Perceptions and behaviours related to COVID-19 in patients with rheumatoid arthritis: a cross-sectional study

Takahiro Itaya1 · Mie Torii2 · Motomu Hashimoto3,4 · Kazuaki Jindai1 · Wataru Yamamoto3,4 · Kyosuke Tanigawa2 · Yuki Urai2 · Ayae Kinoshita2 · Kazuko Nin2 · Ryu Watanabe3 · Koichi Murata3,5 · Kosaku Murakami6 · Masao Tanaka3 · Hiromu Ito3,5 · Shuichi Matsuda5 · Akio Morinobu6

Received: 10 February 2021 / Revised: 28 May 2021 / Accepted: 21 June 2021 / Published online: 28 September 2021
© International League of Associations for Rheumatology (ILAR) 2021

Abstract

Objectives To study the perceptions and behavioural changes related to the coronavirus disease 2019 (COVID-19) in patients with rheumatoid arthritis (RA) and determine their associations with patient characteristics, such as health literacy.

Methods This cross-sectional study was conducted from September to November of 2020 and included 400 outpatients with RA aged 18 and above. We measured self-reported perceptions as outcomes, such as awareness, knowledge and behaviours related to COVID-19. Health literacy and other characteristics as exposures were investigated using self-report questionnaires and electronic health records. To analyse the association between patient factors and the outcomes, multivariable linear and logistic regression models were performed.

Results In total, 365 patients completed the survey. More than half (51%) of patients reported that they were ‘very worried’ about possible infection with COVID-19, whereas over 80% believed the possibility of getting COVID-19 was low. In the multivariable analyses, patients with low health literacy had limited knowledge about COVID-19 and did not change daily routines and perform preventive measures.

Conclusions In this pandemic, healthcare providers may need to be aware of more vulnerable individuals and share COVID-19 related information promptly and effectively with their patients.

Key Points

• This cross-sectional study aimed to investigate the perceptions and behavioural changes related to COVID-19 in patients with RA.
• All patients were aware of COVID-19 and most of them worried about getting infected.
• Health literacy, age, sex, disease activity and rheumatic drugs were associated with perceptions and behaviours related to COVID-19.

Keywords COVID-19 · Health knowledge · attitudes · practice · Health literacy · KURAMA cohort · Rheumatoid arthritis

Corresponding Author
Motomu Hashimoto
mohashim@kuhp.kyoto-u.ac.jp

1 Department of Healthcare Epidemiology, Graduate School of Medicine and Public Health, Kyoto University, Kyoto, Japan
2 Department of Human Health Sciences, Graduate School of Medicine, Kyoto University, Kyoto, Japan
3 Department of Advanced Medicine for Rheumatic Diseases, Graduate School of Medicine, Kyoto University, Kyoto, Japan
4 Department of Health Information Management, Kurashiki Sweet Hospital, Kurashiki, Japan
5 Department of Orthopaedic Surgery, Graduate School of Medicine, Kyoto University, Kyoto, Japan
6 Department of Rheumatology and Clinical Immunology, Graduate School of Medicine, Kyoto University, Kyoto, Japan
Introduction

During the early pandemic phase of the coronavirus disease 2019 (COVID-19), more severe outcomes and higher hospitalisation were reported in patients with rheumatoid arthritis (RA) [1, 2]. Additionally, there have been many clinical studies and news coverage regarding inconsistent effects of rheumatic drugs on COVID-19 treatment [3, 4]. Generally, rheumatic patients are known to be at greater risk of infection due to their immune dysregulation, immuno-suppressive therapy and older age [5]. Therefore, during this highly uncertain time, patients with RA may pose as a risk to themselves and their communities compared to general population or people with common chronic diseases such as diabetes and hypertension. Particularly, people with RA with high disease activity or using biological agents may have a strong fear or concern about COVID-19. Several previous studies have investigated the perceptions of COVID-19, included awareness and concern, knowledge, behaviour and preparedness, in the general population and in patients with these common chronic diseases and found significant associations with health literacy and race [6, 7], but a study on patients with RA has not yet been conducted. By investigating the perception, it is possible to identify which patients with RA are vulnerable to COVID-19 and to identify patient characteristics that healthcare providers should be aware of in their practice. The objective of this study was to clarify the perceptions related to COVID-19—such as awareness, knowledge and actions—amongst patients with RA. Furthermore, we examined the relationship between patient characteristics, especially health literacy and their perceptions.

