The influence of COVID-19 pandemic on decisions for the management of people with inflammatory rheumatic and musculoskeletal diseases – a survey among EULAR countries

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ABSTRACT

Objectives: To investigate how the first wave of COVID-19 pandemic influenced decisions of rheumatologists and health professionals in rheumatology regarding the management of patients with inflammatory rheumatic and musculoskeletal diseases (RMDs).

Methods: An English-language questionnaire was developed by a EULAR working group and distributed via national rheumatology societies of EULAR countries, EMEUNET and individual working group members. Responses were collected using an online survey tool. Descriptive statistics were calculated.

Results: We analysed 1,286 responses from 35/45 EULAR countries. Due to containment measures, 82% of respondents indicated cancellation/postponement of face-to-face visits of new patients (84% of them offering remote consultation) and 91% of follow-up visits (96% with remote consultation). The majority of respondents (58%) perceived that the interval between symptom onset and first rheumatological consultations was longer during containment restrictions than before. Treatment decisions were frequently postponed (34%), and the majority (74%) of respondents stated that it was less likely to start a bDMARD/tsDMARD during the pandemic, mainly because of patients' fear, limited availability of screening procedures and decreased availability of rheumatological services. Use of (hydroxy)chloroquine and tocilizumab for the COVID-19 indication was reported by 47% and 42% of respondents, respectively, leading to a shortage of these drugs for RMDs indications according to 49% and 14% of respondents, respectively.

Conclusion: Measures related to containment of COVID-19 pandemic led to a perceived delay between symptom onset and a first rheumatological visit, postponement of treatment decisions, and shortage of (hydroxy)chloroquine and tocilizumab, thereby negatively impacting early treatment and treat-to-target strategies.

Keywords: Epidemiology; Arthritis, Rheumaotoid; Autoimmune Diseases, Health services research

KEY MESSAGES

What is already known about this subject?

1. Containment measures have been established in several European countries to prevent exponential growth of the infectious rate with the novel Severe Acute Respiratory Syndrome coronavirus (SARS-CoV)-2 causing Coronavirus disease 2019 (COVID-19)
2. (Hydroxy)chloroquine (HCQ) or tocilizumab (TCZ) have been used for treatment of some patients with COVID-19

What does this study add?

1. This study investigated from a public health perspective to what extent COVID-19 affected decisions of rheumatologists and health professionals in rheumatology concerning the management of patients with inflammatory rheumatic and musculoskeletal diseases (RMDs)
2. Rheumatology services were partially or completely closed in the majority of EULAR countries leading to cancellation/postponement of face-to-face visits
3. The perceived interval between symptom onset and first rheumatological consultations was longer during containment restrictions than before.
4. Treatment decisions were frequently postponed and it was less likely to start a bDMARD/tsDMARD during the pandemic.
5. Use of (hydroxy)chloroquine and tocilizumab for the COVID-19 indication led to a shortage of these drugs for RMDs patients

How might this impact on clinical practice or future developments?

1. Telemedicine and other care strategies should be researched more intensively in order to maintain high-quality of care even when face-to-face visits are not feasible.
2. Future off-label use of drugs for COVID-19 indication outside a clinical trial should be discouraged as it might led to shortage of the respective substance for patients with RMDs
3. Prioritizing strategies for face-to-face visits and investigations should be developed in order not to delay diagnosis and treatment and to guarantee adequate monitoring of disease activity and safety of patients with inflammatory RMDs also during future waves of COVID-19 or other pandemics caused by highly contagious infectious agents

INTRODUCTION

The novel Severe Acute Respiratory Syndrome coronavirus (SARS-CoV)-2 and coronavirus disease 2019 (COVID-19) is a highly contagious disease that has reached Europe at the beginning of 2020 and has been causing high morbidity and mortality [1–3]. Containment measures have been established in most European countries in order to prevent exponential growth of the infection [3]. To what extent these measures influenced early diagnosis and treatment of patients with inflammatory rheumatic and musculoskeletal diseases (RMDs) is unknown.

While the majority of patients with COVID-19 has a favorable outcome, some of them develop severe pneumonia eventually leading to respiratory failure along with other organ manifestations and sepsis [1]. COVID-19 appears to have at least 2 distinct disease phases: a phase characterized by the immune response against the virus aiming at eliminating the pathogen, and in some patients, a subsequent phase of severe “cytokine release syndrome” instead of the expected phase of convalescence [4]. Some of the most severe complications of COVID-19 seem indeed to be caused by an exaggerated response of the immune system. Immunomodulatory agents commonly prescribed in rheumatology such as (hydroxy)chloroquine (HCQ) or tocilizumab (TCZ) have been used for treatment of patients with COVID-19 [5–7]. Whether the off-label use of these drugs in COVID-19 induces a shortage of supply and whether this has an impact on treatment decisions in patients with RMDs is elusive so far.

Looking at the current situation from a public health perspective, there are several questions that arise: 1) Have the “treat to target” and “early diagnosis” paradigms for patients with inflammatory RMDs been still feasible during the COVID-19 crisis? 2) Have patients been less likely to initiate TCZ or other biologics or have they been switched from TCZ to therapies with other modes of action in order to save drugs for patients with COVID-19? 3) Has a shortage of medication led to patients having to stop HCQ or TCZ?

This EULAR project was designed to clarify how and to what extent COVID-19 affected decisions of rheumatologists and health professionals in rheumatology (HPR) concerning the management of patients with RMDs from a public health perspective. The knowledge gained from this study will help to prepare for future waves of COVID-19 and other pandemics caused by highly contagious infectious agents.

METHODS

An English-language questionnaire was developed by a EULAR working group composed of rheumatologists, a methodologist, experts in public health, and a HPR. The questionnaire contained 37 questions organized in three broad sections: 1) Professional background, 2) Influence of containment measures on the organisation of care for patients with inflammatory RMDs, and 3) drugs used both in rheumatology and to treat COVID-19. The majority of questions were in the multiple-choice format recognizing the possibility that multiple not mutually exclusive strategies might have been applied (e.g. which patient groups have been prioritized during closure for a face-to-face or remote visit). The survey also contained a few single choice (e.g. for age and sex) or open-ended questions.

The survey was distributed via EULAR secretariat and EULAR scientific member societies (No.: 45), delegates of the EULAR Standing Committee on Epidemiology and Health Services Research, and EMEUNET using e-mails, newsletters and social media. The working group members also personally contacted physicians and HPR from different countries, requesting them to answer and disseminate the questionnaire (snow-ball principle). The questionnaire was accompanied by an explanatory letter regarding the purpose of the survey. The answers were collected via an online survey tool (SurveyMonkey®) from 13th May till 17th June 2020. At least one reminder was sent by EMEUNET and individual working group members. **Supplementary File 1** provides the full questionnaire and additional details on the execution of the survey. Ethical approval was not required because the study did not involve patients; all responses were anonymous.

