



# MAYBE GABAPENTIN IS USEFUL. DISCOVERING POTENTIAL TREATMENTS FOR OPIOID USE DISORDER USING REAL-WORLD DATA FROM ONLINE FORUMS

Jai Kapoor and Michael Chary, MD PhD

Weill Cornell Medicine, New York, NY, USA

## Introduction

- Despite therapy, many individuals with opioid use disorder relapse.
- **Online commentary offers real-world data on self-treatment and may identify therapeutics that other approaches overlook.**
- Distinguishing plausible online claims from implausible ones remains a **key challenge**.
- We previously developed Jarvis, software that extracts drug names, dosages, and effects from online commentary.
- Here, we **extend Jarvis** to identify substances described specifically to treat opioid withdrawal.

## Objective

To identify substances mentioned in online commentary to specifically treat opioid withdrawal.

## Reddit Forums Discuss Opioid Use, Withdrawal, and Self-Treatment.

**Reddit** (n=706,322 comments [126,973 unique])

- r/heroin (n=50,299 [36,674])
- r/OpiatesRecovery (n=157,079 [100,140])
- r/fentanyl (n=14,254 [12,194])
- r/OurOverUsedVeins (n=161,766 [103,683])
- r/opiates (n=126,610 [77,889])
- r/suboxone (n=196,314 [126,871])

| Substances              | Effects                               |
|-------------------------|---------------------------------------|
| Ketamine (15,140, 23%)  | Withdrawal (9,172, 41%)               |
| Calcium (9,223, 14%)    | Anxiety (2,255, 10%)                  |
| Phenibut (7,803, 12%)   | Restless Legs (2,051, 9.1%)           |
| Oxycodone (3,678, 5.7%) | Precipitated Withdrawal (1,815, 8.1%) |
| Suboxone (3,364, 5.2%)  | Craving (994, 4.4%)                   |

Table 1: **Description of Data Source.** **Top:** Forums used in analysis (n = comments [unique]). **Bottom:** 5 most frequent substances and effects (count of mentions, percentage)

