org/10.1007/s10067-006-0407-y>
 20. Hong M, Shin H, De Gagne JC (2019) Social networks, health-promoting behaviors, and health-related quality of life in older adults with and without arthritis. *PLoS ONE* 14(7):1–15. <https://doi.org/10.1371/journal.pone.0220180>
 21. Shah SMA, Mohammad D, Qureshi MFH, Abbas MZ, Aleem S (2020) Prevalence, psychological responses and associated correlates of depression, anxiety and stress in a global population, during the coronavirus disease (COVID-19) pandemic. *Community Ment Health J* 57:101–110. <https://doi.org/10.1007/s10597-020-00728-y>
 22. Marques L, Bartuska AD, Cohen JN, Youn SJ (2020) Three steps to flatten the mental health need curve amid the COVID-19 pandemic. *Depress Anxiety* 37(5):405–406. <https://doi.org/10.1002/da.23031>
 23. Glass CA, Cash JC, Mullen J (2020) Coronavirus Disease (COVID-19). World Health Organization. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>
 24. Hämmig O (2019) Health risks associated with social isolation in general and in young, middle and old age. *PLoS ONE*. <https://doi.org/10.1371/journal.pone.0219663>
 25. Evers AWM, Kraaimaat FW, Geenen R, Jacobs JWJ, Bijlsma JWJ (2003) Stress-vulnerability factors as long-term predictors of disease activity in early rheumatoid arthritis. *J Psychosom Res* 55(4):293–302. [https://doi.org/10.1016/S0022-3999\(02\)00632-3](https://doi.org/10.1016/S0022-3999(02)00632-3)
 26. Zautra AJ, Hoffman JM, Matt KS, Yocum D, Potter PT, Castro WL et al (1998) An examination of individual differences in the relationship between interpersonal stress and disease activity among women with rheumatoid arthritis. *Arthritis Care Res (Hoboken)* 11(4):271–279. <https://doi.org/10.1002/art.1790110408>
 27. Marchetti D, Fontanesi L, Mazza C, Di Giandomenico S, Roma P, Verrocchio MC (2020) Parenting-related exhaustion during the Italian COVID-19 lockdown. *J Pediatr Psychol* 45(10):1114–1123. <https://doi.org/10.1093/jpepsy/jsaa093>
 28. Geenen R, Van Middendorp H, Bijlsma JWJ (2006) The impact of stressors on health status and hypothalamic-pituitary-adrenal axis and autonomic nervous system responsiveness in rheumatoid arthritis. *Ann N Y Acad Sci* 1069:77–97. <https://doi.org/10.1196/annals.1351.007>
 29. Thomason BT, Brantley PJ, Jones GN, Dyer HR, Morris JL (1992) The relation between stress and disease activity in rheumatoid arthritis. *J Behav Med* 15(2):215–220. <https://doi.org/10.1007/BF00848326>
 30. Brady SM, Fenton SAM, Metsios GS, Bosworth A, Duda JL, Kitas GD et al (2021) Different types of physical activity are positively associated with indicators of mental health and psychological wellbeing in rheumatoid arthritis during COVID-19. *Rheumatol Int* 41:335–344. <https://doi.org/10.1007/s00296-020-04751-w>
 31. Taylor S, Landry CA, Paluszczek MM, Fergus TA, McKay D, Asmundson GJG (2020) COVID stress syndrome: concept, structure, and correlates. *Depress Anxiety* 37(8):706–714. <https://doi.org/10.1002/da.23071>
 32. Coyle CE, Dugan E (2012) Social isolation, loneliness and health among older adults. *J Aging Health* 24(8):1346–1363. <https://doi.org/10.1136/bmj.m1166>
 33. Mahase E (2020) Covid-19: six million doses of hydroxychloroquine donated to US despite lack of evidence. *BMJ* 368(March):m1166. <https://doi.org/10.1136/bmj.m1166>
 34. Geleris J, Sun Y, Platt J, Zucker J, Baldwin M, Hripcsak G et al (2020) Observational study of hydroxychloroquine in hospitalized patients with Covid-19. *N Engl J Med* 382(25):2411–2418. <https://doi.org/10.1056/NEJMoa2012410>