The target audience of the survey were rheumatologists and other physicians or HPR from EULAR countries who have been directly involved in care of patients with inflammatory RMDs, however; the survey was open to all physicians/HPR.

Descriptive and summary statistics were applied to the questionnaire responses. Absolute and relative frequencies were calculated and depicted in tabular and graphical form. Data are presented as number (nominator) and percentage of all available responses to each question (denominator) throughout the manuscript. The denominator may change from question to question for the following reasons: 1) questions and individual answers could have been skipped, 2) some questions could have been answered with “not applicable” or “don’t know”, which were detracted from the denominator as indicated, 3) specific subgroup analyses were conducted. Since the majority of questions were in the multiple-choice format, the sum of nominators from individual questions may exceed the corresponding denominator.

RESULTS

A total of 1,428 responses were collected from 58 countries (see **Supplementary Table 1** for number of responses from all countries): 1,286 (90%) were from 35 out of the 45 EULAR countries, 15 (1%) came from Africa, 10 (0.7%) from Asia, 8 from North-America (0.6%), 7 from South-America (0.5%), 2 (0.1%) from Australia/New Zealand, 1 (0.1%) from Andorra whereas 99 (7%) have not specified the country of practice.
In this paper, only results for EULAR countries are presented (n=1,286). Ten (22%) EULAR countries provided no and 19 (56%) more than 10 responses. Demographic data of respondents are summarized in **Table 1**. The number of responses per question ranged from 663 to 1,286. To support the interpretation of results in relation to the country-specific impact of COVID-19, we summarized data on infections with SARS-CoV2, mortality and containment measures in EULAR countries as per April 2020 in **Supplementary Table 2**.

Table 1. Demographics of respondents from EULAR countries (n=1286)

		Number of responses	percentage of responses
Professional background	Rheumatologist (or other specialist primarily managing patients with inflammatory RMDs)	966	75.1%
	Rheumatologist in training	145	11.3%
	Health Care Professional in Rheumatology	163	12.7%
	Other[1]	12	0.9%
Primary affiliation	University hospital	648	50.4%
	Community based hospital	375	29.2%
	Private practice	231	18.0%
	Other	32	2.5%
Responses according to countries	Romania	143	11.1%
	Italy	121	9.4%
	Netherlands	114	8.9%
	Germany	110	8.6%
	France	109	8.5%
	Spain	80	6.2%
	Denmark	78	6.1%
	Austria	76	5.9%
	United Kingdom	70	5.5%
	Greece	69	5.4%
	Switzerland	55	4.3%
	Portugal	46	3.6%
	Croatia	36	2.8%
	Turkey	33	2.6%
	Sweden	31	2.4%
	Ireland	19	1.5%
	Finland	17	1.3%
	Norway	15	1.2%
	Hungary	13	1.0%
	Slovenia	8	0.6%
	Belgium	5	0.4%
	Albania	4	0.3%
	Georgia	4	0.3%
	Israel	4	0.3%
	Lebanon	4	0.3%
	Cyprus	3	0.2%
	Czech Republic	3	0.2%
	Latvia	3	0.2%
	Montenegro	3	0.2%
	Russian Federation	3	0.2%
	Bulgaria	2	0.2%
	Serbia	2	0.2%
	Belarus	1	0.1%

	San Marino North Macedonia	1 1	0.1% 0.1%
Age ranges	<30 30-39 40-49 50-59 60-69 ≥70	60 320 379 336 164 25	4.7% 24.9% 29.5% 26.2% 12.8% 2.0%
Gender	Male Female Other	475 807 2	37.0% 62.9% 0.2%
Number of patients with inflammatory RMDs normally seen in a week by the respondent	<30 30-59 60-99 ≥100	449 552 192 84	35.2% 43.2% 15.0% 6.5%

[1] specialists in rehabilitation, physicians primarily working for pharma or health insurance, specialist in nuclear medicine, dermatologist, nephrologists, internists, retired rheumatologists

Influence of containment measures on organisation of care for patients with inflammatory RMDs

General organisation of rheumatology care

Partial closure of rheumatology services guaranteeing for example only emergency visits was reported by 622/1,094 (57%, 192 skipped the question) of respondents, 19 (2%) indicated that rheumatology services were suspended completely at least temporarily, 265 (24%) reported both, partial and complete closure and only 188 (17%) indicated no closure. Partial closure typically lasted between 5 and 8 weeks (43% of those who reported partial closure), whereas complete closure was normally not longer than 1-4 weeks (48% of those who reported complete closure). See **Figure 1** for data on duration of partial and complete closure according to different EULAR countries. A median of 26.4% (±34.1%) of total working time of respondents (i.e. workforce) was reallocated to other services such as emergency department, infectious disease clinic, COVID-19 unit or similar.

Due to complete and/or partial closure of rheumatology services, 899/1,094 (82%) physicians/HPR indicated cancellation or postponement of at least some face-to-face visits of new patients with (suspected) RMDs, 84% of those who had to cancel/postpone visits offered remote consultation at least for some of these visits (see **Table 2** and **Table 3** for details). Concerning follow-up visits, 991/1,094 (91%) responded to have cancelled/postponed visits with 96% of them offering remote consultation. The frequency of postponement/cancellation of face-to-face visits of new patients and follow-up visits in relation to the duration of partial and complete closure is detailed in **Figure 2**. Accordingly, the percentage of postponed/cancelled visits increased along with the duration of closure.

Table 2. Cancellation or postponement of face-to-face visits of new patients, according to the extent of closure of the rheumatology services

	No closure	Complete closure	Partial closure	Complete and partial closure	Total
No cancellation	67 (35.6)	2 (10.5)	102 (16.4)	24 (9.1)	195 (17.8)
With remote visit	24 (12.8)	4 (21.1)	94 (15.1)	17 (6.4)	139 (12.7)
Without remote visit	14 (7.4)	2 (10.5)	96 (15.4)	33 (12.5)	145 (13.3)
With and without remote visits	83 (44.1)	11 (57.9)	330 (53.1)	191 (72.1)	615 (56.2)
Total	188 (100)	19 (100)	622 (100)	265 (100)	1094 (100)

Data indicate the number (percentages) of respondents indicating cancellation/postponement of face-to-face visits of new patients with (suspected) RMDs with or without remote consultations

Table 3. Cancellation or postponement of follow-up face-to-face visits, according to the extent of closure of the rheumatology services

	No closure	Complete closure	Partial closure	Complete and partial closure	Total
No cancellation	48 (25.5)	2 (10.5)	39 (6.3)	14 (5.3)	103 (9.4)
With remote visit	35 (18.6)	4 (21.1)	115 (18.5)	26 (9.8)	180 (16.5)
Without remote visit	4 (2.1)	2 (10.5)	21 (3.4)	15 (5.7)	42 (3.8)
With and without remote visits	101 (53.7)	11 (57.9)	447 (71.9)	210 (79.2)	769 (70.3)
Total	188 (100)	19 (100)	622 (100)	265 (100)	1094 (100)