## TF-IDF Discriminates Therapies Mentioned to Help with Withdrawal

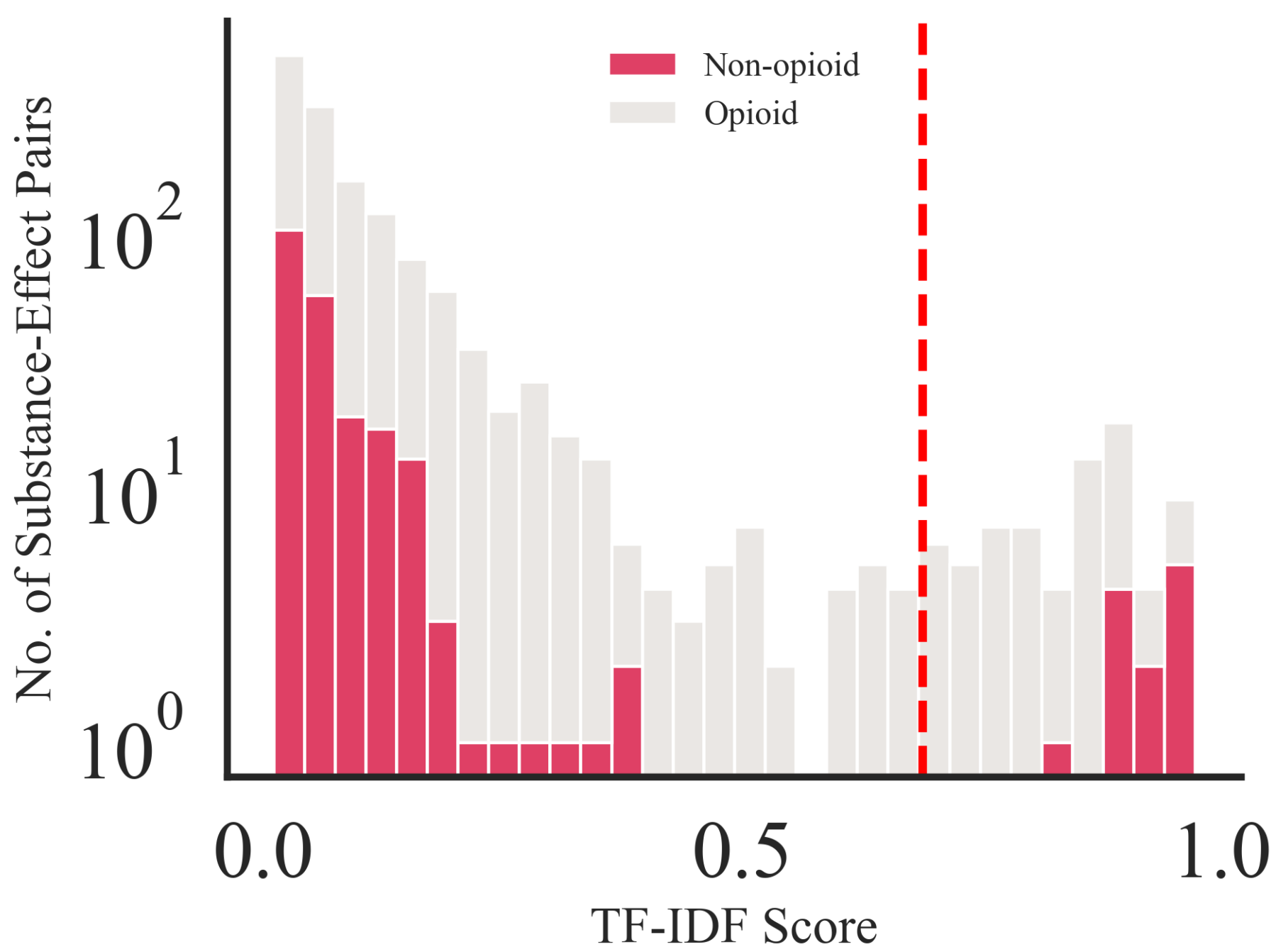


Table 2: **Histogram of TF-IDF scores.** **Grey:** Descriptions involving opioids. **Black:** Descriptions involving non-opioids. The dashed vertical red line denotes threshold of 95<sup>th</sup> percentile.

## Non-Opioids Specifically Described To Ease Withdrawal

| Effect               | Substance                                   |
|----------------------|---|
| <b>Anxiety</b>       | LSD, CBD, SSRI                              |
| <b>Nausea</b>        | Promethazine                                |
| <b>Restless Legs</b> | Magnesium, Diphenhydramine, Gabapentin      |
| <b>PAWS</b>          | Pregabalin, Gabapentin, Ibogaine, Clonidine |

Table 3: **Top 10 Non-Opioid Substance-Effect Associations by Clinical Domain.** Substances most specifically associated with treating aspects of opioid withdrawal, corresponding to items to right of threshold line in Figure 2. (TF-IDF > 0.64, 95<sup>th</sup> percentile). PAWS, post acute withdrawal syndrome.

## Methods (Theory)

- The effect of a substance described online is more likely to be truly due to that substance if that effect is described more frequently with that substance than other substances (textual specificity of substance-effect association).
- Term frequency-inverse document frequency (tf-idf,  $\tau$ ) quantifies textual specificity.