 35. Mendel A, Bernatsky S, Thorne JC, Lacaillie D, Johnson SR, Vinet É (2020) Hydroxychloroquine shortages during the COVID-19 pandemic. *Ann Rheum Dis* 80(3):31
 36. Evers AWM, Zautra A, Thieme K (2011) Stress and resilience in rheumatic diseases: a review and glimpse into the future. *Nat Rev Rheumatol* 7(7):409–415. <https://doi.org/10.1038/nrrheum.2011.80>
 37. Devadula S, Langbecker D, Vecchio P, Tesiram J, Meiklejohn J, Benham H (2020) Tele-rheumatology to regional hospital outpatient clinics: patient perspectives on a new model of care. *Telemed J E Health* 26(7):912–919. <https://doi.org/10.1089/tmj.2019.01119>
 38. Knitza J, Simon D, Lambrecht A, Raab C, Tascilar K, Hagen M et al (2020) Mobile health usage, preferences, barriers, and eHealth literacy in rheumatology: patient survey study. *JMIR Mhealth Uhealth* 8(8):e19661. <https://doi.org/10.2196/19661>
 39. Khilnani A, Schulz J, Robinson L (2020) The COVID-19 pandemic: new concerns and connections between eHealth and digital inequalities. *J Information, Commun Ethics Soc* 18(3):393–403. <https://doi.org/10.1108/JICES-04-2020-0052>
 40. Thombs BD, Tao L, Wu Y, Levis B, Sun Y, Bourgeault A, et al (2020) Preliminary COVID-19 fears questionnaire: systemic sclerosis and chronic medical conditions versions. *OSF Preprints* <https://doi.org/10.31219/osf.io/m2ybt>
 41. Burckhardt CS, Anderson KL (2003) The Quality of Life Scale (QOLS): reliability, validity, and utilization. *Health Qual Life Outcomes* 77(Suppl):1–75. <https://doi.org/10.1186/1477-7525-1-60>
 42. Zigmond AS, Snaith RP (1982) The hospital anxiety and depression scale. *Occup Med (Chic Ill)* 64(5):393–394. <https://doi.org/10.1111/j.1600-0447.1983.tb09716.x>
 43. Hegarty RSM, Conner TS, Stebbings S, Trehan GJ (2015) Feel the fatigue and be active anyway: physical activity on high-fatigue days protects adults with arthritis from decrements in same-day positive mood. *Arthritis Care Res* 67(9):1230–1236. <https://doi.org/10.1002/acr.22582>
 44. Kirwan JR, Reebek JS (1986) Stanford health assessment questionnaire modified to assess disability in British patients with rheumatoid arthritis. *Br J Rheumatol* 25(2):206–209. <https://doi.org/10.1093/rheumatology/25.2.206>
 45. Gross C, Hen R (2004) The developmental origins of anxiety. *Nat Rev Neurosci* 5(7):545–552. <https://doi.org/10.1038/nrm1429>
 46. Rosenberg H, Syed S, Rezaie S (2020) The Twitter pandemic: the critical role of Twitter in the dissemination of medical information and misinformation during the COVID-19 pandemic. *CJEM* 22(4):418–421. <https://doi.org/10.1017/cem.2020.361>
 47. Bish A, Michie S (2010) Demographic and attitudinal determinants of protective behaviours during a pandemic: a review. *Br*

- J Health Psychol 15(4):797–824. <https://doi.org/10.1348/135910710X485826>
48. Pierce M, Hope H, Ford T, Hatch S, Hotopf M, John A et al (2020) Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. *Lancet Psychiatry* 7(10):883–892. [https://doi.org/10.1016/S2215-0366\(20\)30308-4](https://doi.org/10.1016/S2215-0366(20)30308-4)
49. Posadzki P, Mastellos N, Ryan R, Gunn LH, Felix LM, Pappas Y et al (2016) Automated telephone communication systems for preventive healthcare and management of long-term conditions. *Cochrane Database Syst Rev*. <https://doi.org/10.1002/14651858.CD009921.pub2>
50. Hartnett M (2017) Differences in the digital home lives of young people in New Zealand. *Br J Educ Technol* 48(2):642–652

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