Data indicate the number (percentages) of respondents indicating cancellation/postponement of follow-up face-to-face visits of patients with RMDs with or without remote consultations

Remote consultations were conducted by different health workers: 924/1,030 (90%) respondents indicated that rheumatologists and/or other specialists performed this activity, 302 (29%) and 223 (23%) stated that specialists in training and HPR, respectively, were (also) involved. Phone (966/1,005, 96%) and/or e-mail (n=498, 50%) were among the techniques most commonly used to consult with patients, whereas video (n=241, 24%) or mobile applications (n=44, 4%) were less frequently applied. Respondents stated that patients with suspected inflammatory RMDs (458/1,029, 45%), those with previously unstable or active disease (n=563, 55%) or those with ongoing intravenous drug therapy (n=448, 44%) were prioritized for a face-to-face visit. They also indicated that patients receiving biological disease modifying anti-rheumatic drugs (bDMARDs) or targeted synthetic DMARDs (tsDMARDs) (319/1,031, 31%) as well as those with unstable disease (n=234, 23%) were prioritized for a remote consultation. No specific prioritization plan was reported by 277/1,029 (27%) for face-to-face visits and by 434/1,031 (42%) respondents for remote consultations.

Influence of changed care on principles of early diagnosis and treat to target

The majority of respondents had the impression that the intervals between symptom onset and first rheumatological visits were longer during COVID-19 related closure as compared to the months before (599/1,031, 58%, with 26% of those 599 physicians/HPR stating that it was considerably longer).

A minority of respondents (153/1,030, 15%) answered that they were contacted more frequently by patients for a suspected flare as compared to before the crisis. Patients with a suspected flare were managed using multiple approaches: most physicians/HPR indicated that a face-to-face visit (723/927, 78% to whom the question was applicable) or a remote consultation (n=553, 60%) were offered. Day-care or in-patient care, referral to the emergency department or consultation with another specialist were rare options (each <10%). The majority of respondents (678/1,029, 66%) felt that disease activity of patients with inflammatory RMDs they consulted during closure was not different from that in the preceding period.

Cancellation or postponement of non-urgent tests either by the service provider or by patients themselves were reported by 699/1,030 (68%) and 426 (41%) respondents, respectively. Also, 34% of physicians/HPR (299/873 to whom the question was applicable) indicated that treatment decisions were frequently postponed and 62% (n=542) stated that patients' management was mainly based on history and clinical examination without additional tests.

Drugs used in rheumatology and to treat COVID-19

The use of HCQ for COVID-19 indications was reported by 466/1,003 (47%) respondents. HCQ was particularly prescribed to patients admitted to the hospital (351 of those 442 who felt knowledgeable to answer this question, 79%) or to the intensive care unit (n=234, 53%), but also to those managed on an outpatient basis (184, 42%). Only a minority of respondents used HCQ for prophylaxis in health workers and/or

other individuals (38/1,003, 4%) as well as in patients with RMDs (mean 2% ± 9% of RMDs patients, n=914 responses]. A shortage of HCQ was noted by 492/999 (49%) of respondents with large differences between countries (see **Figure 3**). Consequently, this drug had to be stopped in a mean of 10% (±18%) of RMDs patients (n=811 responses). The majority of physicians/HPR (738/996, 74%) stated that they were less likely to start a bDMARD or tsDMARD in RMDs patients during COVID-19 crisis mainly because of patient's fear to start such a treatment (n=569, 57%), limited availability of screening procedures (n=284, 29%) and/or decreased availability of rheumatological services (n=270, 27%).

Treatment of patients with COVID-19 with TCZ was reported by 423/1,005 (42%) respondents, either in the setting of a clinical trial (178 of those 423 who indicated the use of TCZ in their hospital or practice, 42%) or off-label outside a study (n=245, 58%). TCZ was mainly administered to patients admitted to the intensive care unit (64% of those reporting use of TCZ for COVID-19). A shortage of TCZ was noted by 134/980 (14%) respondents, mainly in Italy and Spain as outlined in **Figure 3**. Overall, shortage or expected shortage of TCZ only rarely influenced the decision to start this drug in rheumatoid arthritis (RA) or giant cell arteritis (GCA), or to change treatment in patients with stable disease as depicted in **Table 4**. In Italy and Spain however, preference of another bDMARD/tsDMARD, postponement of treatment with TCZ, as well as change of therapy in stable patients was commonly considered (**Supplementary Table 3)**.

Other bDMARDs/tsDMARDs used to treat patients with COVID-19 were sarilumab (58 of those 728 who felt knowledgeable to answer this question, 8%), baricitinib (n=55, 8%), canakinumab (n=20, 3%) and/or anakinra (n=103, 14%).

A recommendation for patients with RMDs to decrease or stop NSAIDs even when they did not have symptoms of COVID-19 in order to decrease the possible risk for a worse outcome of this disease was made by 151/998 (15%) and 15 (2%) of respondents, respectively. Similarly, 226/1,000 (23%) and 1 (0.1%) recommended to decrease or stop glucocorticoids, respectively.

Table 4. Influence of shortage/expected shortage of tocilizumab on treatment decisions in rheumatoid arthritis (RA) and giant cell arteritis (GCA)

Influenced decision to start tocilizumab de novo			
Rheumatoid arthritis		*Giant cell arteritis*	
	n=707*		n=663*
No influence	599 (85%)	No influence	614 (93%)
Preference of another bDMARD/tsDMARD	76 (11%)	Preference of MTX or another csDMARD	24 (4%)
Postponement of treatment with TCZ	32 (5%)	Postponement of treatment with TCZ	19 (3%)
		Sarilumab used off-label	6 (1%)
Influenced decision to modify treatment with tocilizumab in patients with stable disease			
Rheumatoid arthritis		*Giant cell arteritis*	
	n=925*		n=788*
No influence	683 (74%)	No influence	709 (90%)
Switch of i.v. to s.c. TCZ	191 (21%)	Switch of i.v. to s.c. TCZ	65 (8%)
Prolongation of administration interval	28 (3%)	Prolongation of administration interval	10 (1%)
Change of TCZ to another DMARD	5 (0.6%)	Change of TCZ to another DMARD	2 (0.3%)
Change of TCZ to sarilumab	18 (2%)	Stopped treatment with TCZ	2 (0.3%)

* total number of answers to this question.

DMARD, disease modifying anti-rheumatic drug; b, biological; cs, conventional synthetic; i.v., intravenous; MTX; methotrexate; s.c., subcutaneous; ts, targeted synthetic TCZ, tocilizumab.

