ACR Open Rheumatology
Vol. 3, No. 6, June 2021, pp 381–389
DOI 10.1002/acr2.11239

American College of Rheumatology
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Social Distancing, Health Care Disruptions, Telemedicine Use, and Treatment Interruption During the COVID-19 Pandemic in Patients With or Without Autoimmune Rheumatic Disease

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Background. We aimed to compare concerns, social distancing, health care disruptions, and telemedicine use in patients with autoimmune rheumatic disease (ARD) and non-ARD and to evaluate factors associated with immunomodulatory medication interruptions.

Methods. Patients in a multistate community rheumatology practice network completed surveys from April 2020 to May 2020. Adults with common ARD (rheumatoid arthritis, spondyloarthritis, systemic lupus erythematosus) or non-ARD (gout, osteoarthritis, osteoporosis) were evaluated. Concerns about coronavirus disease 2019 (COVID-19), social distancing, health care disruptions, and telemedicine use were compared in patients with ARD versus non-ARD, adjusting for demographics, rural residence, and zipcode-based measures of socioeconomic status and COVID-19 activity. Factors associated with medication interruptions were assessed in patients with ARD.

Results. Surveys were completed by 2319/36 193 (6.4%) patients with non-ARD and 6885/64 303 (10.7%) with ARD. Concerns about COVID-19 and social distancing behaviors were similar in both groups, although patients receiving a biologic or Janus kinase (JAK) inhibitor reported greater concerns and were more likely to avoid friends/family, stores, or leaving the house. Patients with ARD were less likely to avoid office visits (45.2% vs. 51.0%, odds ratio [OR] 0.79 [0.70-0.89]) with similar telemedicine use. Immunomodulatory medications were stopped in 9.7% of patients with ARD, usually (86.9%) without a physician recommendation. Compared with patients with an office visit, the likelihood of stopping medication was higher for patients with a telemedicine visit (OR 1.54 [1.19-1.99]) but highest for patients with no visits (OR 2.26 [1.79-2.86]).

Conclusion. Patients with ARD and non-ARD reported similar concerns about COVID-19 and similar social distancing behaviors. Missed office visits were strongly associated with interruptions in immunomodulatory medication.

INTRODUCTION

Patients with common autoimmune rheumatic diseases (ARDs), such as rheumatoid arthritis (RA), psoriatic arthritis (PsA), ankylosing spondylitis (AS), and systemic lupus erythematosus (SLE), are known to be at increased risk of infection, with disease activity, immunomodulatory medications, and multimorbidity all contributing to this risk (1–5). It remains uncertain to what degree these autoimmune conditions and immunosuppressive medications increase the risk of severe coronavirus disease 2019 (COVID-19) (6–9), but the perception of increased risk could lead to greater patient and physician concerns about COVID-19 and a

This project received funding from the National Institutes of Health P30 BIGDATA core grant P30AR072583. Dr. George is supported by the National Institute of Arthritis and Musculoskeletal and Skin Diseases at the National Institutes of Health (K23 AR073931), P30 BIGDATA core grant NIH P30AR072583.

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Michael George has received research support from Bristol-Myers Squibb for unrelated work. Joshua Baker has received consulting fees from Bristol-Myers Squibb and Gilead. Peter Merkel has received consulting fees from AbbVie, AstraZeneca, Biogen, Boeringher-Ingelheim, Bristol-Myers Squibb, Celgene, ChemoCentryx, CSL Behring, Forbius, Genentech/Roche, Genzyme/Sanofi, GlaxoSmithKline, InflaRx, Insmed, Jannsen, Kiniksa, Magenta, Pfizer, Sparrow, and Talaris and research support from AstraZeneca, Boeringher-Ingelheim, Bristol-Myers Squibb, Celgene, ChemoCentryx, Forbius, Genentech/Roche, Genzyme/Sanofi, GlaxoSmithKline, and InflaRx and royalties from UpToDate. Maria Danila has received consulting fees from Amgen, Novartis, and Sanofi Regeneron and research support from Genentech, Pfizer, Boehringer,

greater impact on social distancing, avoidance of office visits or diagnostic testing, or stopping immunomodulatory medications. Several studies have found high rates of concern about COVID-19 and frequent health care disruptions in this population, with potential negative impact on their health (10–13). Whether patients with ARD have been disproportionately affected by the COVID-19 pandemic compared with other patients seen in rheumatology practices, however, remains uncertain.