Materials and methods

Study design and population

This cross-sectional study was conducted from 10 September 2020 to 2 November 2020 in Japan and utilised the Kyoto University Rheumatoid Arthritis Management Alliance (KURAMA) cohort, which has enrolled outpatients with RA since 2011 [8]. The eligibility criteria for inclusion were as follows: (1) consecutive outpatients with RA aged ≥ 18 years, and (2) without cognitive impairment. RA was defined by the classification criteria used by the 2010 American College of Rheumatology and European League Against Rheumatism [9, 10]. All participants provided informed consent and the Ethical Review Board at Kyoto University Graduate School and Faculty of Medicine Kyoto University Hospital Ethics Committee, Kyoto, Japan, approved the study (approval number: R0357). This research was conducted according to the principles of the declaration of Helsinki and ethical guidelines for medical and health research involving human subjects by the Japanese Ministry of Health, Labour and Welfare.

Survey items of COVID-19 perceptions

We applied a modified version of a questionnaire used in previous studies (Table 1) [6, 11], and patients were asked to complete the questionnaire individually at the end of their outpatient visit. If they needed assistance due to hand contractures, the nurses helped them complete the form and assured them no answers were affected.

Variables

Health literacy—a primary exposure of interest—was assessed using the 14-item Health Literacy Scale (HLS-14) [12]. The total HLS-14 scores were divided into four groups by quartile points for analysis. We collected patient information using electronic health records (age, sex, disease duration years, disease activity score in 28 joints using erythrocyte sedimentation rate [DAS28-ESR], Health Assessment Questionnaire [HAQ] scores, rheumatic drugs such as biologic agents, methotrexate and glucocorticoids, and the number of comorbidities other than RA), and the questionnaire (working status). Age was categorised into three groups: < 60 years, 60–69 years and > 70 years. DAS28-ESR was categorised as a binary variable according to remission scores of < 2.6.

Statistical analysis

A complete-case analysis was performed and showcased all patient characteristics and survey responses as means with standard deviations for continuous variables and as counts and percentages for categorical variables. We used the items of the questionnaire as outcomes, and only the item of the seriousness of threat was used as a continuous variable while the other items were used as binary variables (e.g. ‘not worried’ was defined as the answers ‘a little worried’ or ‘not worried at all’ to the question of coronavirus concern), with reference to a previous study [6]. Multivariable linear regression models were used to estimate least-squares means and 95% confidence intervals for the continuous outcome. Multivariable logistic regression models were used to estimate odds ratios and 95% confidence intervals for the binary outcomes. All models included the following explanatory variables: age, sex, working status, health literacy, remission and rheumatic drugs. All statistical analyses were performed using STATA version 16.1 (Stata Corp., College Station, Texas, USA).
Table 1  Perceptions and behaviours towards COVID-19 (n=365)