Box 1. Lessons learnt from this wave of COVID-19 pandemic

- Patient communication needs to be improved in order to address patients' concerns about the risk of infection and course of new viral epidemics such as COVID-19, particularly if a new DMARD therapy is planned.
- Telemedicine and other models of care should be regularly assessed and researched more intensively in order to maintain high-quality of care even when face-to-face visits are not feasible.
- Off-label use of drugs for COVID-19 indication outside a clinical trial might lead to shortage of the respective substance for patients with RMDs and should be discouraged.
- Prioritizing strategies for face-to-face visits and investigations such as laboratory testing, imaging and others should be developed in order not to delay diagnosis and treatment, and to guarantee adequate monitoring of disease activity and safety of patients with RMDs.

DISCUSSION

The magnitude of the impact of COVID-19 on both management decisions and quality of care of patients with RMDs has been unknown. The most worrisome findings, although not unexpected, are the fact that the lag between symptom onset to first rheumatological visits was increased during COVID-19 related closure, and that treatment decisions, particularly those to start a new b/tsDMARD were postponed mainly because of patients' concerns to start a new treatment during the pandemic, but also due to limited availability of rheumatological services and/or screening tests. COVID-19 thus impacts heavily on two fundamental principles of rheumatology management, namely those of early diagnosis and treat to target [8,9]. While we know from previous studies that long-term non-adherence to these strategies results in worse clinical and structural outcomes, the question to what extent a short-term interruption due to an infectious crisis impacts patients' disease course is still unclear [8,10]. See **Box 1** for the lessons learnt from this wave of the COVID-19 pandemic.

EULAR provisional recommendations for the management of RMDs in the context of SARS-CoV-2 suggest to consider withholding face-to-face visits temporarily or transforming them into a remote visit in phase of closure when the rheumatic disease is stable [11]. According to the results of our survey, rheumatology service providers compensated for cancelled/postponed face-to-face visits using telemedicine, and many of them developed standard operating procedures to prioritize patients for face-to-face visits. Recent publications also indicate rapid development of telemedicine during the first wave of the pandemic [12–14], however, it seems that patients' acceptance of telemedicine is only moderate yet [15,16]. Besides, we have insufficient data on the effectiveness of telemedicine in rheumatology and need to know more about how and when telemedicine might efficaciously replace live visits [17]. Given the expected increase in the prevalence of inflammatory and non-inflammatory RMDs in future due to an aging population and other reasons, and the expected insufficient growth of workforce in rheumatology [18,19], telemedicine and strategies to better prioritize visits are essential to maintain high quality of care in RMDs, irrespective of additional waves of the COVID-19 pandemic.

Another lesson we learnt from this crisis is that we need to better address patients' concerns and fears about possible risks of immunosuppression in order not to delay treatment of new or active patients. Till today, there is no convincing evidence suggesting that patients with RMDs (regardless of whether or not they are taking DMARDs) are at an increased risk for COVID-19 infection and course as compared to the general population [20,21]. Many advisories, including official government bodies nevertheless considered these patients at risk with corresponding communications to patients' societies, which might have further increased patients' concerns to adhere to hospital visits and immunosuppressive therapy [22–26].

Another observation is that management of RMD patients during closure was mainly based on patient's history and clinical examination, given that non-urgent tests were either not available or not desired by patients. Some of these tests such as imaging are important to inform rheumatologists who establish a diagnosis and to aid

monitoring of disease status and disease activity [27–29]. Similarly, laboratory tests are essential to guarantee patients' safety in case a new DMARD is considered but also for those who are on stable drug treatment [30]. Investigations performed in the office as part of the clinical visit (e.g. ultrasound conducted by the rheumatologist) or on a domestic basis (e.g. blood tests) might be preferable over those requested from another department or hospital service, in order to reduce (patients' concerns about) the contact to other patients and hospital-based structures.

(Hydroxy)-chloroquine was used for the COVID-19 indication according to almost half of respondents for in- and out-patients and occasionally for prophylaxis. The common use of this drug in this off-label indication led to a shortage in several countries and consequently, about 10% of patients with RMDs had to stop it at least temporarily. A shortage of TCZ occurred mainly in Italy and Spain, two countries who were heavily affected by the Coronavirus. Clinicians might have been pressured to try every drug with possible efficacy in critically ill patients, however, the use of HCQ and TCZ for COVID-19 was not based on solid data rather than on theories about the mode of action, case series and small observational studies [31–33]. Recent studies indicate that HCQ is not beneficial for COVID-19 [34,35], and some evidence suggests that it might perhaps increase mortality when combined with azithromycine [36]. Patients with inflammatory RMDs, particularly those with connective tissue disease, might be at a considerable risk of flare when they run out of HCQ [37]. A comparable problem arises for TCZ: while a change to another bDMARD/tsDMARD (at least in RA) might be considered in case of drug shortage, this is definitely not desirable due to the risks of intolerance and lack of efficacy. Our survey indicates that in fact, this has been performed only occasionally in clinical practice. While there is some evidence from observational studies and non-randomized trials that TCZ helps to reduce the mortality of patients with COVID-19 who develop severe (autoinflammatory) pneumonia [39], the randomized Phase III (COVACTA) trial comparing TCZ with placebo in patients with severe COVID-19 associated pneumonia failed its primary endpoint of improved clinical status, as well as the key secondary endpoint of reduced mortality [40]. Almost 60% of those 423 physicians/HPR who stated that TCZ had been used in their hospital/practice for patients with COVID-19 indicated off-label use of this drug outside a clinical trial, an ethically questionable approach that is discouraged by EULAR [11].

NSAIDs, which have been concerned to upregulate angiotensin-converting enzyme (ACE) 2 receptors and to increase the susceptibility to the virus [41], and glucocorticoids, which might negatively affect virus clearance [42], should not automatically be stopped in patients with RMDs according to the EULAR task force [11]. Even patients with symptoms of COVID-19 who are chronically treated with glucocorticoids should continue this treatment [11]. Interestingly, 23% of respondents advised their patients to reduce the glucocorticoid dose and 15% that of NSAIDs, presumably not to expose patients to unnecessary risk during the pandemic. Discontinuation of these drugs, however, was the exception.

Our study is limited by the descriptive nature and by a potential responder bias. There were more responses from Romania and the Netherlands, countries with a relatively small population, than from the UK, Spain, France or Germany. We followed the same

dissemination strategy of the survey in every country, so any imbalance in the number of responses compared to the expected target population may be due to factors beyond our control (e.g. different communication strategies of national societies). Furthermore, owing to its anonymous nature, the survey could have been completed by different healthcare providers within the same centre, and we were unable to contact respondents to solve any data inconsistency. Two respondents for example indicated no cancellation of first or follow-up visits despite complete closure of their rheumatology service. While there might be a plausible explanation for this answer (e.g. patients were sent to another rheumatologist), we were unable to clarify it. We did not ask to stratify the responses on prioritisation strategies according to diagnosis, acknowledging that the diagnosis (e.g. inflammatory arthritis versus systemic RMDs) might have had an impact on these strategies.

