**Proceedings Paper:**
Hensor, EMA, McKeigue, P, Conaghan, PG et al. (2016) Validity of a 2-Component Disease Activity Score for Accurate Assessment of Synovitis in Rheumatoid Arthritis. In: Arthritis and Rheumatology. ACR/ARHP Annual Meeting, 11-16 Nov 2016, Washington, DC, USA. Wiley-Blackwell. ISSN: 2326-5191. EISSN: 2326-5205.

# Validity of a 2-Component Disease Activity Score For Accurate Assessment of Synovitis in Rheumatoid Arthritis

Hensor EMA[1,2], McKeigue PM[3], Conaghan PG[1,2], Buch M[1,2], Barrett JH[1,4], Nam JL[1,2], Colombo M[3], Spiliopoulou A[3], Agakov F[3], Kelly S[5], Lewis M[5], IACON Consortium[1,2], PEAC Consortium[5], Pitzalis C[5], Emery P[1,2], Morgan AW[1,2]

1. NIHR-Leeds Musculoskeletal Biomedical Research Unit, Chapel Allerton Hospital, Leeds, LS7 4SA
2. Leeds Institute of Rheumatic and Musculoskeletal Medicine, University of Leeds, Chapel Allerton Hospital, Leeds, LS7 4SA
3. Centre for Population Health Sciences, University of Edinburgh, Edinburgh, UK
4. School of Medicine, University of Leeds, Leeds, LS2 9JT
5. Barts and the London School of Medicine and Dentistry, William Harvey Research Institute, Queen Mary University of London, London, UK

**Background:**

The original Disease Activity Score (DAS) was derived from clinicians' therapeutic decisions[1], which may have been influenced by patient-subjective factors such as general health status and joint tenderness. Modern imaging allows accurate measurement of synovitis and provides an objective standard against which to derive an updated DAS. We aimed to identify alternative forms of the DAS28 that are more strongly associated with ultrasound (US) measures of synovial inflammation than existing definitions.

**Methods:**

Patients were included from 2 observational early RA cohorts [Inflammatory Arthritis CONtinuum (IACON n=433) and Pathobiology of Early Arthritis Cohort (PEAC n=117)], and a clinical trial (IDEA n=89); all satisfied ACR 1987 and/or ACR/EULAR 2010 criteria for RA. Data were available at repeated time-points [weeks 0, 26, 52, 78, 104 (IACON); 0, 26 (PEAC); 0, 50, 78 (IDEA)]; US scan was within 1 week of clinical exam. In IACON and IDEA US grey scale and power Doppler scores (0-3) for bilateral wrists, knees, MCPs 2&3, PIPs 2&3 and MTPs 1-5 were combined into a global GSPD score with Rasch analysis. In PEAC global GSPD was GS+PD in bilateral MCPs 1-5. Using linear mixed models with random intercepts for within-patient clustering we modelled the association in each cohort between GSPD and: original 4-component (4C) DAS28CRP score, a 2-component (2C) score with weights for SJC28 (0.15) and lnCRP+1 (0.49) from an existing MRI-based equation[2], and DAS28CRP components [SJC28, CRP or TJC28, SJC28, CRP, general health VAS (GH)]. We compared models using restricted maximum likelihood deviance. Multiple imputation addressed missing data. Analyses used R v3.2.5.

**Results:** Models included 843, 237 and 183 visits from IACON, IDEA and PEAC respectively. Using DAS28 scores, deviance differences favoured 2C-DAS28 for

IACON (2C-4C: -31) and PEAC (-16) but original 4C-DAS28 in IDEA (8). Nevertheless, using individual components, in all 3 studies only SJC28 and CRP were associated with GSPD. Coefficients from models using individual components are presented in Table 1. Despite differences in joints measured and methods of creating GSPD, the ratio of coefficients in the 2C models (SJC:CRP) were consistent: IACON 2.2, IDEA 2.1, PEAC 2.5.

**Conclusion:** Using a more objective measure of synovial inflammation, US-derived GSPD, the subjective elements of the DAS28 equation (TJC28, GH) can potentially be removed without loss of association with underlying synovitis and their removal may even improve the association. A 2-component DAS28CRP would simplify clinical examination and reduce the likelihood of missing data in clinical studies. This has the potential to improve patient care by targeting escalation of therapy to those with synovitis. Additional modelling will determine optimal weights for a 2-component DAS28CRP.


1. van der Heijde DM et al. J Rheumatol. 1993;20:579-81.
2. Baker et al. Arthritis Rheum. 2014;66:794-802.


| **Covariate** | **Coefficient (SE) for association with GSPD** | |
|---|---|---|
| **IACON** | **4-component** | **2-component** |
| sqrt(SJC28) | 1.06 (0.13) | 1.03 (0.10) |
| ln(CRP+1) | 0.48 (0.13) | 0.46 (0.12) |
| sqrt(TJC28) | -0.02 (0.11) | |
| GH VAS | 0.00 (0.01) | |
| **IDEA** | **4-component** | **2-component** |
| sqrt(SJC28) | 0.84 (0.27) | 1.18 (0.18) |
| ln(CRP+1) | 0.52 (0.24) | 0.57 (0.22) |
| sqrt(TJC28) | 0.39 (0.22) | |
| GH VAS | 0.00 (0.01) | |
| **PEAC** | **4-component** | **2-component** |
| sqrt(SJC28) | 5.48 (1.00) | 5.32 (0.68) |
| ln(CRP+1) | 2.17 (0.66) | 2.09 (0.65) |
| sqrt(TJC28) | 0.17 (0.88) | |
| GH VAS | -0.02 (0.03) | |

**Table 1:** Associations between DAS28CRP components and GSPD in each cohort