In this study, we used information from a large community rheumatology practice–based network to better understand the concerns and behaviors of patients with ARDs compared with patients without ARDs seen at those same practices. We hypothesized that patients with ARDs would be more concerned about COVID-19, with more strict social distancing behaviors and more health care disruptions compared with patients without ARDs. In addition, we sought to identify factors associated with interruptions in medications, with a particular focus on the role of health care disruptions.

METHODS

The Autoimmune COVID-19 project has collected data from patients who are part of one of four patient-powered research networks of the Autoimmune Research Collaborative or who are members of online patient communities (11,12). In addition, patients with and without autoimmune conditions cared for by members of the American Arthritis and Rheumatology Associates (AARA) practice–based research network were emailed survey invitations. AARA is a network of community rheumatology practices (not affiliated with academic institutions) in the United States comprising approximately 300 full-time practicing rheumatology clinicians in 27 states. All four regions of the United States are represented, although approximately three-quarters of the practice is in the southern region (Supplemental Table 1). This study reports results of surveys completed April 22, 2020, to May 27, 2020, by patients seen in AARA practices.

Surveys collected data about what medications patients were currently taking, whether they had a respiratory illness in the previous 2 weeks or had been diagnosed with COVID-19, concerns about COVID-19, and the degree to which their rheumatic condition affected their concerns (each a five-point Likert scale). We assessed health care disruptions by asking patients if COVID-19 concerns had caused them to avoid office visits, laboratory testing, or other diagnostic testing, such as radiographs, providing the option "not applicable" if visits or testing were not needed. Social distancing behaviors were similarly assessed by asking whether COVID-19 concerns had caused them to avoid restaurants, friends/family, stores, or leaving the house (again with a "not applicable" option). Patients were also asked about any use of telemedicine ("telephone or telehealth visit") and whether they had stopped any of their immunomodulatory medications because of concerns about COVID-19.

Survey data were linked to the AARA electronic health record (EHR) data warehouse ("Columbus") to extract demographic information and rheumatic disease diagnoses. Patients' nine-digit ZIP codes were used to measure the Area Deprivation Index (ADI), a socioeconomic measure that includes domains of income, education, employment, and housing quality based on census block group from the American Community Survey (14). Rural versus urban county of residence was defined using National Center for Health Statistics classification (15). Tertiles of COVID-19 activity in the patient's county relative to all other counties in the United States were defined using the cumulative cases per capita on May 1, 2020 (the median date of survey response), weighting counties by population (16). Finally, door-to-door driving distance between each patient's residence and their rheumatologist's office address was computed based on estimates from Google Maps (Google).

Identifying patients with common autoimmune rheumatic conditions and a non-autoimmune comparator group. Using diagnoses listed from rheumatology office visits from the Columbus EHR data warehouse, we identified adults 18 years or older old with two or more clinician diagnoses on unique calendar dates (using all available data) for one of the following common ARDs: RA, spondyloarthritis (SpA) (including PsA and AS), or SLE. Patients who had two or more diagnoses for multiple conditions were categorized hierarchically in order to create mutually exclusive groups (SLE > SpA > RA) based on the expected specificity of these diagnosis codes, similar to methods in previous studies (11,17).

The comparator group with non-ARDS included patients with one or more diagnoses of gout, osteoarthritis, or osteoporosis (categorizing as gout > osteoarthritis > osteoporosis for patients with diagnoses for multiple conditions). From the non-ARD group, we excluded patients with any ARD diagnosis (RA, SpA, SLE, and also scleroderma, vasculitis, inflammatory bowel disease, myositis, Sjögren syndrome, and polymyalgia rheumatica). We also excluded patients from the non-ARD group if prescribing data in the EHR included use of any immunomodulatory drug other than glucocorticoids. Self-reported immunomodulatory drug use from survey responses was not an exclusion because this was available only in survey responders.

and Horizon for unrelated work. Jeffrey Curtis has received consulting fees from AbbVie, Amgen, Bristol-Myers Squibb, Corrona, Janssen, Lilly, Myriad, Pfizer, Regeneron, Roche, and UCB and research support from AbbVie, Amgen, Bristol-Myers Squibb, Corrona, Janssen, Lilly, Myriad, Pfizer, Regeneron, Roche, and UCB. Global Healthy Living Foundation (GHLF) receives grants, sponsorships and contracts from pharmaceutical manufacturers and private foundations. A full list of GHLF funders is publicly available here: https://www.ghlf.org/our-partners/. No other disclosures relevant to this article were reported.

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Submitted for publication January 4, 2021; accepted in revised form February 2, 2021.