| Survey item                                                                 | Summary value |
|----------------------------------------------------------------------------|---------------|
| **COVID-19 awareness and concern**                                         |               |
| Mean response (SD) to ‘On a scale of 1 to 10, how serious of a public health threat do you think the coronavirus is or might become? (1 being no threat at all, 10 being a very serious public health threat)’ | 7.6 (2.0)     |
| How worried are you about getting the coronavirus?                          |               |
| Very worried                                                               | 50.7          |
| Somewhat worried                                                           | 34.3          |
| A little worried                                                           | 14.0          |
| Not worried at all                                                         | 1.1           |
| How worried are you about getting the flu?                                 |               |
| Very worried                                                               | 18.9          |
| Somewhat worried                                                           | 46.9          |
| A little worried                                                           | 27.1          |
| Not worried at all                                                         | 7.1           |
| Did you get a flu shot this past year?                                     |               |
| Yes                                                                        | 57.8          |
| No                                                                         | 42.2          |
| I do not know                                                              | 0.0           |
| Do you think you will get sick from the coronavirus?                       |               |
| I definitely will                                                          | 2.2           |
| I probably will                                                            | 16.2          |
| It is possible                                                             | 76.7          |
| Not at all                                                                 | 4.9           |
| How likely do you think it is that you or someone you know may get sick from the coronavirus this year? |               |
| Very likely                                                                | 2.5           |
| Somewhat likely                                                            | 16.2          |
| Not that likely                                                            | 76.2          |
| Not at all likely                                                           | 5.2           |
| **COVID-19 knowledge**                                                     |               |
| Mean response (SD) to ‘What percentage of people who get the coronavirus do you think will have severe symptoms?’ | 24.3 (21.8)   |
| Mean response (SD) to ‘What percentage of people who get the coronavirus do you think will have only mild symptoms?’ | 58.8 (23.1)   |
| Mean response (SD) to ‘What percentage of patients with RA who get the coronavirus do you think will have severe symptoms?’ | 45.8 (28.8)   |
| Mean response (SD) to ‘What percentage of patients with RA who get the coronavirus do you think will have only mild symptoms?’ | 40.3 (23.9)   |
| Correctly identified two symptoms of the coronavirus                       |               |
| Yes                                                                        | 76.7          |
| No                                                                         | 23.3          |
| Correctly identified two prevention methods of the coronavirus             |               |
| Yes                                                                        | 71.5          |
| No                                                                         | 28.5          |
| **Related behaviours**                                                     |               |
| How much has the coronavirus changed your daily routine?                   |               |
| A lot                                                                      | 25.2          |
| Some                                                                       | 39.2          |
| A little                                                                   | 30.4          |
| Not at all                                                                 | 5.2           |
| How much has the coronavirus changed your frequency of taking more preventive measures, such as hand washing or mask-wearing? |               |
| A lot                                                                      | 68.5          |
| Some                                                                       | 21.6          |
Results

Patient characteristics

In total, 400 patients were enrolled in this study, but only 365 patients answered the questionnaire completely. Most patients were over the age of 60, and 82% were female. The mean total score of health literacy was 52.1 points. The mean DAS28-ESR score was 2.7, and approximately 30% of the patients were in remission of RA. About half of the patients were using biological drugs, and 63% used methotrexate. Half of the patients had no comorbidities other than RA. More detailed characteristics are summarised in Table 2.

Awareness and concern of COVID-19

Most patients thought the public health threat of COVID-19 was high. Additionally, more than half of them answered that they were ‘very worried’ about getting COVID-19, whereas only 18.9% were ‘very worried’ about getting the influenza virus. Less than a fifth of participants believed that they would definitely or probably be infected with COVID-19. In the multivariable analyses, older patients and patients with high health literacy rated the COVID-19 threat with greater severity; conversely, patients using methotrexate felt that it was less serious than those without methotrexate (Table 3). Older individuals and women were statistically associated with greater worry regarding COVID-19 infection. However, the projection of getting sick from COVID-19 was not associated with any patient characteristics.
Table 3  Multivariable models to investigate patient characteristics and perceptions of COVID-19