Our study reflects experiences and opinions of physicians and HPR from EULAR countries and despite its limitations, this survey provides important insights into management decisions concerning patients with inflammatory RMDs during the COVID-19 outbreak. Retrieval of empiric data to respond to the questions raised was certainly not feasible during this wave of the pandemic.

In conclusion, measures related to containment of the COVID-19 pandemic led to a perceived delay between symptom onset and a first rheumatological visit, a postponement of treatment decisions, and a shortage of drugs used to treat RMDs patients and those with COVID-19 such as HCQ and TCZ. Important lessons we have learnt are the need to better address patients' concerns about the risk of infection and course of COVID-19, particularly in case a new DMARD is planned. Telemedicine and prioritizing strategies should be researched more extensively in order to maintain high quality of care even when face-to-face visits and other investigations, such as laboratory testing or imaging, are not feasible, for example during a future wave of the COVID-19 pandemic.

Competing interests

CD received consulting/speaker's fees from Abbvie, Eli Lilly, Janssen, Novartis, Pfizer, Roche and Sanofi, as well as grant support from Celgene, all unrelated to this manuscript.

AA has nothing to disclose

JWJB received honoraria from Lilly, Roche, Abbvie, Galapagos, SUN all unrelated to this manuscript.

AB received research grants form Abbvie and Celgene, and consultation/speakers fees from Eli Lilly, Novartis, UCB and Galapagos all to here department and all unrelated to this manuscript

BC: received honoraria from AbbVie; BMS; Gilead; Janssen; Lilly; Merck; Novartis; Pfizer; Roche-Chugai; Sanofi; and research grants from Novartis, Pfizer, and Roche; all unrelated to this manuscript.

AF has nothing to disclose

PMM received consulting/speaker's fees from Abbvie, BMS, Celgene, Eli Lilly, Janssen, MSD, Novartis, Pfizer, Roche and UCB, all unrelated to this manuscript.

IP received honoraria from Novartis, Sanofi, Abbvie, Sandoz and Roche, all unrelated to this manuscript.

FS has nothing to disclose

TS has nothing to disclose

FB received consulting/speaker's fees from Abbvie, Lilly, Horizon Therapeutics, Pfizer and Roche/Chugai, all unrelated to this manuscript.

Contributorship

All authors designed the study and contributed to data collection. CD analysed the data and drafted the first version of the manuscript. All coauthors critically interpreted the results, discussed the findings together, critically reviewed the manuscript and approved its final version.

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Ethical approval information

Not applicable, since no patients were involved.

Data sharing statement

The data will be shared if there is a reasonable request for it.

Patient and public involvement

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

Previous abstract presentations

The results of this study have not been presented in form of an abstract before.

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FIGURES

Figure 1. Partial and complete closure of rheumatology services in EULAR countries

Figures indicate the percentage of respondents indicating the number of weeks with partial (A) or complete (B) closure according to different countries.

Figure 2. Postponement/cancellation of face-to-face visits according to the duration of closure of rheumatology services

Figures indicate the cumulative percentage of respondents (Y axis) indicating the proportion of face-to-face visits (4 categories represented by the colours) of new patients and follow-up visits postponed/cancelled with or without remote consultation in relation to the duration of partial and/or complete closure of rheumatology services in weeks

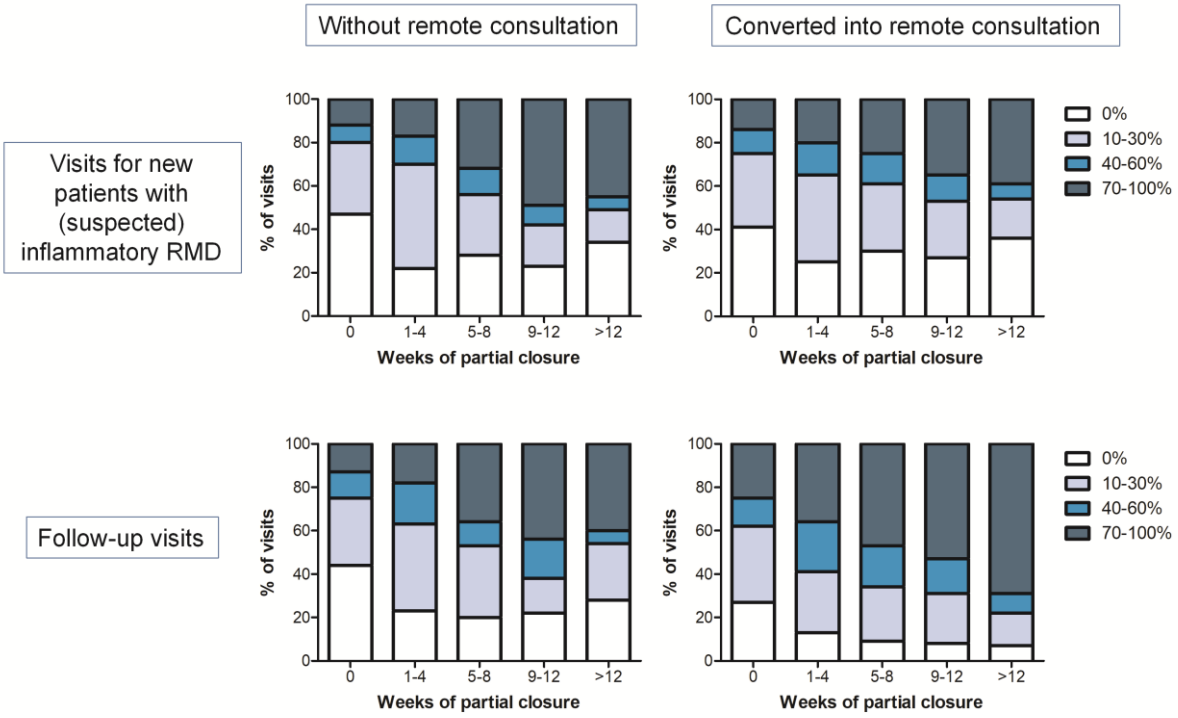
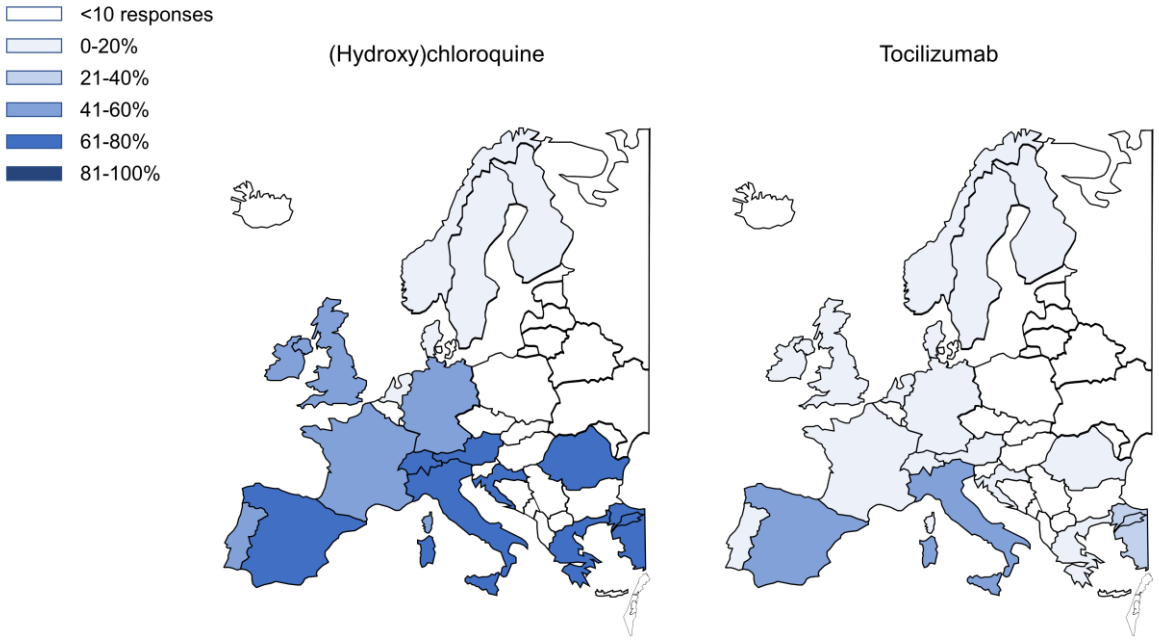


