Utilizing Ontologies to Map the Intervention Landscape of Depression

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Introduction

- **Major depressive disorders** can lead to disability, and its incidence is increasing annually.[1]
- Obtaining relevant information for managing depression is challenging, especially for tracking **non-pharmacological interventions**.

Aim

- **Use ontologies to extract and structure pharmacological and non-pharmacological treatment** information from clinical notes.

Methods

Step 1. Building our cohort

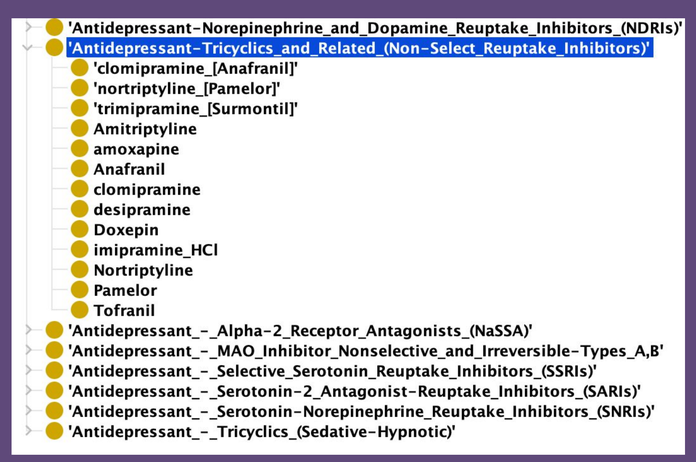
Data source: MIMIC-IV[2] is a publicly available, de-identified electronic health record database from Beth Israel Deaconess Medical Center (2008–2019).

Filtered cohort:

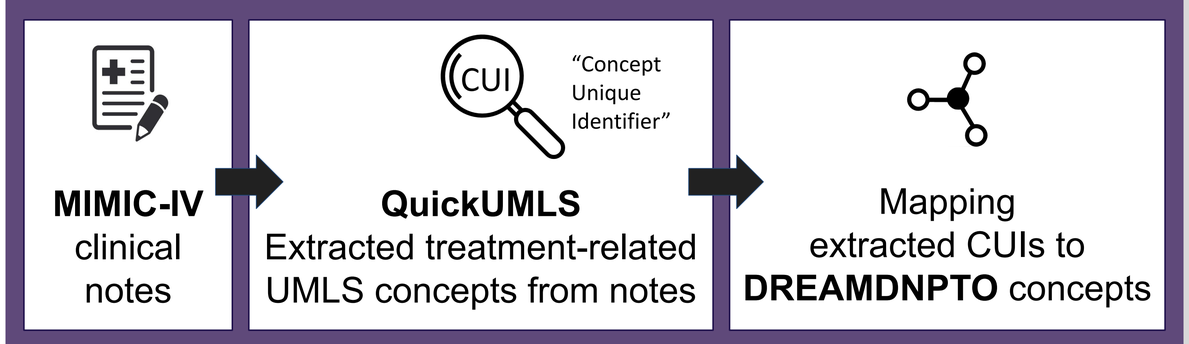
- ICD-10 codes:
  - *F32*: depressive episode
  - *F33*: recurrent major depressive disorder
- Drug information with ontology group names
- Clinical notes

Step 2. Extracting pharmacological interventions

Extracted pharmacological ontology in Protégé showing some subclasses of antidepressants.



Step 3. Extracting non-pharmacological interventions using DREAMDNPTO[3] and QuickUMLS[4]



DREAMDNPTO is an ontology for non-pharmacological treatment for dementia.[3]

Results

Final cohort includes **9,121 unique patients** with depression.

- **7,184 (78.8%)** had mentions of **pharmacological** treatments.
- **5,419 patients (59.4%)** had mentions of **non-pharmacological** treatments.

- **4,389 (81%)** also received antidepressants.
- **30 non-pharmacological concepts** from DREAMDNPTO were identified from our cohort (top 10 showed in Table 1.).

Non-pharmacological Entity Name	Count
Physical Therapy	899
Light Therapy	293
Occupational Therapy	180
Deep Breathing Exercise	145
Physical Restraint	46
Assisting with Activity of Daily Living	31
Behaviour Therapy	25
Stretching Exercise	20
Spiritual Therapy	19
Psychotherapy	18

Top 10 most mentioned DREAMDNPTO non-pharmacological concepts.

Conclusion & Next Steps

- Our methods help researchers **see the type and frequency of non-pharmacological interventions**.
- While our analysis is **limited to MIMIC-IV data and to the use of QuickUMLS**, future work could test:
  - cross-institutional datasets
  - advanced NLP-based methods to identify patients without ICD codes
  - enhanced entity extraction via transformers, such as those with negation-aware pipelines

References

1. Cui L, Li S, Wang S, et al. Major depressive disorder: hypothesis, mechanism, prevention and treatment. *Signal Transduct Target Ther*. 2024;9(1):1-32. doi:10.1038/s41392-024-01738-y
2. Johnson AEW, Bulgarelli L, Shen L, et al. MIMIC-IV, a freely accessible electronic health record dataset. Sci Data. 2023;10(1):1. doi:10.1038/s41597-022-01899-x
3. Zhang Z, Yu P, Yin M, et al. Developing an ontology of non-pharmacological treatment for emotional and mood disturbances in dementia. Sci Rep. 2024;14(1):1937. doi:10.1038/s41598-023-46226-5
4. Luca Soldaini and Nazli Goharian. "QuickUMLS: a fast, unsupervised approach for medical concept extraction." MedIR Workshop, SIGIR 2016.