Use of AI-Powered Methods to Extract and Categorize Reasons for Treatment Changes in Real-World Care Settings in Mental Health, Immunology, and Rheumatology

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Background

Real-world data are widely used to characterize treatment patterns across diseases and patient populations, providing insight into treatment initiation, sequencing, duration, and outcomes. However, analyses of real-world data rarely report on the reasons that patients discontinue or switch therapies. Understanding the clinical and non-clinical reasons for treatment change is critical for understanding observed treatment patterns and patient outcomes. These reasons are typically documented only in unstructured clinical notes, making it challenging to extract these data in a scalable manner.

Objectives

To develop and apply scalable AI-enabled methods to identify reasons for medication switching or discontinuation from unstructured clinical documentation across multiple disease areas.

Methods

This effort developed tools leveraging natural language processing and large language models to extract reasons for medication switching or discontinuation from clinical notes. Models identified relevant raw text, extracted the key terms, and categorized them (Table 1).

Models were tested in three condition areas and data sources: patients with depression treated with selective serotonin reuptake inhibitors at mental health clinics; patients with infectious diseases treated with antiviral therapies at academic medical centers; and patients with rheumatoid arthritis treated with disease-modifying antirheumatic drugs within a network of rheumatology practices.

Results

Across condition areas, this effort identified a diverse set of reasons for treatment switching or discontinuation, including inadequate response, adverse effects, disease progression, and non-clinical factors such as access or cost, in rheumatoid arthritis (Figures 1-2), depression (Figures 3-4), and infectious disease (Table 2). Key methodological challenges varied by disease context and included distinguishing medication side effects from underlying symptoms and resolving discrepancies in treatment switch dates recorded in electronic medical records. The analysis also identified generalizable best practices for applying AI-powered tools to extract clinically meaningful variables from unstructured data.

TABLE 1 From clinical note to categorized reason

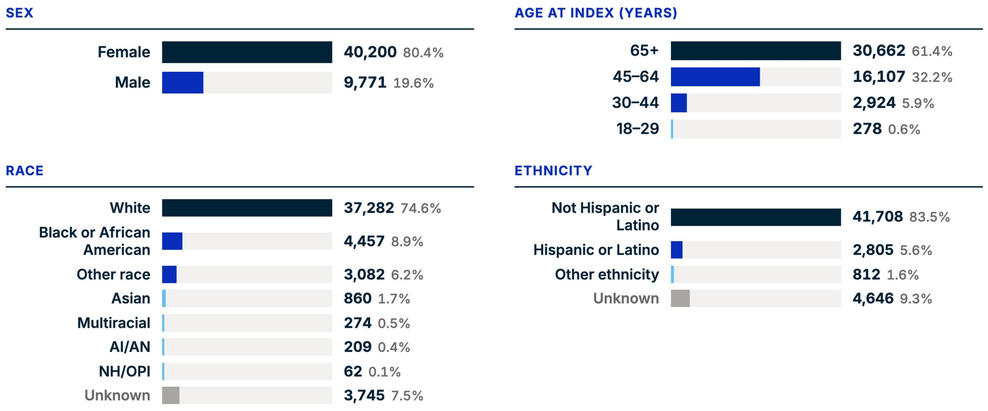
Illustrative example of the extraction and categorization applied to unstructured clinical notes.

RAW NOTE TEXT	EXTRACTED TEXT	CATEGORIZATION
OPHTHALMOLOGY CONSULT NOTE Patient Name: [NAME_1] · MRN: [HEALTHCARE_NUMBER_1] · Consulting Service: Ophthalmology · Requesting Physician: [NAME_MEDICAL_PROFESSIONAL_1] History of Present Illness: [NAME_1] is a [AGE_1] y.o. female with a history of ESRD 2/2 RPGN s/p renal txp 1/4/2019 c/b graft failure with nephrectomy and re-transplant 12/16/23 who presents with right facial shingles. She was recently admitted for treatment of VZV affecting V1 and V2 and discharged with PO valacyclovir. She notably received an infusion of acyclovir and **became itchy so it was stopped** and benadryl was given. She presents today with worsening of the swelling around her right eye. ...	"itchy reaction"	Allergy

Note text is de-identified; bracketed tokens replace protected health information and the excerpt is abridged. Highlighting marks the span from which the reason for discontinuation was extracted before assignment to a category.