Figure 3. Shortage of (hydroxy)chloroquine and tocilizumab in EULAR countries

Figures indicate the percentage of respondents indicating a shortage of (hydroxy)chloroquine and/or tocilizumab according to countries. Only data for EULAR countries with >10 responses are shown



Supplementary Table 1. Complete list of responses according to individual countries (n=58)

		Number of responses	percentage of responses
Responses according to countries	Romania	143	10.7%
	Italy	121	9.1%
	Netherlands	114	8.6%
	Germany	110	8.3%
	France	109	8.2%
	Spain	80	6.0%
	Denmark	78	5.9%
	Austria	76	5.7%
	United Kingdom	70	5.3%
	Greece	69	5.2%
	Switzerland	55	4.1%
	Portugal	46	3.5%
	Croatia	36	2.7%
	Turkey	33	2.5%
	Sweden	31	2.3%
	Ireland	19	1.4%
	Finland	17	1.3%
	Norway	15	1.1%
	Hungary	13	1.0%
	Slovenia	8	0.6%
	Algeria	7	0.5%
	United States of America	6	0.5%
	Belgium	5	0.4%
	Morocco	5	0.4%
	Albania	4	0.3%
	Georgia	4	0.3%
	Israel	4	0.3%
	Lebanon	4	0.3%
	Mexico	4	0.3%
	Cyprus	3	0.2%
	Czech Republic	3	0.2%
	Latvia	3	0.2%
	Montenegro	3	0.2%
	Russian Federation	3	0.2%
	Argentina	2	0.2%
	Bulgaria	2	0.2%
	Canada	2	0.2%
	India	2	0.2%
	Luxembourg	2	0.2%
	Serbia	2	0.2%
	Andorra	1	0.1%
	Australia	1	0.1%
	Azerbaijan	1	0.1%
	Belarus	1	0.1%

	Benin	1	0.1%
	China	1	0.1%
	Colombia	1	0.1%
	Egypt	1	0.1%
	Japan	1	0.1%
	Kazakhstan	1	0.1%
	Kuwait	1	0.1%
	New Zealand	1	0.1%
	Pakistan	1	0.1%
	Qatar	1	0.1%
	Republic of Korea	1	0.1%
	San Marino	1	0.1%
	North Macedonia	1	0.1%
	Tunisia	1	0.1%

Supplementary Table 2. People with SARS CoV2, number of deaths and COVID-19 related containment measures

*EULAR countries**	*Infections with SARS CoV2*	*COVID-19 related deaths*	*National events stop*	*Schools, nurseries, educational facilities closure*	*National movements restrictions*	*Non-essential shops closure*	*International movements restrictions*	*Flight restrictions*
Romania	6,633	331	●	●	●	●	●	●
Italy	159,516	20,465	●	●	●	●	●	●
Netherlands	26,551	2,823	●	●	●	●	●	●
Germany	128,208	3,043	●	●	●	●	●	●
France	98,076	14,967	●	●	●	●	●	●
Spain	169,628	17,628	●	●	●	●	●	●
Denmark	6,318	285	●	●	●	●	●	●
Austria	14,041	368	●	●	●	●	●	●
United Kingdom	88,621	13,037	●	●	●	●	●	●
Greece	2,145	99	●	●	●	●	●	●
Switzerland	25,688	1,138	●	●	●	●	●	●
Portugal	16,934	535	●	●	●	●	●	●
Croatia	1,650	25	●	●	●	●	●	
Turkey	61,049	1,296	●	●	●	●	●	●
Sweden	10,948	919	●	●	●	●	●	●
Ireland	10,647	365	●	●	●	●	●	●
Finland	3,064	59	●	●	●	●	●	●
Norway	6,565	134	●	●	●	●	●	●
Hungary	1,458	109	●	●	●	●	●	●
Slovenia	1,212	55	●	●	●	●	●	●
Belgium	30,589	3,903	●	●	●	●	●	●
Albania	467	23	●	●	●	●	●	●
Georgia	272	3	●	●	●	●	●	●
Israel	11,586	116	●	●	●	●	●	●
Lebanon	632	20	●	●	●	●	●	●
Cyprus	662	12	●	●	●	●	●	●
Czech Republic	6,022	143	●	●	●	●	●	●

Latvia	655	5	●	●	●	●	●		
Montenegro	274	3	●	●	●	●	●	●	
Russian Federation	18,328	148	●	●	●	●	●	●	
Bulgaria	685	32	●	●	●	●	●	●	
Serbia	4,054	85	●	●	●	●	●	●	
Belarus	2,919	29	●	●	●	●	●	●	
San Marino	356	35	●	●	●	●	●	●	
North Macedonia	854	38	●	●	●	●	●	●	

This table provides an overview of people infected with SARS CoV2, number of deaths associated with COVID-19 as well as COVID-19 related containment measures in EULAR countries who provided at least one response to the survey, as per April 13th 2020 (modified from [1-16]); * EULAR countries are listed in descending order according to the number of responses to the survey

● national measures; ● Partial/regional measures; ● no restrictions; empty cells – data not available

