Biomarkers for SpeciLic Etiologies, Pathophysiologies and Symptoms of Chronic Pain

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Introduction

Chronic pain's diagnostic complexity necessitates improved tools for prediction and categorization. Utilizing the UK Biobank data (n=499,911), **this study examines the diagnostic potential of both biological and psychosocial features across various pain-associated diagnoses**.

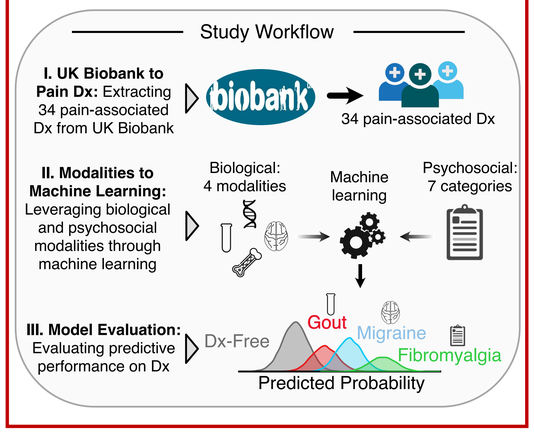
Methods

Data:
- Derived from the UK Biobank, we utilized pain-associated diagnoses based on self-reports, emphasizing on those with a chronic pain prevalence > 50% (Fig. D).

Biological and Psychosocial Modalities:
- Biological modalities included biochemical assays, polygenic risk scores, T1 structural, resting fMRI, diffusion MRI, and bone density. Additionally, 80 psychosocial features were considered.

Model Construction and Assessment:
- We applied cross-validated logistic regression for each diagnosis, resulting in 7 distinct models (6 biological, 1 psychosocial) per Dx. The predictive efficacy of these models was quantified using ROC-AUC measures. (Fig. A/B).

Comparative Analysis:
- An in-depth comparison was conducted between the biological vs. psychosocial models, gauging their predictive capabilities across diagnoses (Fig. C).



Results

A | Biological Predictors of Pain-Associated Dx

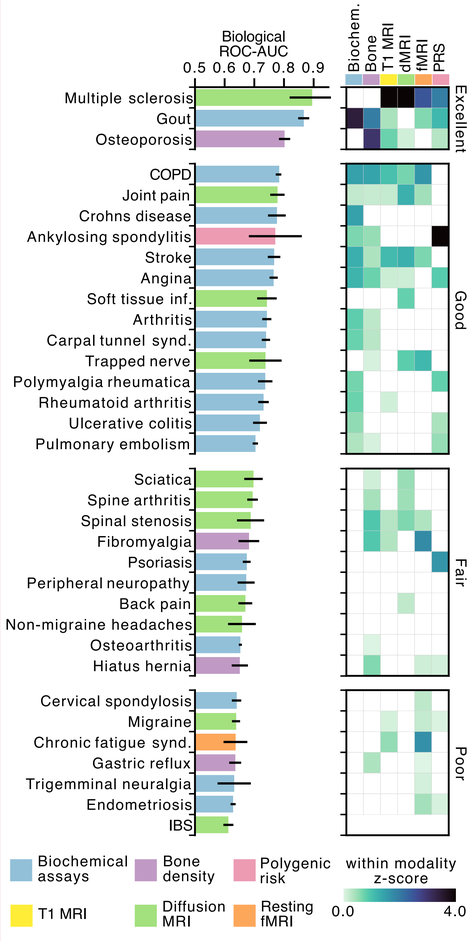


Fig. A: *Left*: Bar plot ranks 34 diagnoses by ROC-AUC with colors indicating top modality. *Right*: Heatmap displays z-scores for each diagnosis. X-axis identifies the modality used for z-scoring, highlighting relative diagnostic efficacy.

