Background: Flare, relapse from status of treat-to-target (T2T, DAS28<=3.2), is hard predicted. We try to make it predictable by applying machine learning to a database from smart system of disease management (SSDM). SSDM is an interactive mobile disease management APPs.

Objectives: To develop and validate machine learning algorithms for flare prediction in RA.

Methods: Patients were trained using SSDM and input their data, including demographic, comorbidities (COMBs), lab test, medications and monthly self-assessments, including DAS28, HAQ, SF-36, Hospital Anxiety and Depression Scale (HADS). The data was uploaded to cloud and synchronized to the mobile of authorized rheumatologists. The COMBs were by ICD-9, and medications were listed as cDMARDs, Bio (BioDMARDs), NSAIDs, Steroid, FS (food supplements), MC (medicine for COMBs), TCM (Traditional Chinese Medicine), and combinations.

Results: From Jan of 2015 to Jan of 2020, 8811 RA patients, 85% female and 15% male, used to reach T2T. 4556 were flare-free and 4255 suffering at least one flare. The average 160 attributes were extracted from each flare-free patient at time of reaching T2T, and each flare patients at time of 3 months before the flare. Patients were randomly assigned as model setup (training) group (70%) and validation (testing) group 30%.

For training, data were processed using Python with statistical analyses in R. In R, random forests were implemented. Logistic regression via glm in base R. The random forest comprises a set of decision trees. "Splits" in the decision trees reflect binary (i.e., yes/no) respect to attributors. Bootstrapping was used to assess, quantify, and adjust for model optimism. Model performance was evaluated using AUC, precision and recall metrics. Brier scores for accuracy of probabilistic predictions ranged from 0 to 1 (0 is perfect discrimination).

The testing showed model performance for prediction windows are 0.78 for AUC (95% CI), 0.71 for Recall (sensitivity), 0.195 for Brier score, and 0.68 for precision (true positive 893, false positive 417, false negative 367, true negative 966).

Based on weighing in the random forest, the top 10 pro-flare attributes were CRP, swollen joint count (SJC), tender joint count (TJC), HAQ, DAS28, morning stiffness, gout, MCTD, OA, duration; while top 10 anti-flare attributes were cDMARDs+Bio, cDMARDs+steroid+NSAIDs, stable on HAQ, on morning stiffness, on SJC, medicine on COMBs, cDMARDs+TCM, stable on TJC, on ESR, income at 100-200k (Fig.1). The top weighing COMBs for pro-flaring were gout (0.81), MRD (0.75), OA (0.56), AS (0.48). The monotherapies with either Bio or NSAIDs, or steroid, or TCM was pro-flare; while with cDMARDs was anti-flare (-0.21).

Figure 1.

Conclusion: The attempt to develop a machine learning algorithm for RA flare prediction is successful. The discrimination was acceptable. The attributes of both pro-flare and anti-flare are identified, which may inspire the proactive intervention.

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HPR Service developments, innovation and economics in healthcare

SAT0648-HPR CAN A SPECIALIST NURSE REPLACE A CONSULTANT - AN INNOVATIVE MODEL FOR OSTEOPOROSIS CARE

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Background: Specialist services are heavily reliant on a consultant reviewing a patient and discussing management options. However this can significantly delay treatment pathway owing to lack of sufficient consultant appointments. Clinical nurse specialists (CNSs) are an integral part of a multidisciplinary team employed to provide effective care for the diverse needs of patients with chronic conditions such as osteoporosis.

Objectives: We designed an innovative proof-of-concept osteoporosis service with patients only consulting a metabolic bone CNS and a consultant providing remote oversight. The aim of the project was to improve the efficiency of the service by eliminating consultant appointments and reducing unnecessary hospital visits whilst continuing to deliver a high-quality and safe service.

Methods: A new pathway was implemented where a consultant rheumatologist and a CNS virtually triaged post menopausal women over the age of 65 into the service. A dedicated proforma provided the template for the CNS to undertake new patient telephone consultation. Relevant investigations were requested during the telephone clinic and treatment related information was despatched to help with shared decision making. All patients were then reviewed in a consultant-CNS virtual MDT. Appropriate parenteral treatment option was agreed and confirmed to each individual. The CNS worked through a safety checklist and provided further advice and support to the patient as necessary. Using the database, we compared the timelines for patient journey to conventional pathway, obtained the number of consultant follow-up appointments saved by implementing this service and calculated total savings.

Results: In the proof-of-concept phase, 60 patients were triaged into the new service. It was a combination of 25 new referrals and 35 patients pulled from the consultants' waiting list. Mean age of participants was 77.2 years (65-92). Referral to virtual triage took median 20 days (0-62). Median time for triage to new patient CNS telephone consultation was 18 days (6-87). Time to virtual MDT for treatment authorisation was median zero days (0-76 days). 19 patients had anabolic therapy commenced via home care. Remaining had anti resorptive therapy. No patient requested face-to-face review. Only one patient fed back that they would've preferred to see the consultant once. Sixty new patient consultant appointments were saved and median delay in treatment commencement was reduced from 84 to 38 days.

Conclusion: To our knowledge, this is the first successful example of an innovative service wholly provided by CNSs for commencing parenteral anti-osteoporotic therapy with only remote consultant supervision. Our service redesign has significantly improved the efficiency of the parenteral osteoporosis pathway with reduction in treatment delay and a more streamlined patient journey. A nurse-delivered osteoporosis treatment pathway is highly effective, safe and provides an innovative solution to thinly stretched health care needs of people with chronic conditions.

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SAT0649-HPR DIRECT COSTS OF SYSTEMIC LUPUS ERYTHEMATOSUS IN COLOMBIA

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Background: Treatment burden of Systemic Lupus Erythematosus (SLE) is considered high. There are no studies in Colombia that includes the estimation of an incremental cost associated to SLE.

Objectives: To estimate the direct cost associated to SLE in contributory healthcare scheme in Colombia. To estimate prevalence and characterize SLE population affiliated in the contributory healthcare scheme in Colombia. To estimate the direct healthcare cost in patients with and without SLE and the effect of being diagnosed with SLE in the total direct cost during a period of two years.