FIGURE 1 DMARD cohort characteristics

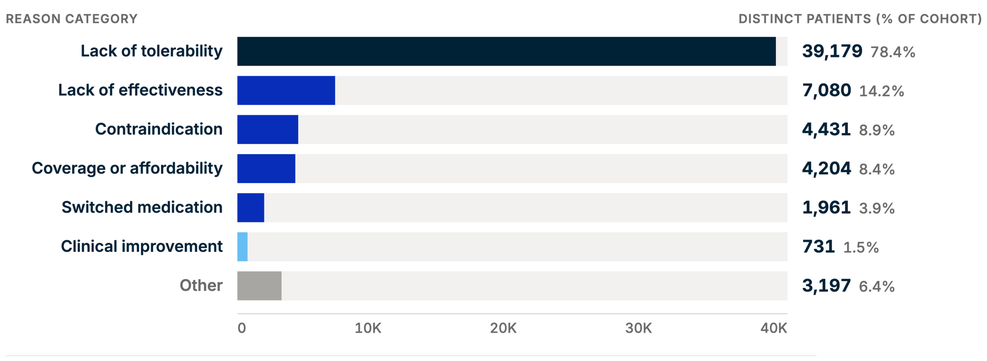
Demographic composition of the study cohort, N = 49,971 patients.



Race, ethnicity, and state as recorded in the source electronic health records; unknown categories are shown for transparency. Percentages are of the full cohort and may not sum to 100% due to rounding.

FIGURE 2 Reasons for DMARD discontinuation

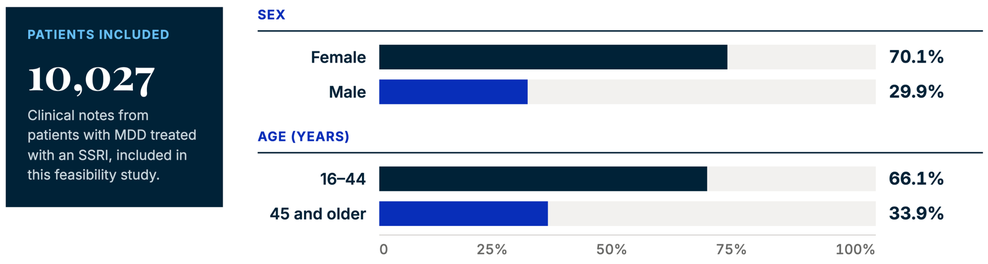
Distinct patients with each documented reason category, N = 49,971 patients.



Reason categories are not mutually exclusive — a patient may have more than one reason documented across discontinuation events, so percentages sum to more than 100%. Percentages are of the full cohort (N = 49,971).

FIGURE 3 SSRI cohort characteristics

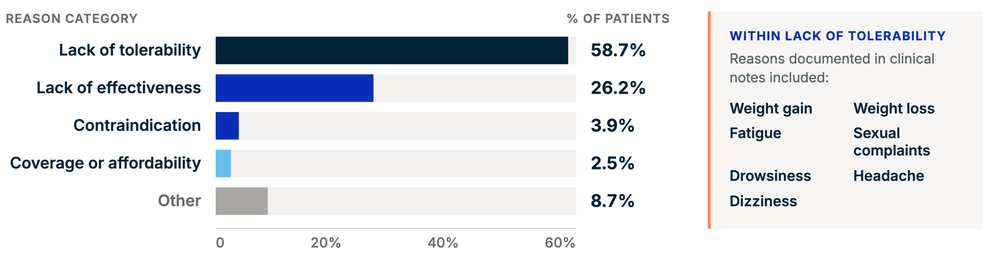
Patients with major depressive disorder receiving SSRI treatment, N = 10,027.



Sex and age as recorded in the source electronic health records. Percentages are of all included patients (N = 10,027).

FIGURE 4 Reasons for SSRI discontinuation

Share of patients with each documented reason category, N = 10,027 patients with MDD.



Reason categories are not mutually exclusive — a patient may have more than one reason documented across discontinuation events. Median time to discontinuation varied by reason category and drug; early discontinuation (within 3 months of treatment start) was most common for coverage or affordability issues and for lack of tolerability.

Conclusions

- AI-enabled approaches can be used to efficiently and accurately extract reasons for medication switching or discontinuation from clinical notes across diverse conditions and practice settings.
- Incorporating these methods into real-world studies may increase the value of real-world data for characterizing treatment patterns and interpreting real-world outcomes.

TABLE 2 Infectious disease — reason-for-discontinuation taxonomy

Virologic / antiviral effectiveness
Developed resistance · Inadequate viral suppression · Viral clearance (infection resolved)

Hematologic (blood & lymphatic)
Anemia · Neutropenia · Febrile neutropenia · Leukopenia · Lymphopenia · Thrombocytopenia · Marrow suppression

Gastrointestinal
Nausea · Vomiting · Diarrhea · Dysgeusia · GI intolerance

Renal & urinary
Acute kidney injury · Renal impairment · Renal failure · Proteinuria · Nephrotoxicity

Other tolerability
Electrolyte disturbance · Fluid overload · Peripheral edema · Weight gain · Allergy · Unable to take oral therapy

Other clinical (general)
Adverse event · Poor tolerance · Fever · Hepatotoxicity · Absorption issues · Infectious complications

Because this taxonomy is more granular than the harmonized categories used in Figures 1 and 4, terms are presented qualitatively without patient-level counts.

Conference

Presented at ISPE Annual Meeting, August 31, 2026, 12:00 PM – 1:30 PM. Milan, Italy.