Statistical analysis. *Assessing characteristics associated with survey response and creating survey weights to adjust for non-response bias.* The frequency of survey completion was assessed among all patients for each of the six different autoimmune or non-autoimmune rheumatic conditions of interest (as defined above). To assess characteristics associated with survey response and correct for potential nonresponse bias, a multivariable logistic regression model was created with survey completion as the outcome variable and covariates including type of rheumatic disease (each of the six conditions of interest as well as an "other" category), age (categorized), sex, race/ethnicity, region, ADI quintiles, driving distance from the rheumatology office in quintiles, rural versus urban, and tertiles of COVID-19 activity in the patient's county.

Similar logistic regression models with survey completion as the dependent variable were used to create survey weights based on the likelihood of survey response, stratified by rheumatic condition to assess whether the covariates had different effects in patients with different rheumatic conditions. To avoid overfitting, age was modeled as continuous instead of categorical with a squared term added to account for nonlinearity. Survey weights were calculated as 1 divided by the probability of survey response. Weights were calibrated to match the frequency of each rheumatic condition in the larger population. For all subsequent analyses, these survey weights were incorporated using Taylor Series Linearization methods for variance estimation with rheumatic conditions as strata (18). These weighted results provide results that better reflect the larger population of patients in the rheumatology practice with one of the rheumatic conditions of interest.

Comparing patients with autoimmune versus non-autoimmune rheumatic conditions. Characteristics of patients with ARDs were compared descriptively with patients with non-ARDs. Logistic regression models were used to compare concerns about COVID-19, social distancing behaviors, health care disruptions, and use of telemedicine in patients with ARDs versus those with non-ARDs, adjusting for age (categorized), sex, race/ethnicity, region, ADI quintiles, driving distance quintiles, rural versus urban, and COVID-19 activity tertiles. Separate models were used for each outcome. For models in which concerns about COVID-19 were the outcome, outcomes were dichotomized and defined as the patient reporting being extremely concerned (5 on a five-point Likert scale). For models assessing social distancing behaviors and health care disruptions, patients reporting that the measure was "not applicable" were excluded (not a response option for the question about telemedicine). The logistic regression models were used to predict the probability of each outcome in the autoimmune and non-autoimmune groups (the average marginal effect) at the means of all covariates. Because we hypothesized that concerns and behaviors might be different among patients receiving a biologic drug or a Janus kinase inhibitor (JAKi), analyses were repeated, restricting patients with autoimmune rheumatic conditions to those treated with one of these therapies.

Assessing factors associated with medication interruptions. The frequency of stopping an immunomodulatory drug (other than glucocorticoids) because of concerns about COVID-19 was assessed among patients in the ARD group who reported use of one of these therapies and did not report a respiratory illness or COVID-19 infection (to avoid cases in which the patient's illness led to medication interruptions). To identify factors independently associated with medication interruption, univariate logistic regression was performed for all covariates of interest, and covariates with $p < 0.1$ in univariate analysis were included in a multivariable model. In these analyses, health care visits were categorized as 1) office visit (patients who reported not avoiding an office visit), 2) telemedicine visit (those who avoided an office visit but had telemedicine), 3) neither (avoided an office visit and did not have telemedicine), or 4) not applicable (patients who answered "not applicable" to the question about avoiding an office visit and who did not have a telemedicine visit).

The study protocol was approved by the Advarra Institutional Review Board (Pro00042873) and explicit patient consent was obtained to participate. Stata version 16.0 (StataCorp) was used for all analyses.

RESULTS

Among 235354 patients in the rheumatology practice network, email addresses were available for 198308 (84.2%), with emails opened by 58694 (29.6%) of patients who received emails, and surveys were completed by 18355 (9.3%) of emailed patients. Completed surveys could be merged with EHR data for 15608 patients, representing 6.6% of the rheumatology practice network patients. After applying inclusion/exclusion criteria related to the underlying rheumatologic condition and immunomodulatory medication use, there were 100496 patients with a rheumatic condition of interest in the practice network of whom 9204 (9.2%) completed surveys. These totals included 36193 with a non-ARD of whom 2319 (6.4%) completed surveys and 64303 with an ARD of interest of whom 6885 (10.7%) completed surveys. Survey response was more common in patients who had an ARD, were 40 years or older but younger than 80 years old, White, non-Hispanic, of higher socioeconomic status (based on ADI), from urban counties, lived further from the rheumatology office (driving distance), or lived in areas of higher COVID-19 activity (Supplemental Table 1).

