Response to: 'Incidence of severe COVID-19 in a Spanish cohort of 1037 patients with rheumatic diseases treated with biologics and JAK-inhibitors' by Jovani *et al*

We appreciate the comments by Jovani *et al*[1] in response to our manuscript evaluating the outcomes among a cohort of patients with rheumatic diseases and COVID-19.[2] We commend the authors for sharing the experience of their patients during the COVID-19 pandemic and would like to reply to some of the queries they posed to us.

First, Jovani *et al* wondered why we included age in our multivariable models if we matched on age. This was done because continuous age was matched over a range (±5 years). To further address any potential differences in ages between the study groups (which was minimal), we included age in our multivariable models. Notably, adjusting for age did not change our findings when comparing adjusted to unadjusted models.

Second, the authors questioned why lymphopaenia and troponin levels were not included in the multivariable models. These laboratory changes may be a result of infection that occurred after the exposure of interest (COVID-19 infection). As such, they should not be adjusted for in models because they may be on the causal pathway between the exposure and outcome (eg, mechanical ventilation and death). Further, these tests were performed as part of clinical care and not as a research protocol and so may only have been performed among patients who were hospitalised.

Third, Jovani *et al* commented that we did not have a denominator from which to estimate the risk of COVID-19 infection for patients with rheumatic diseases. While we agree this is of interest, that was not the purpose of our study since all patients in our study had documented COVID-19 infection. We hope that future studies evaluate the susceptibility of infection for patients with rheumatic diseases. While surveys are a convenient tool during a pandemic, they may underestimate the detection of severe infections because these cannot be completed by patients who are critically ill or have died. Self-report of infection on a survey may also have limitations related to accuracy and availability of testing.

We appreciate the details of patients from the authors' practice who developed COVID-19 and would also be interested in how it was determined whether each patient did or did not have a COVID-19 infection. We believe that it is important to include details of how cases were identified in studies describing rheumatic disease patient outcomes in the COVID-19 pandemic, given the variability in presentations and testing availability and accuracy. In contrast to a survey design, we identified our rheumatic disease population among the cohort of patients who were diagnosed with COVID-19 by PCR testing in the Partners HealthCare System (PHS). Of note, PHS is the largest healthcare system in the greater Boston, Massachusetts, area, which has a population of approximately five million people, increasing our ability to observe a more complete picture of the impact of COVID-19 in patients with rheumatic diseases. As we found in our study and has been suggested in other studies,[3–5] there is variability in the severity of COVID-19 infection in the general population and in those with rheumatic diseases. The detection of severe cases will likely be impacted by the size of the cohort, the method used to identify cases, the distribution of demographics and comorbidities in the group being studied, the rheumatic diseases represented in the cohort and other factors.

In the context of the evolving pandemic, data regarding outcomes of COVID-19 infection in patients with rheumatic disease are welcome and should be encouraged. Each will have its own strengths and weaknesses, but the collective efforts of all contributing to the public space will be valuable to inform how we educate and manage patients living with rheumatic diseases. We agree that our findings should certainly not be taken to imply that patients should discontinue any of their existing medications. We agree with recommendations set forth by the American College of Rheumatology regarding the management of rheumatic diseases during the COVID-19 pandemic.[6] We do not know the impact of immunosuppression on the risk of COVID-19 infection or outcomes of COVID-19 infection. Additional work is needed to understand why patients with rheumatic diseases may be at higher risk of mechanical ventilation, as observed in our study and that by Ye *et al*.[7]

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Contributors KMDS, NS-B, RW, TH, JAS and ZSW contributed to the conception and drafting of the article. All listed authors provided critical revision for important intellectual content and final approval.

Funding KMDS and NS-B are supported by the National Institutes of Health (NIH) Ruth L. Kirschstein Institutional National Research Service Award (T32-AR-007258). JAS reports grants from NIH/National Institute of Allergy and Infectious Diseases/Autoimmune Centers of Excellence, the Rheumatology Research Foundation, the Brigham Research Institute and the R. Bruce and Joan M. Mickey Research Scholar Fund, as well as personal fees from Bristol-Myers Squibb, Gilead, Inova, Janssen and Optum. ZSW reports research grants from NIH/National Institute of Arthritis and Musculoskeletal and Skin Diseases (K23AR073334 and L30 AR070520) and Bristol Myers Squibb.

Competing interests None declared.

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

Patient consent for publication Not required.

Provenance and peer review Commissioned; internally peer reviewed.

To cite D'Silva KM, Serling-Boyd N, Wallwork R, *et al*. *Ann Rheum Dis* Epub ahead of print: [*please include* Day Month Year]. doi:10.1136/annrheumdis-2020-218179

Received 3 June 2020
Accepted 5 June 2020

Linked

► http://dx.doi.org/10.1136/annrheumdis-2020-218152

Ann Rheum Dis 2020;**0**:1–2. doi:10.1136/annrheumdis-2020-218179

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