COVID-19, coronavirus disease 2019; SARS-CoV2, Severe Acute Respiratory Syndrome coronavirus-2

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Supplementary Table 3. Influence of shortage/expected shortage of tocilizumab on treatment decisions in rheumatoid arthritis (RA) and giant cell arteritis (GCA) in Italy and Spain

Influenced decision to start tocilizumab de novo					
Rheumatoid arthritis			*Giant cell arteritis*		
	Italy	Spain		Italy	Spain
	n=98*	n=72*		n=82*	n=63*
No influence	59 (60%)	38 (53%)	No influence	71 (87%)	43 (68%)
Preference of another bDMARD/tsDMARD	28 (29%)	29 (40%)	Preference of MTX or other csDMARD	7 (9%)	9 (14%)
Postponement of treatment with TCZ	11 (11%)	5 (7%)	Postponement of treatment with TCZ	4 (5%)	5 (8%)
			Sarilumab used off-label	0	6 (10%)
Influenced decision to modify treatment with tocilizumab in patients with stable disease					
Rheumatoid arthritis			*Giant cell arteritis*		
	Italy	Spain		Italy	Spain
	n=121*	n=83*		n=89*	n=70*
No influence	44 (36%)	23 (28%)	No influence	70 (79%)	38 (54%)
Switch of i.v. to s.c. TCZ	54 (45%)	46 (55%)	Switch of i.v. to s.c. TCZ	15 (17%)	25 (36%)
Prolongation of administration interval	11 (9%)	7 (8%)	Prolongation of administration interval	3 (3%)	5 (7%)
Change of TCZ to another DMARD	3 (3%)	0	Change of TCZ to another DMARD	1 (1%)	1 (1%)
Change of TCZ to sarilumab	9 (7%)	7 (8%)	Stopped treatment with TCZ	0	1 (1%)

* total number of answers to this question.

DMARD, disease modifying anti-rheumatic drug; b, biological; cs, conventional synthetic; i.v., intravenous; MTX; methotrexate; s.c., subcutaneous; ts, targeted synthetic TCZ, tocilizumab.

Suppl. File 1. The Survey

We used SurveyMonkey® to conduct the survey. The survey was designed as an open survey, the link to the questionnaire was distributed via e-mails, newsletters and social media. The survey was piloted for usability and technical functionality by the EULAR working group and by a group of 28 rheumatologists invited personally by the EULAR working group members. No incentive was provided to the recipients of the survey; however, national EULAR societies was offered to receive country-specific data on request.

All questions appeared in the same order to all respondents, i.e. items were not randomized. No adaptive questioning was used, mandatory items were highlighted. Respondents were able to review and change their answers by using the back button. The IP address of the client computer has been used by SurveyMonkey® to prevent potential duplicate entries from the same user.

The full questionnaire including the introduction text as displayed on SurveyMonkey® is depicted below:

Page 1 : Introduction

Title: EULAR survey on Impact of COVID-19 on care of RMD

Please help EULAR to prepare for future waves of COVID-19 pandemic!

EULAR is conducting this survey to investigate how the COVID-19 pandemic influences management decisions of rheumatologists toward patients with inflammatory rheumatic and musculoskeletal diseases (RMD). The data obtained from this project will help EULAR to prepare for future waves of COVID-19 pandemic.

Please help us by filling out the following questionnaire. It consists of 37 questions divided into 3 sections. It will take less than 10 minutes to complete the questionnaire.

Page 2 : Section 1 – Professional background:

1) What is your profession?
   a) Rheumatologist (or other specialist primarily managing patients with inflammatory rheumatic and musculoskeletal diseases (RMDs))
   b) Rheumatologist in training (or other specialist primarily managing patients with inflammatory RMDs)
   c) Health Professional in Rheumatology
   d) Patient or health professional <u>not directly involved</u> in care of patients with RMD **(in survey monkey this will go directly to the end of the survey)**
   e) Other

Page 3:

2) What is your main affiliation? (please complete the survey from that perspective)
   a) University hospital
   b) Community based hospital
   c) Private practice
   d) Other:

3) In which country do you practice?
   a) Drop down menu

4) What is your age?
   a) Age ranges (<30, 30-39, 40-49, 50-59, 60-69, ≥70)

5) What is your gender?
   a) Male
   b) Female
   c) Other

6) What is the number of patients with inflammatory RMD you normally see in a week?
   a) Ranges (<30, 30-59, 60-99, 100-129, ≥130)

Page 4: Section 2 – Influence of containment measures on organisation of care for patients with inflammatory rheumatic and musculoskeletal diseases (RMD):

7) How long did partial or complete closure of your rheumatology clinic/practice last due to COVID-19? (multiple responses)
   a) No closure
   b) Partial closure (e.g. open only for emergency visits) (field for a number in weeks)
   c) Complete closure (field for number in weeks)

8) How much of your working time have you been reallocated to other services (emergency department, infectious disease / COVID-19 unit or other) in the last weeks?
   a) 0-100% of the overall working time spent in that service (Slider)

9) What percentage of face-to-face visits of <u>new patients</u> with (suspected) inflammatory RMD did you have to postpone or cancel in the last weeks? (Several answers possible)
   a) None, conducted all face-to-face visits scheduled
   b) Yes, without remote consultation, 0-100%
   c) Yes, converted into remote consultations, 0-100%

10) What percentage of face-to-face <u>follow-up</u> <u>visits</u> of patients with inflammatory RMD did you have to postpone or cancel in the last weeks? (Several answers possible)

a) None, conducted all face-to-face visits scheduled
b) Yes, without remote consultation, 0-100%
c) Yes, converted into remote consultations, 0-100%

Page 5:

11) Who conducted remote consultations? (several answers possible)
    a) Rheumatologist (or other specialist primarily managing patients with inflammatory RMDs)
    b) Rheumatologist in training (or other specialist primarily managing patients with inflammatory RMDs)
    c) Health care professional in rheumatology
    d) Other, specify
    e) Not applicable

12) Which tools did you use for remote consultation? (Several answers possible)
    a) Phone call via landline or mobile
    b) Video-consultation
    c) Email
    d) Mobile application dedicated to monitoring of RMD (e.g. with self-assessment)
    e) Other, specify
    f) Not applicable

13) Have you developed in your hospital/practice standards how to prioritize patients for face-to-face visits? (several answers possible)
    a) No specific plan
    b) Yes, patients with suspected inflammatory RMD
    c) Yes, patients with bDMARDs or tsDMARDs
    d) Yes, patients with previously instable or active disease
    e) Yes, patients with ongoing intravenous infusion therapy
    f) Yes, patients on >7.5 mg prednisone equivalent
    g) Yes, elderly people (e.g. >age of 70 years)
    h) Yes, other, please specify