Table 1 shows the characteristics of the 2319 survey completers with a non-ARD and 6885 patients with an ARD, weighted to represent the larger population of 36193 and 64303 patients, respectively. RA was the most common ARD (62.4% of this group), and osteoarthritis was the most common non-ARD (65.3% of this group). Those with an ARD were younger (mean age 59.5 vs 68.0 years), of lower socioeconomic status, lived further from

Table 1. Characteristics of patients with autoimmune versus non-autoimmune rheumatic diseases

Parameter	Non-autoimmune rheumatic diseases	Autoimmune rheumatic diseases	Total
N	2319	6885	9204
Population represented	36 193	64 303	100 496
Age, mean	68.0 (10.5)	59.5 (16.1)	62.5 (14.7)
Female	75.1%	76.3%	75.9%
Race			
White	74.5%	74.4%	74.5%
Black	6.7%	10.1%	8.9%
Other	18.8%	15.5%	16.7%
Hispanic	15.0%	13.1%	13.7%
Region			
East North Central	3.6%	11.2%	8.5%
East South Central	1.1%	3.9%	2.9%
Mid-Atlantic	2.2%	2.9%	2.6%
Mountain	4.0%	6.2%	5.4%
New England	0.0%	0.2%	0.2%
Pacific	6.8%	7.0%	7.0%
South Atlantic	73.8%	57.1%	63.1%
West North Central	0.2%	1.3%	0.9%
West South Central	8.0%	10.1%	9.4%
Missing	0.2%	0.2%	0.2%
Area deprivation index quintile			
1	25.0%	18.4%	20.8%
2	20.7%	19.4%	19.9%
3	18.0%	18.8%	18.5%
4	18.1%	21.2%	20.0%
5 (least affluent)	18.2%	22.3%	20.8%
Driving distance from doctor's office, quintiles			
1	26.2%	19.6%	22.0%
2	20.1%	17.4%	18.4%
3	20.0%	20.9%	20.6%
4	17.5%	19.5%	18.8%
5 (furthest)	16.1%	22.6%	20.3%
Rural	3.2%	7.4%	5.9%
Missing urban/rural	1.0%	1.1%	1.1%
COVID-19 cases per capita, tertiles			
1	22.3%	28.9%	26.5%
2	33.9%	40.2%	37.9%
3	42.8%	29.8%	34.5%
Missing	1.0%	1.1%	1.1%
Rheumatic condition			
Rheumatoid arthritis	0.0%	62.4%	39.9%
Spondyloarthritis	0.0%	22.6%	14.4%
Systemic lupus erythematosus	0.0%	15.0%	9.6%
Gout	13.1%	0.0%	4.7%
Osteoarthritis	65.3%	0.0%	23.5%
Osteoporosis	21.6%	0.0%	7.8%
Medications[a]			
Biologics/JAK inhibitor	-	48.2%	31.6%
Methotrexate	-	34.0%	22.0%
Hydroxychloroquine	-	25.7%	16.8%
Glucocorticoids	8.7%	24.2%	18.6%
Physician diagnosis of COVID-19	0.4%	0.6%	0.5%

Note. Mean (standard deviation) and proportions incorporate survey weighting to reflect the larger rheumatology practice population, based on the likelihood of survey response.
Abbreviations: COVID-19, coronavirus disease 2019; JAK, Janus kinase.
[a] Medication use here is based on patient self-report. Patients with non-autoimmune conditions were excluded if electronic health record data included prescriptions for immunomodulatory medications other than glucocorticoids, but a small proportion of included patients reported biologic/JAK inhibitor use (2.0%), methotrexate (0.8%), and hydroxychloroquine use (1.0%).

the physician's office, more often lived in a rural county, and less often lived in a county in the top tertile of COVID-19 activity. Glucocorticoid use was substantially more common in the ARD group (24.2% vs 8.7%). Few patients reported a diagnosis of COVID-19, with no significant difference between the groups (0.4% of non-ARD vs 0.6% of ARD, $p = 0.15$).

Concerns, social distancing behaviors, health care disruptions, and telehealth use. In analyses adjusted for demographics, geography, and socioeconomic status (see Methods section for details), there were no significant differences between the non-ARD and ARD groups in the frequency of reporting extreme concern about COVID-19 (5 on a five-point Likert scale). There were also no differences in most social distancing behaviors, including avoiding restaurants, avoiding friends or family, and avoiding leaving the house (Figure 1A, Supplemental Table 2). Patients with ARD were more likely to report avoiding stores (62.4% vs 58.7%, odds ratio [OR] 1.17 [95% confidence interval (CI): 1.04-1.32]), although differences were small. Those with ARD were substantially more likely to report that their rheumatic condition extremely affected their concerns about COVID-19 (41.8% vs 20.3%, OR 2.82 [95% CI: 2.46-3.24]).