| Variable | Awareness and concern | Knowledge | Related behaviours | Preparedness |
|----------|-----------------------|-----------|--------------------|--------------|
|          | Seriousness of threat (scale of 1 to 10) | Not likely to get sick | Symptoms | Prevention | Changed daily routine | Took more precautions | Confidence in government | Not prepared |
|          | LSM (95% CI) | OR (95% CI) | OR (95% CI) | OR (95% CI) | OR (95% CI) | OR (95% CI) | OR (95% CI) | OR (95% CI) |
| Age      |           |           |           |           |           |           |           |           |
| <60 years | 7.04 (6.65–7.43) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) |
| 60–69 years | **8.09 (7.69–8.48)**§ | 0.62 (0.28–1.37) | 0.80 (0.39–1.64) | 1.21 (0.55–2.65) | 0.65 (0.30–1.38) | 0.81 (0.41–1.58) | 1.51 (0.77–2.98) | 1.27 (0.70–2.29) |
| ≥70 years | **7.78 (7.43–8.13)**† | 0.56 (0.25–1.22) | 0.63 (0.30–1.31) | **0.35 (0.17–0.74)**‡ | 0.98 (0.49–1.97) | 1.07 (0.55–2.10) | 1.46 (0.79–2.70) | 0.68 (0.37–1.26) |
| Sex      |           |           |           |           |           |           |           |           |
| Female   | 7.69 (7.47–7.91) | **0.43 (0.20–0.93)**† | 0.54 (0.26–1.11) | 1.19 (0.59–2.39) | **2.64 (1.38–5.05)**‡ | 1.37 (0.67–2.80) | 1.55 (0.82–2.92) | 1.05 (0.58–1.91) |
| Male     | 7.26 (6.77–7.76) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) |
| Health literacy |           |           |           |           |           |           |           |           |
| 1st quartile (the lowest) | 7.20 (6.80–7.59) | 1.65 (0.68–4.05) | 0.55 (0.24–1.22) | **0.47 (0.22–0.98)**† | **0.33 (0.16–0.70)**‡ | **0.44 (0.21–0.90)**† | **0.22 (0.11–0.44)**§ | 1.08 (0.58–2.00) |
| 2nd quartile | 7.72 (7.31–8.14) | 0.86 (0.33–2.23) | 0.69 (0.32–1.49) | 0.87 (0.38–1.97) | **0.45 (0.21–1.00)**† | 0.76 (0.38–1.51) | 0.64 (0.30–1.33) | 1.12 (0.59–2.10) |
| 3rd quartile | **7.82 (7.43–8.21)**‡ | 1.40 (0.60–3.27) | 0.78 (0.38–1.61) | 0.70 (0.32–1.52) | 0.62 (0.28–1.36) | 0.84 (0.44–1.63) | 0.76 (0.37–1.56) | 1.49 (0.81–2.73) |
| 4th quartile (the highest) | 7.77 (7.35–8.18) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) |
| Remission |           |           |           |           |           |           |           |           |
| Yes      | 7.74 (7.39–8.10) | 0.66 (0.34–1.29) | 0.95 (0.53–1.71) | 0.74 (0.42–1.30) | 1.09 (0.62–1.91) | 0.54 (0.31–0.95)† | 0.89 (0.53–1.50) | 1.08 (0.68–1.73) |
| No       | 7.55 (7.31–7.79) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) |
| Biological agent |           |           |           |           |           |           |           |           |
| Yes      | 7.66 (7.38–7.95) | 0.75 (0.41–1.38) | 0.83 (0.48–1.44) | 0.95 (0.57–1.59) | 0.93 (0.56–1.53) | 0.85 (0.52–1.39) | 0.87 (0.54–1.39) | 0.98 (0.64–1.51) |
| No       | 7.57 (7.29–7.85) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) |
| Methotrexate |           |           |           |           |           |           |           |           |
| Yes      | **7.44 (7.58–8.25)**§ | 1.61 (0.82–3.19) | 1.11 (0.61–2.02) | 1.07 (0.62–1.84) | 0.91 (0.53–1.54) | 0.72 (0.43–1.21) | 0.80 (0.49–1.53) | 0.99 (0.63–1.60) |
| No       | 7.92 (7.19–7.69) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) |
| Glucocorticoid |           |           |           |           |           |           |           |           |
| Yes      | 7.60 (7.39–7.85) | 0.71 (0.32–1.57) | 0.57 (0.27–1.21) | 0.59 (0.33–1.05) | 0.74 (0.41–1.31) | **0.52 (0.27–0.98)**† | 0.74 (0.43–1.30) | 1.68 (1.00–2.80) |
| No       | 7.62 (7.18–8.02) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) | 1.00 (reference) |