B | Psychosocial Predictors of Pain-Associated Dx

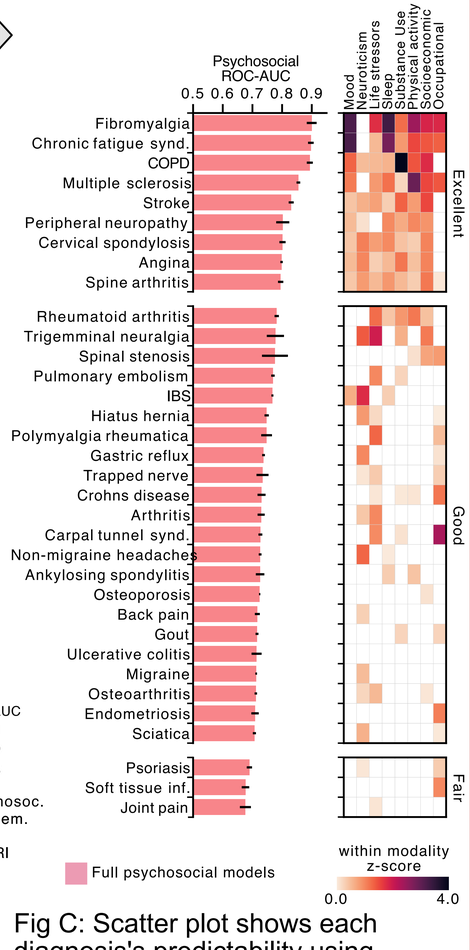


Fig. B: *Left*: Bar plot ranks 34 diagnoses using 80 psychosocial features. *Right*: Heatmap of z-scores per diagnosis. X-axis divides features into 7 categories, emphasizing effective discernment for diagnoses.

C | Biological vs. Psychosocial Predictive Power for Diagnoses

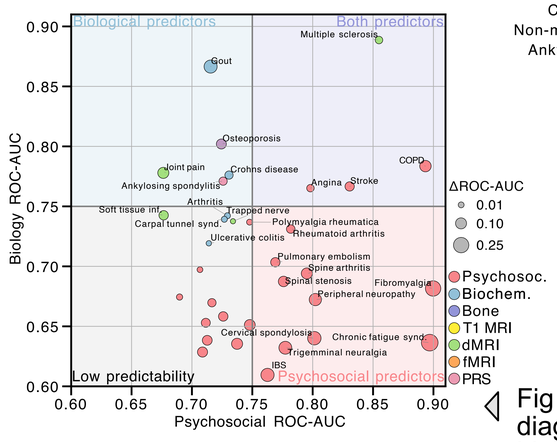


Fig C: Scatter plot shows each diagnosis's predictability using biological vs. psychosocial features. Points are colored by leading modality and sized by ROC-AUC difference. Quadrants highlight stronger predictor: Top-left (Biological), Top-right (Both), Bottom-left (Low), Bottom-right (Psychosocial).

D | Prevalence of Pain Types and Diagnosis Frequencies

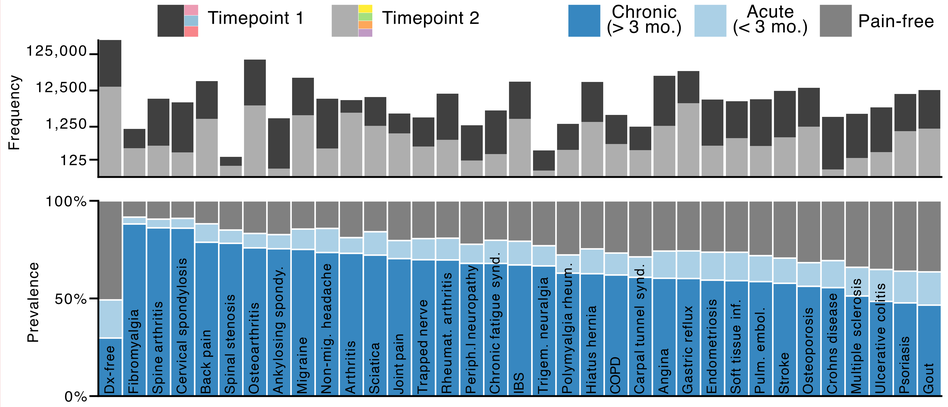


Fig D: *Top*: Stacked barplot shows subject count per diagnosis at two timepoints: dark grey (T1: biochemistry, genetics, psychosocial) and light grey (T2: brain, bone). *Bottom*: Aligned barplot indicates prevalence of chronic, acute pain, and pain-free statuses for each diagnosis. subjects for each diagnosis

Discussion

1) The results underscore the variability in predicting pain-related diagnoses using biological and psychosocial markers. Notably, Gout's predictability is primarily biological with an ROC of 0.86 from blood tests, while Fibromyalgia and Chronic Fatigue Syndrome, with ROCs of 0.89 and 0.9, lean heavily on psychosocial factors, particularly in the Mood and Sleep domains.

2) Many conditions, such as Trapped nerve, require a comprehensive approach, blending both biological and diverse psychosocial dimensions for accurate assessment.

3) The varied psychosocial z-scores across diseases, like the significant Substance Use score in COPD (z=3.8), underscore the intricate and unique psychosocial relationships inherent to each condition.

References

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