Differences between the two study groups were more pronounced, however, when comparing patients with non-ARDs to

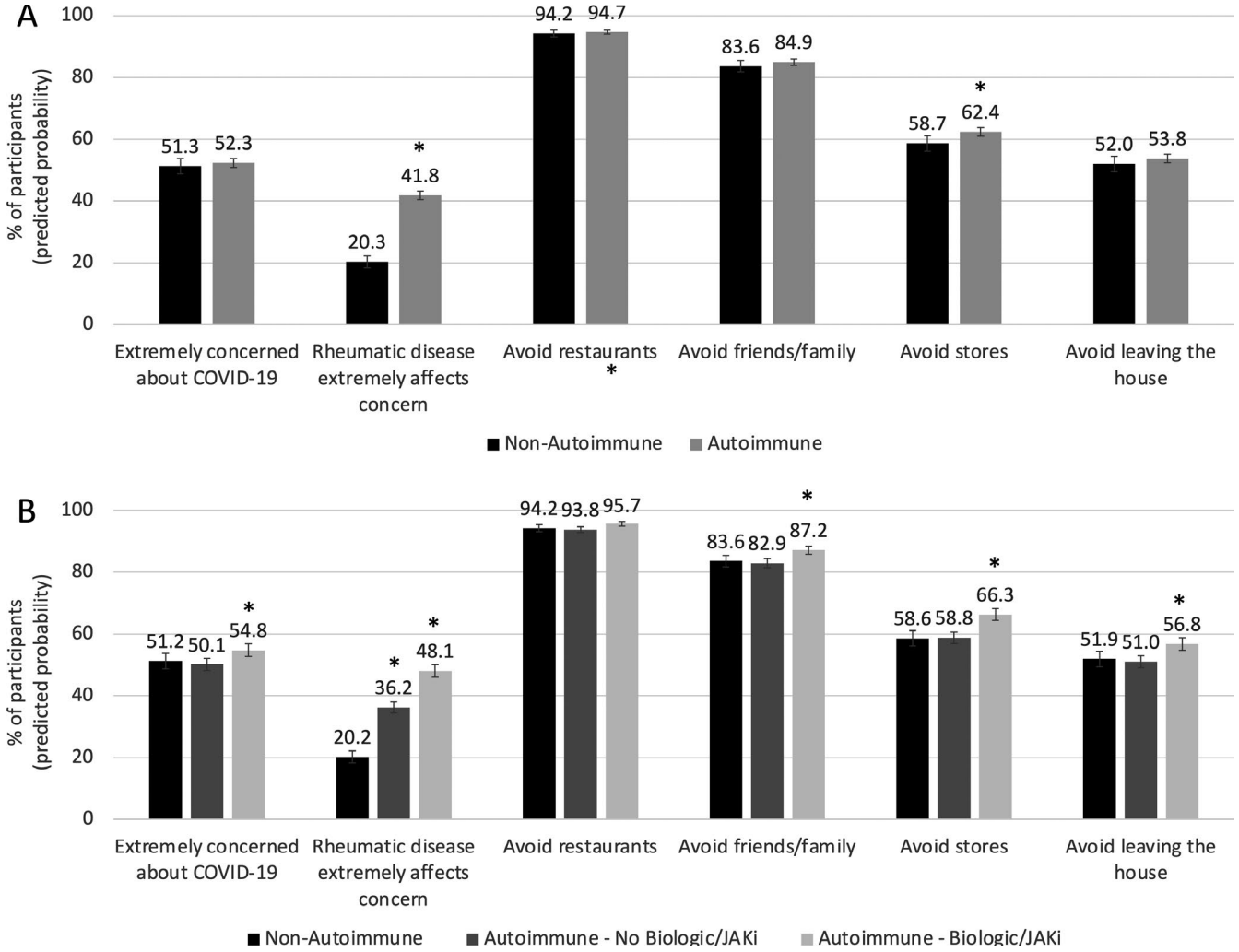

Figure 1. Differences in coronavirus disease 2019 (COVID-19) concerns and social distancing behaviors in patients with autoimmune vs non-autoimmune rheumatic conditions. **A**, Results from logistic regression models adjusted for age, sex, race, ethnicity, region, Area Deprivation Index, driving distance, rural, and COVID-19 activity with marginal predicted probabilities in patients with autoimmune or non-autoimmune rheumatic conditions obtained at the means of all covariates in the model. **B**, Results from identical analyses except that patients are categorized as having non-autoimmune rheumatic conditions, autoimmune rheumatic conditions not receiving a biologic or Janus kinase inhibitor (JAKi), or autoimmune rheumatic conditions receiving a biologic or JAKi. Error bars represent 95% confidence intervals.
*$p < 0.05$ compared with patients with non-autoimmune rheumatic conditions. In panel **B**, whenever significant differences are shown for patients with autoimmune rheumatic disease on a biologic or JAKi vs patients with non-autoimmune rheumatic conditions, differences were also significant with $p < 0.05$ when comparing patients with autoimmune rheumatic conditions receiving versus not receiving a biologic or JAKi.