‘Seriousness of threat’ was measured as a scale of 1 to 10, how serious of a public health threat do you think the coronavirus is or might become? (1, being no threat at all; 10, being a very serious public health threat). COVID-19, coronavirus disease 2019; LSM, least-squares mean; OR, odds ratio; CI, confidence interval. Remission was defined as the disease activity score in 28 joints using erythrocyte sedimentation rate <2.6. *P <0.05. †P <0.01. §P <0.001

The italicized entries specified the major components of the survey.
Knowledge of COVID-19

Approximately 24.3% participants considered that people infected with COVID-19 will have severe symptoms, and 58.8% thought infected people will have only mild symptoms. Conversely, 45.8% and 40.3% of the participants thought that patients with RA would have severe and mild symptoms, respectively. Most patients correctly identified the two symptoms (76.7%) and two preventive measures (71.5%) of COVID-19 from the list. After adjustment, low health literacy was associated with low percentages of correct answers for both symptoms and prevention. Furthermore, in terms of prevention, older patients were more likely to give incorrect answers, while women were more likely to give correct answers.

Related behaviours

Most patients changed their daily routine and habits with the onset of COVID-19; in particular, 68.5% reported that they began taking more preventive measures for the disease. However, when asked about reduced visits to doctors, only half answered ‘some’ or ‘a little’. In the regression analyses, low health literacy was associated with less change in daily routines and fewer preventive methods. Patients in RA remission had fewer changes to their daily routines, and the frequency of visits to the doctor appeared to remain the same. In addition, patients using glucocorticoids were less likely to have a change in lifestyle.

Preparedness for COVID-19 pandemic

Respondents were divided on trusting and distrusting the government’s measures to prevent the outbreak. About 12% reported that they were ‘very prepared’ for the COVID-19 outbreak. In the multivariable analyses, there was no factor associated with confidence in government. Regarding preparedness, glucocorticoid users were more prepared for the pandemic compared to non-users.

Discussion

We found that all participants were aware about COVID-19, and most were worried about getting it. Health literacy was associated with three-quarters of the survey domains. In particular, those with lower health literacy scores had less preventive knowledge of COVID-19 and were less likely to take preventive measures. Previous studies with different target populations have shown similar results [6, 7]. Low health literacy is a barrier to gaining knowledge about health and enacting behaviour changes such as wearing masks or hand washing. It is difficult to identify patients with low health literacy in clinical practice, but rheumatologists estimated that around 25% of their patients had low health literacy [13]. Health professionals would do well to provide patients with up-to-date COVID-19 information and to observe infection-related behavioural changes.

In terms of socio-demographics, older patients were more likely to believe that the pandemic was serious and were more worried about infection, compared to patients under 60 years. However, older patients had less knowledge about COVID-19. Older people understand that their age is a risk factor for the disease [14, 15], but they are not properly informed about it. Therefore, clinicians should share information effectively with older patients given their knowledge gap.

Clinically, patients with low RA disease activity did not change their daily routine or their number of healthcare visits, given the pandemic; possibly, they consider themselves healthier than patients with high disease activity. Additionally, methotrexate users were less fearful of COVID-19 than non-users. This may be attributed to the fact that using methotrexate indicates that their disease is relatively well-controlled, and they assume that they are healthier than patients without methotrexate. Furthermore, glucocorticoid users were better prepared for the pandemic than non-users, but no lifestyle changes were found. This may be explained by the fact that, regardless of the pandemic, they are more likely to take preventive action against the everyday risk of infection.

