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**Article:**

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**Short running head:**

**COVID-19 impact on non-adherence**

**Full title of manuscript:**

**The impact of COVID-19 on medication adherence in a rheumatoid (BRAGGSS) and psoriatic arthritis (OUTPASS) UK cohort**

**Authors complete given names:**

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**Funding statement (Sources):**

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A list of OUTPASS and BRAGGSS collaborating sites and authors is available in the appendix.

**Conflicts of interest:**

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**Key message:**

COVID-19 impacted adherence to immunosuppressive therapies in psoriatic and rheumatoid arthritis UK patients.

**Key indexing Terms (MeSH)**

(COVID-19)(Medication Adherence)(Arthritis, Psoriatic)(Arthritis, Rheumatoid)

**Ethics statement:**

This study complies with the Declaration of Helsinki, the locally appointed ethics committee has approved the research protocol and that written informed consent has been obtained from the subjects (or their legally authorized representative). BRAGGSS-MREC No: 04/Q1403/37. OUTPASS-REC ref: 13/NW/0068.

**Data availability statement:**

The data that support the findings of this study are available on request from the corresponding author, JB. The data are not publicly available due to privacy/ethical restrictions.

Dear Editor,

Suboptimal treatment adherence has been reported in patients with arthritic diseases, is associated with psychological factors, including anxiety, and correlates with future treatment response (1,2). During the COVID-19 pandemic, patients identified as 'clinically extremely vulnerable', including people prescribed  $\geq 2$  immunosuppressives, were advised to shield and continue treatment unless they developed COVID-19 symptoms. The aim of this multi-centre study was to investigate the impact of the COVID-19 pandemic on adherence to disease modifying anti-rheumatic drugs (DMARDs) in patients with established rheumatoid arthritis (RA) and psoriatic arthritis (PsA) in the UK.

Between August 2020 and June 2021, RA and PsA patients from two multi-centre observational studies (BRAGGSS and OUTPASS) who were within 12 months of commencing biologic or targeted synthetic DMARDs, were sent a questionnaire on adherence and medication perceptions. Adherence during the COVID-19 pandemic was assessed using a 5-point Likert scale, as described previously (2,3), and the reason for non-adherence recorded. Pandemic adherence was compared to paired pre-pandemic data (prior to 2020), where available, using similar questionnaires. Summary statistics for pandemic and pre-pandemic data, and Pearson's chi-squared ( $\chi^2$ ) tests were used to investigate variables associated with self-reported non-adherence. Linear and logistic regression were used to investigate association between returning questionnaires, Hospital Anxiety and Depression Scale (HADS) and drug response.

One hundred and fifty-nine questionnaires were returned (81.1% RA and 18.9% PsA). Seven patients reported COVID-19 symptoms with five testing positive and two being hospitalised. Methotrexate (53.5%) was the most frequently prescribed agent, followed by etanercept (25.2%), sulfasalazine (22.6%), adalimumab (22.0%) and hydroxychloroquine (21.4%), with 72.3% of patients being prescribed  $\geq 2$  immunosuppressives. In the PsA cohort there was no significant association between questionnaire responders/non-responders and 6-month drug response, demonstrating no evidence of responder bias. Information was not available in the RA cohort. Of patients with adherence

information, 43.2% reported missing or delaying a treatment dose. Of those that missed or delayed therapy, 59.7% reported non-medically advised non-adherence. Overall, this resulted in 25.8% of patients self-reporting non-adherence during COVID-19.

There was no significant difference in non-adherence rates between the different DMARDs.

Furthermore, there was no association between disease type (RA vs. PsA) or perception of disease control (good vs. bad) and adherence. Of non-adherent patients, 22.5% reported increased anxiety and fear of a greater risk of infection due to the COVID-19 pandemic as an influencing factor; 25.0% listed non-COVID-19 intentional reasons such as fear of treatment, side-effects and aversion to injections, while 55.0% reported non-intentional reasons, with forgetting and lack of treatment availability listed most frequently, similar to previous literature (4,5). A higher HADS-T score was associated with increased self-reporting missing or delaying a dose of treatment [Odds Ratio=1.11 (95% Confidence Interval:1.01-1.14), p-value=0.01], however there was no significant association with non-medically advised non-adherence during COVID-19.

Considering pre-pandemic data, 26.7% of the OUTPASS cohort had adherence information available, with 100.0% self-reporting complete adherence within the first 3 months of treatment. In the BRAGSS cohort 21.7% had pre-pandemic adherence information available. Of these patients 25.0% reported non-adherence within the first 3 months of treatment. Compared to pre-pandemic data, non-adherence was seen to increase during the pandemic for both RA and PsA patients. In international cohorts, non-adherence of patients on immunosuppressive therapy, was described at similar levels (**Table 1**) (4,6–8).

Throughout the pandemic, there was a vast amount of conflicting information, which may have contributed to increased anxiety and exacerbated symptoms in patients prescribed immunosuppressants (4,5). By contrast, patients with higher adherence had lower levels of relapse (7). In one cohort, only one patient that stopped therapy did not restart following reassurance, highlighting the benefits of good communication skills (7). This was supported by findings from the

current study, with one patient describing stopping treatment due to fear of COVID-19 before restarting after discussion with their Rheumatology team.

Strengths of the study include the multi-centre recruitment, inclusion of patients with both RA and PsA and the availability of pre-pandemic adherence data. Despite this, adherence information was only available for 3-months following treatment commencing, which could have led overestimated treatment adherence. Limitations include the inability to explore the influence of telemedicine which, may support higher levels of adherence due to a continuation of disease management (8).

In this multi-centre UK study of patients with RA and PsA commencing anti-rheumatic therapy 12 months prior, non-adherence during COVID-19 was captured at a national level and showed an increase in these patients compared to pre-pandemic available data. Increased anxiety and fear of infection were contributory factors to non-adherence. Lack of clear communication was cited as a reason for non-adherence both in the current UK study and in previous reports internationally.

Clear, non-judgemental, and transparent communication and further education about infection risk in immunosuppression are pivotal for improving adherence behaviours and potential drug response in immunosuppressed patients in the context of infectious diseases.

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## **Appendix:**

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