patients with ARD who were receiving a biologic or JAKi. Patients on a biologic or JAKi demonstrated significantly greater concerns about COVID-19 and were significantly more likely to avoid restaurants, avoid stores, avoid friends or family, or avoid leaving the house (Figure 1B, Supplemental Table 3).

In similar adjusted analyses, patients with autoimmune disease were less likely to avoid office visits (predicted probability 45.2% vs 51.0%, OR 0.79 [95% CI: 0.70-0.89]) and avoid laboratory tests (34.9% vs 38.8%, OR 0.84 [95% CI: 0.73-0.96]) (Figure 2, Supplemental Table 2). Avoidance of other tests and telemedicine use were not significantly different between groups. Results were similar when evaluating the subgroup of patients receiving a biologic or JAKi (Supplemental Table 3).

Full models for the above analyses are shown in Supplemental Tables 4–6. COVID-19 concerns were significantly more common in patients who were older, female, racial/ethnic minorities, and who lived in urban versus rural areas and in areas of higher COVID-19 activity. Social distancing measures and health care disruptions were also more common among patients who were female and who lived in areas of higher COVID-19 activity.

Stopping immunomodulatory medications. Among 5730 patients with an ARD who were on immunomodulatory medications who did not report respiratory illness or COVID-19 infection, there were 570 (9.9%) patients who reported stopping an immunomodulatory medication because of concerns about COVID-19, weighted to represent 5152/53 325 (9.7%) patients stopping a medication in the larger rheumatology practice population. The majority (86.9%) of medication interruptions were not recommended by a physician. Patients who were older, of lower socioeconomic status, or who had SLE were less likely to stop medications, whereas those in rural counties, receiving biologics, or JAKi or who had SpA were more likely to stop medications (Table 2). Associations between SLE and medication interruptions were not significant in analyses excluding patients who were only receiving hydroxychloroquine/chloroquine (OR 0.79 [0.54-1.16], full model not shown). No major differences in the likelihood of stopping medications was seen in patients receiving biologics by infusion versus not by infusion.

Office visits and telehealth use were strongly associated with interruptions of medication. Compared with patients who had an office visit, those who had avoided an office visit and did not have a telehealth visit were at the highest risk of stopping a medication (OR 2.29, 95% CI: 1.81-2.89) (Table 2). Patients who had a telemedicine visit were at greater risk of stopping a medication than those with an office visit (OR 1.54, 95% CI: 1.19-1.99) but at lower risk than patients who had neither an office nor a telemedicine visit (OR 0.67, 95% CI: 0.51-0.88).

DISCUSSION

In this study of patients from a large community rheumatology practice network, we found similar concerns about COVID-19 and similar social distancing behaviors in patients with ARD compared with those with non-ARD, demonstrating that the pandemic has broadly affected patients seen by rheumatologists. Patients in both groups had frequent interruptions in their health care and, of concern, 10% of patients on immunomodulatory medications had stopped a medication because of concerns about COVID-19, usually without the recommendation of their treating rheumatologist. Health care disruptions appear to have exacerbated these medication interruptions, with the highest rate of interruptions among patients who had neither office nor telemedicine visits.

We expected that concerns about a possible increase in the risk of severe COVID-19 in patients with ARD would lead