Owing to the dynamic COVID-19 situation, this study has several limitations. First, examining the causal relationships between patient characteristics and perceptions of COVID-19 was limited due to the cross-sectional design. Although our findings are similar to previous research findings, future studies are needed to clarify these relationships. Second, the questionnaire we used could not check the validity of measuring perceptions and behaviours related to COVID-19. However, previous studies have used a similar format, making it easier to compare results [6, 7, 11]. Finally, although our recruited sample with RA was large, these findings have limited generalisability because this study was based on a university hospital in Japan and was conducted during the summer and autumn of 2020. Therefore, the results should be interpreted cautiously as the situation is dynamic, and future trends in the spread of infection may differ.

In conclusion, healthcare providers may need to be aware of more vulnerable individuals during the pandemic and share COVID-19 related information promptly and effectively with their patients. Especially, patients with lower health literacy faced disparities in knowledge and behaviour change towards COVID-19.
Author contribution  TI, MTo, KJ and MH contributed to the conceptualisation and the study design. TI, MTo, WY, KT, YU and MH were responsible for data acquisition. TI performed the analyses and wrote the first draft of the manuscript. All authors were responsible for data interpretation and drafting, revising and approving the final, submitted manuscript.

Funding  KURAMA cohort study is supported by a grant from Daiichi Sankyo. Daiichi Sankyo had no role in the study design, data collection or analysis, manuscript preparation or the decision to submit the manuscript for publication. This work was also supported by JSPS KAKENHI (Grant Number JP19K11165).

Data availability  Data are available upon reasonable request by contacting the corresponding author.

Declarations

Ethics approval  The Ethical Review Board at Kyoto University Graduate School and Faculty of Medicine Kyoto University Hospital Ethics Committee, Kyoto, Japan, approved the study (approval number: R0357).

Consent for participation and publication  All participants provided informed consent.

Competing interests  Department of Advanced Medicine for Rheumatic Diseases is supported by Nagahama City, Shiga, Japan, Toyooka City, Hyogo, Japan and five pharmaceutical companies (Mitsubishi Tanabe Pharma Co., Chugai Pharmaceutical Co. Ltd, UCBS Japan Co. Ltd, AYUMI Pharmaceutical Co. and Asahi Kasei Pharma Corp.). MH received a research grant and/or speaker fee from Bristol-Myers, Eisai, Eli Lilly and Mitsubishi Tanabe Pharma. RW received speaker’s fee from Mitsubishi Tanabe Pharma, Pfizer, Sanofi, AbbVie, Asahi Kasei, Eisai, Eli Lilly, Bristol-Myers Squibb and Janssen. KMurat received speaker fees from Eisai Co., Ltd. MTA received research grants and/or speaker fees from AbbVie GK, Asahi Kasei Pharma Corp., Astellas Pharma Inc., Ayumi Pharmaceutical Corp., Bristol-Myers Squibb, Chugai Pharmaceutical Co., Ltd., Eisai Co., Ltd., Eli Lilly Japan K.K., Pfizer Inc., UCBS Japan Co., Ltd., Janssen Pharmaceutical K.K., Mitsubishi Tanabe Pharma Corp., Novartis Pharma K.K., Taisho Pharma Co., Ltd., Takeda Pharmaceutical Co., Ltd. HI received research grants and/or speaker fees from BMS, Kyocera, Asahi-Kasei, Eisai, Mochida and Toyama. SM received research grants and/or speaker fees from AYUMI Pharmaceutical Co., Pfizer Inc., Eli Lilly Japan K.K., Mitsubishi Tanabe Pharma Corp., Kyocera, Chugai Pharmaceutical Co. Ltd., Mochida and Taisho Pharma Co., Ltd. AM received speaking fees and/or research grants from Eli Lilly Japan K.K., Ono Pharmaceutical Co., Pfizer Inc., UCBS Japan, AbbVie G.K., Asahi Kasei Pharma and Chugai Pharmaceutical Co. Ltd. TI, MTo, WY, KT, YU, AK, KN, KJ and KMurak have declared no conflicts of interest.

