Background: Flare, relapse from status of treat-to-target (T2T, DAS28 $\leq$ 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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SATURDAY, 06 JUNE 2020

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.

Methods: The present study was carried out with an administrative database that includes all the enrollees in the contributive health scheme for a period of 4 years. It was established an operative definition to identify individuals with the disease in order to make the descriptive analysis and calculation of prevalence. every patient was aged 18 or older on index date. Additionally, as the length of follow-up period was fixed to two years, all patients whose index 14 date had been greater than 1st January 2016 were excluded from the study sample (Figure 1). The variables considered in this part of the study were demographic, clinical (Charlson Comorbidity Index) and cost-related variables, which was the outcome variable of the study, this cost was made up of the sum of all medical costs, regardless of whether they were related or not to SLE. Costs were adjusted for inflation, to values in 2017. To evaluate the effect of having SLE vs. not having, on the direct cost in health, propensity scores analysis was used to reduce differences in the baseline characteristics. Three groups were formed based on disease severity: high (patients who had renal failure), medium (patients in intensive care unit at least once but without renal failure) and low (remaining SLE patients) (See table 1).

Table 1. Incremental cost by degree of severity

Degree of Severity	Average adjust incremental cost per year (in COP)	Confidence interval construction method	Confidence interval (95 %) (in COP)
High	\$ 19,930,931.67	t-interval	\$16,525,728.01, \$23,336,135.32
		Bootstrap	\$17,088,627.49, \$23,068,518.89
Medium	\$7,248,201.04	t-interval	\$2,123,742.99, \$12,372,659.09
		Bootstrap	\$3,460,932.89, \$11,688,205.25
Low	\$ 885,300.40	t-interval	\$642,925.6, \$1,127,675.2
		Bootstrap	\$ 688,197.5, \$ 1,098,098.2

Results: From 2014 to 2017, 21,993 SLE patients were identified. Women represented 87.4% of the cases, 5428 patients were selected to make up the sample of SLE patients. the number of patients without diagnosis of SLE was 19,419,540. From this population was drawn randomly a 10% size sample, to make up the potential control sample. To estimate the incremental cost of having SLE it was used multivariate regression through a GAM model. The estimated average annual total cost of a patient with SLE was \$6,139,046 COP vs. non-SLE patient cost of \$4,113,191 COP. Meanwhile the adjusted incremental cost of SLE vs non-SLE was \$2,025,855 COP. Subsequently, adjusted incremental cost was estimated taking into account the levels of severity. In the Table 1 are presented the mean values of incremental costs and 95% confidence intervals.

Conclusion: Although the prevalence of SLE in Colombia is relatively low, the direct costs generated for this disease might be very high. The annual cost for a SLE patient was \$2,025,855 COP greater than the cost of a non-SLE patient. When considering the severity levels of the disease, it was found a \$ 19,930,931.67 incremental cost estimate for high level of severity. In the medium level, the estimate was \$ 7,248,201.04. Meanwhile, a patient in the low severity level had a \$ 885,300.40 incremental cost.

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SAT0650-HPR

WHAT CAN WE LEARN FROM A ROUTINE FRAILITY ASSESSMENT IN RHEUMATOLOGY? A SERVICE EVALUATION OF 170 NEW PATIENT REFERRALS TO A SINGLE RHEUMATOLOGY CENTRE.

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Background: Frailty is common among patients with rheumatological diseases, and there is increasing evidence that it is associated with poorer outcomes. Frailty scores worsen during the course of chronic inflammatory arthritis (IA) and connective tissue disease (CTD). Existing tools such as the Rockwood Clinical Frailty Scale (a nine-point scale from 1 very fit- 9 severely frail) allow for rapid frailty assessment by doctors and nurses. Frailty assessment is recommended by NHS England as an important public health opportunity for targeted interventions for both primary and secondary care. We have limited understanding of frailty in rheumatology new patient cohorts, and it is not routinely assessed in most centres. We report the feasibility and utility of frailty scores in patients referred to rheumatology, and association with final diagnosis.

Objectives: This service evaluation assesses the utility and feasibility of implementing the Rockwood Clinical Frailty Score for new patient referrals at a single UK centre.

Methods: New patient assessments at a rheumatology consultant general new patient clinic were prospectively coded over 9-months (March- December 2019). Anonymised coded demographic data included: age, gender, referral source, history of depression, RFCS and clinical diagnosis (coded against established categories, those requiring further tests coded 'awaiting investigations'). RFCS coding was assisted by an online validated pictorial aide memoir for coding.

Results: Of the 181 referrals, 11 (6%) were excluded for incomplete data. The mean age of the remaining 170 patients was 53 years (SD 16.8; range 17-87), predominantly female (123/170; 72%). Most referrals, 57% (97/170) were from primary care, 23% (39/170) from musculoskeletal integrated triage services, 5% (9/170) from orthopaedics, 4% (7/170) from gastroenterology; 18 were from 12 secondary-care specialties. The RCFS was: mean 2.6 (median 2, range 1-7) with depression in 61/170 (36%), but no effect of this on mean RCFS (2.6 in both). RCFS increased with age (70-79, n=21, mean 2.9; >80, N=12, 4.3). The majority of patients had non-inflammatory (NI) diagnoses (119/170, 70%) e.g. osteoarthritis, fibromyalgia. Overall 19% (32) 'inflammatory arthritis' (IA; rheumatoid arthritis, psoriatic, undifferentiated inflammatory arthritis, gout); 4% (6) were diagnosed with a form of connective tissue disease (undifferentiated CTD; SLE; Sjogren's syndrome); 8% (13) were awaiting further investigations. Patients in both the NI and IA category were found to have an average RCFS of 2.6 (SD, NI 1.1; IA 0.9). Patients who received a diagnosis of CTD had an average RCFS of 3.5 (SD 1.8). We identified 30 patients who scored four or more (vulnerable/ at risk) for targeted intervention by therapy and allied health professionals. The RCFS was positively evaluated by clinicians.

Conclusion: RFCS was simple to introduce to our centre and has provided us with additional data to plan our service provision for primary and secondary care support for our cohort. Our new patients with CTD, and who were elderly had higher frailty scores, we found no association between frailty and depression or presence of IA or NI. The RCFS was easy to use and can be integrated into routine clinical practice for new and follow up patients. Further studies are required to support these findings.

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SAT0651-HPR

BARRIERS IN DIAGNOSING RHEUMATOID ARTHRITIS – A FOCUS GROUP STUDY ON THE GENERAL PRACTITIONERS' PERSPECTIVES

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Background: Early treatment, before three months from symptom onset of rheumatoid arthritis (RA), is essential to increase the likelihood of remission and to