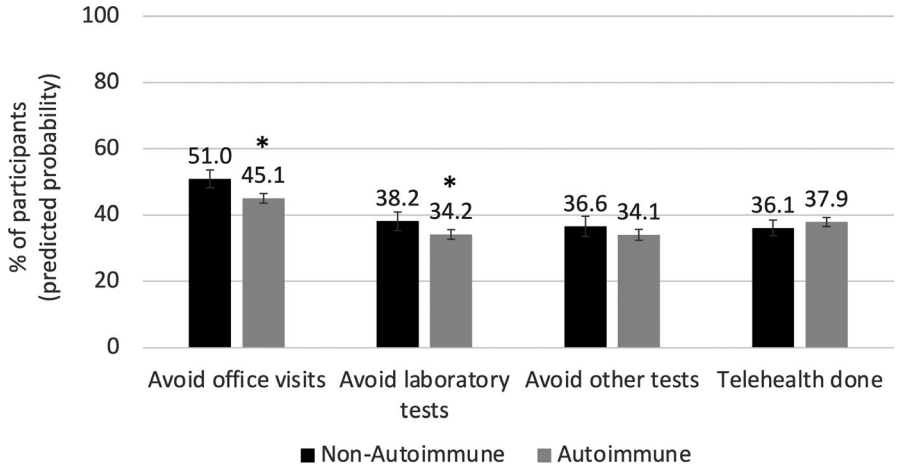

Figure 2. Use and avoidance of rheumatologic monitoring and health care in patients with autoimmune vs non-autoimmune rheumatic conditions. Results from logistic regression models adjusted for age, sex, race, ethnicity, region, Area Deprivation Index, driving distance, rural, and coronavirus disease 2019 activity with marginal predicted probabilities in patients with autoimmune or non-autoimmune rheumatic conditions obtained at the means of all covariates in the model. Error bars represent 95% confidence intervals for these estimates. *$p < 0.05$

Table 2. Factors associated with medication interruptions among patients with autoimmune rheumatic conditions receiving immunomodulatory medications

Parameter	Medication Interruption OR (95% CI) N = 5730 Population size: 53 325
Health care visits	
Office visit	Reference
Telemedicine visit	1.54 (1.19-1.99)
Neither	2.29 (1.81-2.89)
Not applicable	1.32 (0.89-1.95)
Age, y	
<40	Reference
40-50	0.85 (0.59-1.20)
50-65	0.74 (0.54-1.02)
65-80	0.54 (0.39-0.77)
≥80	0.23 (0.11-0.47)
Region	
East North Central	Reference
East South Central	1.23 (0.66-2.27)
Mid-Atlantic	0.36 (0.15-0.85)
Mountain	0.63 (0.37-1.08)
New England	0.70 (0.10-5.09)
Pacific	1.27 (0.82-1.96)
South Atlantic	0.82 (0.62-1.09)
West North Central	1.15 (0.40-3.24)
West South Central	0.92 (0.62-1.36)
Area Deprivation Index Quintile	
1 (most affluent)	Reference
2	1.13 (0.87-1.46)
3	0.70 (0.52-0.94)
4	0.69 (0.50-0.95)
5 (least affluent)	0.71 (0.52-0.98)
Urban/Rural	
Urban	Reference
Rural	1.90 (1.27-2.85)
Missing	0.85 (0.32-2.23)
Biologics or JAKi (vs none)	1.53 (1.22-1.90)
Glucocorticoids	0.86 (0.67-1.11)
Autoimmune disease	
Rheumatoid arthritis	Reference
Spondyloarthritis	1.28 (1.03-1.60)
Systemic lupus erythematosus	0.63 (0.45-0.89)

Note. Results from a multivariable logistic regression model, excluding the following variables with $p > 0.1$ from univariate analyses: female, race/ethnicity, methotrexate, driving distance, county COVID-19 cases per capita tertiles.
Abbreviations: CI, confidence interval; COVID-10, coronavirus disease 2019; JAKi, Janus kinase inhibitor; OR, odds ratio.

to greater concerns and stricter social distancing behaviors in patients with autoimmune conditions but were surprised to find that these concerns and behaviors were quite similar in the two groups. Patients on a biologic drug or JAKi did have somewhat greater concerns and reported stricter social distancing, but differences were small even among this population. Social distancing behaviors may have been driven largely by local restrictions, policies, and COVID-19 activity. In addition, because a large majority of both groups reported avoiding friends and family and avoiding restaurants, a ceiling effect may have prevented the detection of differences between the groups.

Previous studies about the COVID-19 pandemic have shown high rates of social distancing in patients with autoimmune disease, with patients reporting strict social distancing also having lower quality of life (19,20). Few studies, however, have compared social distancing with a control population. A study from the Netherlands asked patients with autoimmune conditions to select controls from close family or friends and found that patients with autoimmune conditions were more likely to practice strict social distancing behaviors (staying indoors as much as possible with complete social isolation) (21). Our finding that social distancing behaviors were similar to controls could be due to differences in the control population (patients with non-ARDs in our study), between-country attitudes, or in how questions were asked (eg, "avoiding activities" vs asking about complete isolation). Our results have implications for studies examining risk of COVID-19 in patients with ARD, as differences in social distancing behaviors are likely to have important effects on the rates of developing COVID-19. These results suggest that patients with other rheumatologic diseases may be a better comparator for those with ARD than a sample of the general population. The finding that patients treated with a biologic drug or JAKi had greater concerns and reported somewhat stricter social distancing, however, highlights the challenge of these analyses.