14) Have you developed in your hospital/practice standards how to prioritize patients for remote consultation? (several answers possible)
    a) No specific plan
    b) Yes, patients with biological DMARDS (bDMARDs) or targeted synthetic DMARDs (tsDMARDs)
    c) Yes, patients with previously instable or active disease
    d) Yes, patients with previously stable disease
    e) Yes, patients on >7.5 mg prednisone equivalent
    f) Yes, elderly people (e.g. >age of 70 years)
    g) Yes, other, please specify:

15) Have you been contacted in the last weeks by patients who had a suspected flare?
    a) No
    b) Yes, less than usually
    c) Yes, equally as usually
    d) Yes, more than usually

16) **If yes,** how did you manage these patients? (several answers possible)
    a) Invited them to a face-to-face visit
    b) Sent them to hospital for day-care or in-patient treatment
    c) Remote consultation using telephone/E-mail/video or similar
    d) Sent them to another rheumatologist or specialist
    e) Sent them to the emergency department
    f) Other
    g) Not applicable

17) Do you have the impression that disease activity of your patients was higher in the last weeks as compared to the period before COVID-19 crisis?
    a) No, better
    b) No, equal
    c) Yes, somewhat higher
    d) Yes, considerably higher
    e) Don't know

18) Do you have the impression that the interval between symptom onset and a first rheumatological visit was longer in the last weeks as compared to the time before COVID-19 crisis?
    a) No, shorter
    b) No, equal
    c) Yes, somewhat longer
    d) Yes, considerably longer
    e) Don't know

19) Have you had in the last weeks difficulties to arrange diagnostic tests (e.g. ultrasound, x-ray, laboratory tests) for your RMD patients? (several answers)
    a) No
    b) Yes, non-urgent tests were cancelled or postponed
    c) Yes, patients themselves cancelled or postponed tests
    d) Other:

20) **If yes,** did this influence your decisions how to manage patients with RMD? (several answers)
    a) No
    b) Yes, management was mostly based on history and clinical examination

c) Yes, treatment decisions have been postponed
d) Other
e) Not applicable

Page 6: Section 3 – Role of drugs used in rheumatology and to treat COVID-19:

21) Have patients with COVID-19 in your hospital/practice been treated with (hydroxy)chloroquine for the COVID-19 indication?
   a) No
   b) Yes
   c) Don't know

22) **If YES**, which patient groups? (several answers)
   a) Patients with suspected COVID-19 managed on an out-patient basis
   b) Patients with confirmed COVID-19 managed on an out-patient basis
   c) Patients with suspected/confirmed COVID-19 admitted to hospital
   d) Patients with suspected/confirmed COVID-19 admitted to intensive care unit
   e) Other groups (specify)
   f) Don't know or not applicable

23) Have health workers or other groups in your hospital/practice systematically received (hydroxy)chloroquine as prophylaxis against COVID-19 infection? (several answers)
   a) No
   b) Health workers
   c) Other groups: specify
   d) Don't know

24) Have you added to your patients with inflammatory RMD (hydroxy)chloroquine as prophylaxis against COVID-19?
   a) No
   b) Yes, 0-100%, specify which groups

25) Have you noticed in the last weeks a shortage of supply with (hydroxy)chloroquine in your hospital/practice?
   a) No
   b) Yes

26) **If YES,** in what percentage of your patients with RMD have you changed or stopped treatment with (hydroxy)chloroquine due to shortage of the drug?
   a) No
   b) Yes, 0-100%, specify which groups

27) Has it been less likely in the last weeks that you started a biological or targeted synthetic DMARD in your RMD patients due to COVID-19 pandemic? (several answers)
   a) No
   b) Yes, because of financial restrictions (e.g. lack of insurance coverage)
   c) Yes, because of decreased availability of rheumatological services
   d) Yes, because of limited availability of screening procedures (e.g. chest X-ray, tuberculosis testing)
   e) Yes, because of drug shortage
   f) Yes, because of patient's fear to start such a treatment during COVID-19 pandemic
   g) Other:

28) Have patients with COVID-19 in your hospital/practice been treated with tocilizumab for COVID-19 indication? (Several answers)
   a) No
   b) Yes, in the setting of a clinical trial
   c) Yes, off-label (not in a trial)
   d) Don't know
   e) Not applicable

29) **If YES,** which patient groups? (several answers)

   a) Patients with suspected/confirmed COVID-19 plus hyperinflammation who are managed on an out-patient basis
   b) admitted to the hospital
   c) admitted to the intensive care unit
   d) Other groups (specify)
   e) Don't know
   f) Not applicable

30) Have you noticed in the last weeks a shortage with supply of tocilizumab in your hospital/practice?
   a) No
   b) Yes

31) Did the shortage/expected shortage influence your decision to start tocilizumab de novo in patients with rheumatoid arthritis?
   a) No
   b) Yes, therefore another biological or targeted synthetic DMARD was preferred
   c) Yes, treatment start was postponed
   d) Not applicable

32) Did the shortage/expected shortage influence your decision to start tocilizumab de novo in patients with giant cell arteritis?
   a) No
   b) Yes, therefore methotrexate or another DMARD was preferred
   c) Yes, therefore sarilumab was used off-label
   d) Yes, treatment start was postponed
   e) Not applicable

33) Have you in the last weeks changed current treatment with tocilizumab in patients with rheumatoid arthritis and stable disease due to drug shortage/expected shortage? (several answers)
   a) No
   b) Yes, prolonged the interval between tocilizumab administrations
   c) Yes, changed from intravenous to subcutaneous administration of tocilizumab
   d) Yes, changed from tocilizumab to sarilumab
   e) Yes, changed from tocilizumab to another DMARD
   f) Not applicable

34) Have you in the last weeks changed current treatment with tocilizumab in patients with giant cell arteritis and stable disease due to drug shortage/expected shortage? (several answers)
   a) No
   b) Yes, prolonged the interval between tocilizumab administrations
   c) Yes, changed from intravenous to subcutaneous administration of tocilizumab
   d) Yes, changed from tocilizumab to another DMARD
   e) Not applicable

35) Are other biological or targeted synthetic DMARDs used in your hospital/practice to treat patients with COVID-19? (several answers)
   a) No
   b) Yes, sarilumab
   c) Yes, baricitinib
   d) Yes, canakinumab
   e) Yes, anakinra
   f) Yes, other (specify)
   g) Don’t know

36) Do you generally recommend your patients with RMD to stop/decrease intake of NSAIDs even when they do NOT have COVID-19 symptoms in order to decrease the possible risk for a worse outcome of COVID-19?
   a) No
   b) Yes, decrease the dose / frequency of intake
   c) Yes, stop it completely

37) Do you generally recommend your patients with RMD to stop/decrease intake of glucocorticoids even when they do NOT have COVID-19 symptoms in order to decrease the possible risk for a worse outcome of COVID-19?
    a) No
    b) Yes, decrease the dose / frequency of intake
    c) Yes, stop it completely