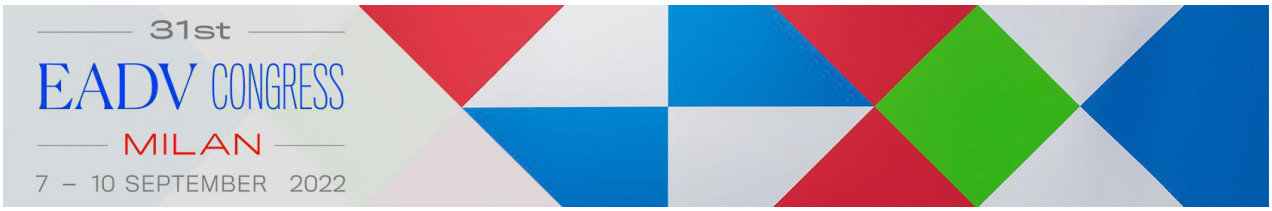

Abstract N°: 592

Title: A machine learning tool for the early identification of undiagnosed psoriatic arthritis patients. Is it possible?

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Introduction

Psoriatic Arthritis (PsA) is a chronic inflammatory immune mediated disease involving the joints and the skin. PsA affects approximately 0.27% of the adult population and 20% of patients with psoriasis. Prevalence of undiagnosed PsA patients among psoriasis patients was estimated to be 10.1% [1]. Early diagnosis helps to prevent irreversible joint changes that cause physical disability. Questionnaire-based screening tools were previously developed for identification of undiagnosed PsA patients, but they require the active involvement the patient and the physician. Using machine learning, we have developed PredictAI^{TM}, a proprietary tool that uses structured electronic medical record (EMR) data to identify undiagnosed PsA patients 1 to 4 years prior to the first-time patients are suspected of having PsA (reference event).

Materials and methods

This retrospective study utilized data from an anonymized EMR dataset, between 2008 and 2020, consisting of ~ 2.5 million members of Israel's second largest health maintenance organization - Maccabi Healthcare Service (MHS). Data was extracted using MDClone. Since prevalence of PsA is higher among psoriasis (Ps) patients compared to the general population, we created 2 cohorts: The general population ("GP Cohort") including patients with and without psoriasis and the Psoriasis cohort ("Ps Cohort") including psoriasis patients only. Each cohort was divided into 2 non-overlapping train and test sets. This study evaluated the ability of the model to identify undiagnosed PsA patients 1, 2, 3 and 4 years prior to the reference event (time gaps 1-4), using 3 years of consecutive data up to the time gap. Patients under the age of 18 and those without 7 years of continuous data were excluded from each group. We used clinically established criteria to identify PsA patients; patients in the psoriasis cohort were identified by having at least one psoriasis diagnosis registered by a dermatologist. The model was built using Gradient boosted trees. ROC analysis, sensitivity and PPV were used to investigate the performance of the model at different specificity levels.

Results

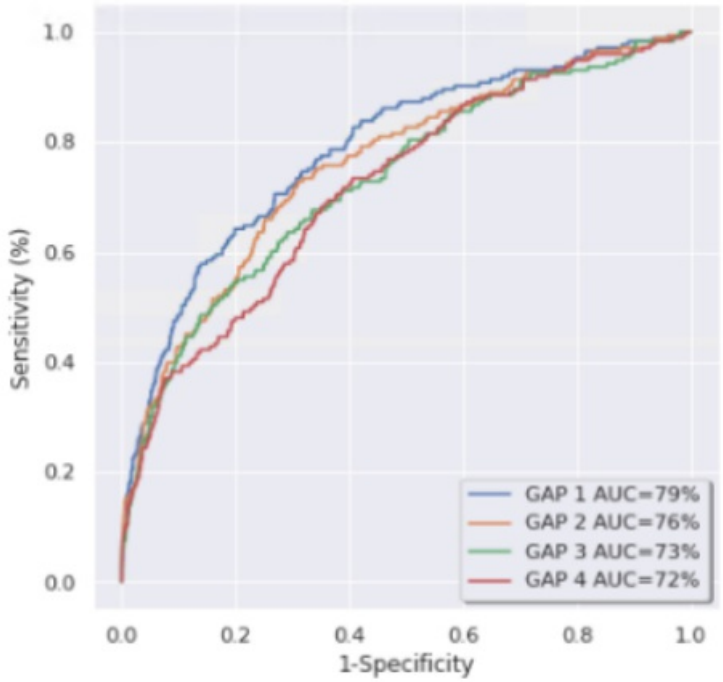

Figure 2: ROC Plot for Ps Cohort

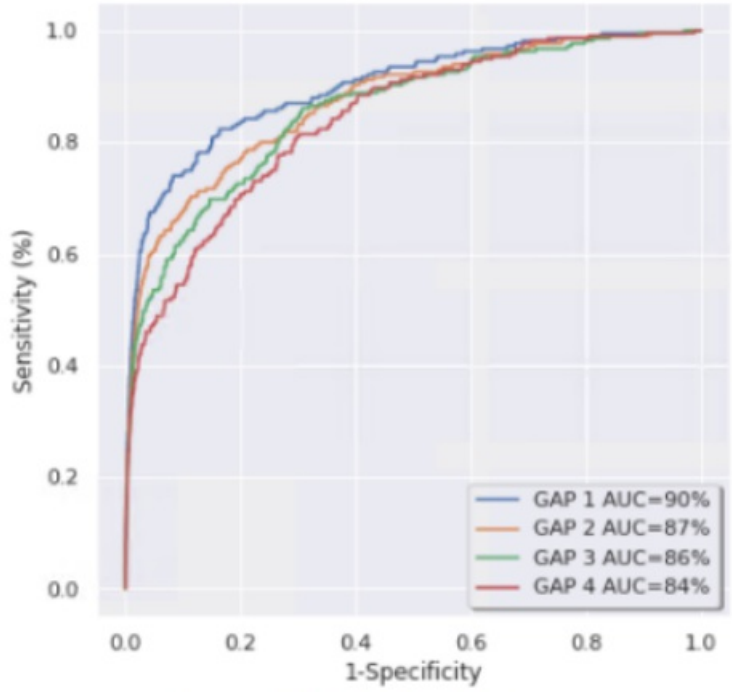

Figure 1: ROC Plot for GP Cohort

A total of 2084 patients met the criteria for PsA. For a specificity of 90%, in the Ps cohort, undiagnosed PsA patients were identified by PredictAI^{TM} 1 to 4 years before the reference event with a sensitivity range of 50% to 38%, and a PPV range of 34% to 30%, respectively.

For the GP cohort for a specificity of 99% and for the same time gaps, PredictAI^{TM} achieved a sensitivity range of 42% to 32% and a PPV range of 10% to 8%, respectively. The ROC plots for the GP cohort and Ps cohort are presented in figure 1,2. The SHAP value with most prominent features including psoriasis, arthritis and arthralgia diagnoses will be presented.

Discussion

Early diagnosis and screening for PsA has been acknowledged as a diagnostic process that should be implemented in the daily practice of physicians. We developed PredictAI^{TM}, a ML tool which may aid in early identification of undiagnosed PsA patients and with a specificity of 90% could identify 50% of undiagnosed PsA patients among psoriasis patients, which if no measures were to be taken, their diagnosis could be delayed in at

least one year. Further studies will help to establish implementation guidelines.

Reference:

1. Villani AP et al. J Am Acad Dermatol. 2015;73(2):242–8