Disruptions in regular medical care were common in both groups, with frequent avoidance of office visits and routine testing. Patients with ARD were less likely to report avoiding an office visit or laboratory testing and had similar rates of telemedicine use to those with non-ARD. These results likely reflect the greater need for close follow-up and the need for laboratory monitoring of medications among patients with an ARD.

A potential consequence of these disruptions in medical care is a resulting interruption in medication use. We found that 10% of patients receiving immunomodulatory medications had stopped one of their medications because of concerns about COVID-19, even if they were well with no COVID-19 diagnosis or respiratory illness. Most medication interruptions were not recommended by a physician, similar to results from previous studies (10–12,22,23). Guidance from the American College of Rheumatology recommends not stopping medications unless patients have contracted or been exposed to severe acute respiratory syndrome coronavirus 2, although this guidance was first published in April 2020 and was not available when many patients answered their surveys (24).

Patients who avoided an office visit and did not have a telemedicine visit in its place were more than twice as likely to have stopped one of their medications compared with patients who had office visits. Medication interruptions in these patients may have been driven by an inability to discuss the pandemic and their medication concerns with their provider or an inability to receive needed medication refills. It is also possible that patients chose not to go to appointments because they had stopped their medications or that missed office visits reflect overall greater nonadherence to treatment.

Patients who used telemedicine were also substantially less likely to have stopped a medication compared with patients who had no visits, although telemedicine users were more likely to have stopped a medication than patients who had an in-person office visit. Differences compared with patients seen in the office could reflect different concerns about COVID-19 in patients choosing telemedicine, although we could not distinguish telemedicine visits selected by patients versus those dictated by rheumatology practices. In the setting of the pandemic, telemedicine provides an important way to maintain contact with patients who are hesitant or unable to attend office visits (25,26), and the results of our study suggest that discussing patient concerns about medications should be a priority for these visits. Continued research on how to maximize the effectiveness of telemedicine is needed, as well as on how to best integrate telehealth into routine rheumatology care in the future.

We also found that patients receiving a biologic or JAKi were more likely to stop a medication (11,27), perhaps reflecting greater concern among this population and the perception that these medications may place patients at higher risk of complications of COVID-19. Interestingly, older patients were less likely to have stopped medications, even though these patients are at greater risk of severe COVID-19.

The nesting of this survey study within a large rheumatology practice network with detailed EHR data, and the ability to identify a true denominator of patients seen within the clinical practice, provided the opportunity to assess factors associated with survey response and to use survey weights to better reflect the larger practice population. Patients who were from racial/ethnic minority groups, who had lower socioeconomic status, or who were elderly were less likely to respond to the survey. These results raise the concern that in this study (and in other similar studies) responders might not adequately represent these vulnerable populations. We applied survey weights to partially correct for this response bias, but efforts to reach vulnerable populations more broadly are important for identifying disparities in care. Additionally, patients with ARD were almost twice as likely to respond to the survey as those with non-ARD, which could reflect greater interest in or concern about COVID-19 among patients with ARD or closer relationships with the rheumatology practice for these patients.

Several limitations of this study are important to note. Despite assessing factors associated with survey response and accounting for these factors with weighting, patients with greater COVID-19 concerns may have been the most likely to respond to surveys, making the ARD and non-ARD groups appear more similar to each other. Comorbidities were not explicitly assessed and could also affect concerns and behaviors, although we might expect that patients with autoimmune rheumatic conditions would be expected to have greater multimorbidity, leading to greater concerns (5). We also could not assess the impact of disease severity on outcomes. A five-point scale may not have been sufficient to separate out small differences in patient concerns about COVID-19, and although several questions about social distancing were asked, more detailed questions about the frequencies of different activities, face mask use, and questions about employment might have revealed greater differences between the groups.

In conclusion, the pandemic has broadly affected patients cared for by rheumatologists. Although patients with ARD have substantial concerns about COVID-19 related to their autoimmune condition, clinicians should be aware of the need to address patient concerns and manage health care disruptions across their practice. Identifying and communicating with patients who have missed office visits is particularly important because these patients are at high risk of stopping their medications. Telemedicine appears to partially offset medication interruptions, and better methods to standardize and optimize telemedicine approaches to rheumatology care delivery are needed.

AUTHOR CONTRIBUTIONS

All authors contributed to drafting the article or revising it critically for important intellectual content. All authors provided final approval of the version of the article to be published.

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Acquisition of data. George, D Curtis, Gavigan, Stewart, Xie, J Curtis.

Analysis and interpretation of data. George, Baker, Merkel, Xie, J Curtis.

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