References

1. Gianfrancesco M, Hyrich KL, Al-Adely S, et al (2020) Characteristics associated with hospitalisation for COVID-19 in people with rheumatic disease: data from the COVID-19 Global Rheumatology Alliance physician-reported registry. Ann Rheum Dis 79(7):859–66. https://doi.org/10.1136/annrheumdis-2021-217871

2. Ye C, Cai S, Shen G, et al (2020) Clinical features of rheumatic patients infected with COVID-19 in Wuhan, China. Ann Rheum Dis 79(8):1007–13. https://doi.org/10.1136/annrheumdis-2020-217627

3. Della-Torre E, Campochiaro C, Cavalli G, et al (2020) Interleukin-6 blockade with sarilumab in severe COVID-19 pneumonia with systemic hyperinflammation: an open-label cohort study. Ann Rheum Dis 79(10):1277–85. https://doi.org/10.1136/annrheumdis-2020-218122

4. Gupta S, Wang W, Hayek SS, et al (2020) Association between early treatment with tocilizumab and mortality among critically ill patients with COVID-19. JAMA Intern Med https://doi.org/10.1001/jamainternmed.2020.6252

5. Listing J, Gerhold K, Zink A (2013) The risk of infections associated with rheumatoid arthritis, with its comorbidity and treatment. Rheumatology (Oxford) 52(1):53–61. https://doi.org/10.1093/rheumatology/ket305

6. Wolf MS, Serper M, Opsasnlick L, et al (2020) Awareness, attitudes, and actions related to COVID-19 among adults with chronic conditions at the onset of the U.S. outbreak: a cross-sectional survey. Ann Intern Med 173(2):100–9. https://doi.org/10.7326/m20-1239

7. McCaffrey KJ, Dodd RH, Cvejie E, et al (2020) Health literacy and disparities in COVID-19-related knowledge, attitudes, beliefs and behaviours in Australia. Public Health Res Pract 30(4):e30342012. https://doi.org/10.17061/phrp30342012

8. Terao C, Hashimoto M, Yamamoto K, et al (2013) Three groups in the 28 joints for rheumatoid arthritis synovitis—analysis using more than 17,000 assessments in the KURAMA database. PLoS One 8(3):e59341. https://doi.org/10.1371/journal.pone.0059341

9. Arnett FC, Edworthy SM, Bloch DA, et al (1988) The American Rheumatism Association 1987 revised criteria for the classification of rheumatoid arthritis. Arthritis Rheum 31(3):315–24. https://doi.org/10.1002/art.1780310302

10. Aletaha D, Neogi T, Silman AJ, et al. (2010) Rheumatoid arthritis classification criteria: an American College of Rheumatology/European League Against Rheumatism Collaborative Initiative. Arthritis Rheum 62(9):2569–81. https://doi.org/10.1002/art.27584

11. Kelly B, Squiers L, Bann C, et al (2015) Perceptions and plans for prevention of Ebola: results from a national survey. BMC Public Health 15(1):1136. https://doi.org/10.1186/s12889-015-2441-7

12. Suka M, Odajima T, Kasai M, et al (2013) The 14-item health literacy scale for Japanese adults (HLS-14). Environ Health Prev Med 18(5):407–15. https://doi.org/10.1007/s12199-013-0340-z

13. Mehta B, Jannat-Khah D, Fontana MA, et al (2020) Impact of COVID-19 on vulnerable patients with rheumatic disease: results of a worldwide survey. RMD Open 6(3):e001378. https://doi.org/10.1136/rmdopen-2020-001378

14. Zheng Z, Peng F, Xu B, et al (2020) Risk factors of critical & mortal COVID-19 cases: a systematic literature review and meta-analysis. J Infect 81(2):e16–e25. https://doi.org/10.1016/j.jinf.2020.04.021

15. Banerjee A, Pasea L, Harris S, et al (2020) Estimating excess 1-year mortality associated with the COVID-19 pandemic according to underlying conditions and age: a population-based cohort study. Lancet (London, England) https://doi.org/10.1016/s0140-6736(20)30854-0

Publisher’s note  Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.