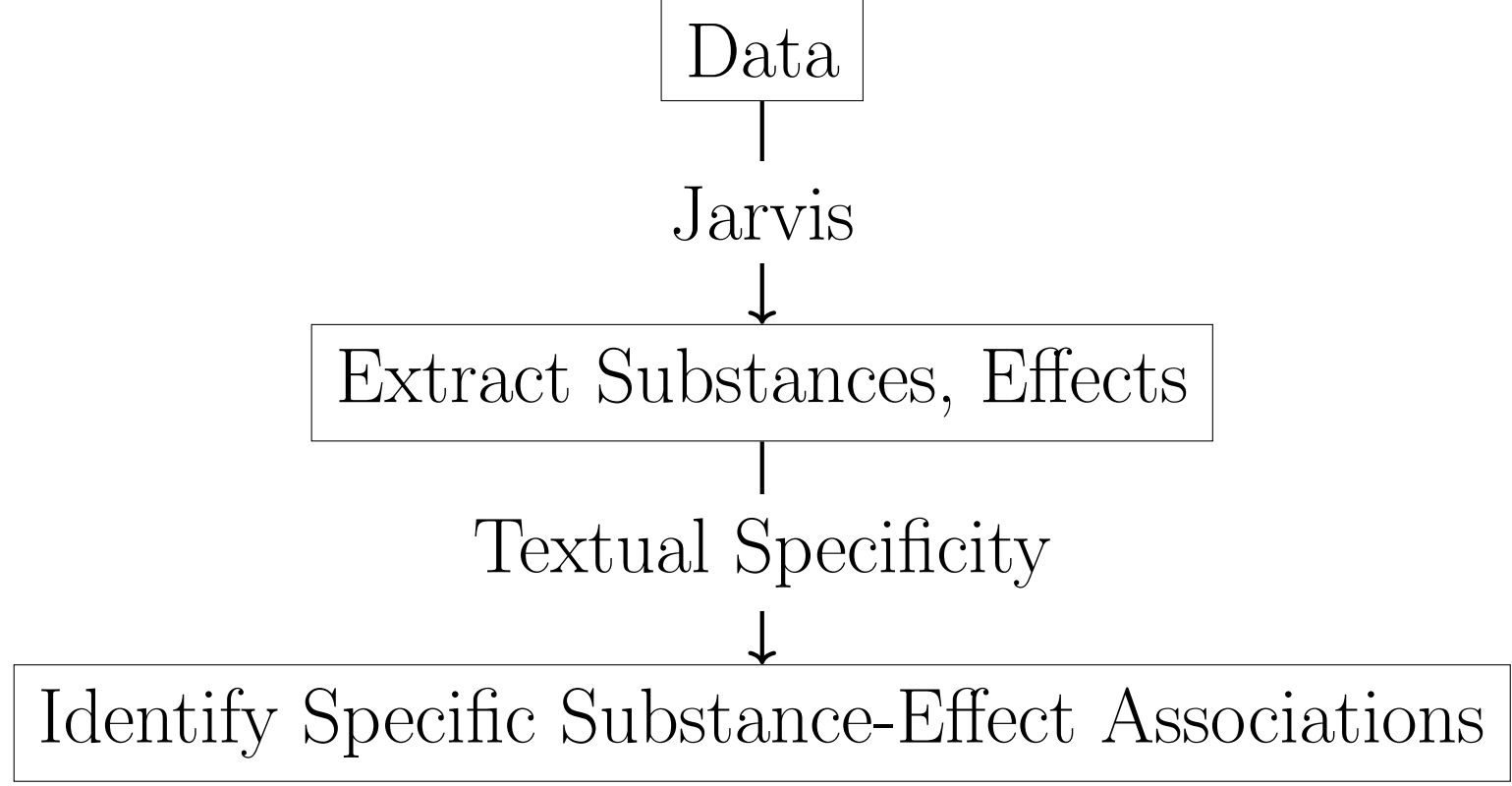
$$\tau = \frac{\# \text{ of times } term \text{ is mentioned}}{\# \text{ of times all words are mentioned in } data \text{ set}} \cdot \frac{1}{\# \text{ of documents mentioning } term}$$

| word       | $f_1$ | $f_2$ | $\dots$ | $f_{25}$ | $\tau$                     |
|------------|-------|-------|---------|----------|----------------------------|
| aspirin    | .04   | .04   | $\dots$ | .04      | $.04/25 \rightarrow .0016$ |
| gabapentin | .04   | 0     | $\dots$ | 0        | $.04/1 \rightarrow .04$    |

→ Select words with  $\tau$  above 95<sup>th</sup> percentile of empiric distribution.

## Methods (Experiment)

- We acquired comments from 6 Reddit forums dedicated to opioid use disorder.
- We used Jarvis to identify compounds.
- We calculated term frequency-inverse document frequency (tf-idf) to determine how often a compound is mentioned for particular opioid withdrawal symptoms (textual specificity).



## Discussion

**Validity of Data Extraction.** Most frequently mentioned substances include suboxone and oxycodone. Most frequently mentioned effects include withdrawal, precipitated withdrawal, and craving.

**Validity of TF-IDF Measure.** Most substances are mentioned indiscriminately and are filtered out by tf-idf. Opioids mentioned more frequently than non-opioids. SSRIs are a recommended treatment for anxiety disorders.

**New findings** Online discussions discuss leg paresthesias (“restless legs”) and PAWS, effects less described in the scientific literature, for which gabapentinoids may be useful treatments

## Conclusion

We found that TF-IDF can separates plausible claims of substance efficacy from implausible ones and identifies new therapies.

**Next steps:** We will test Jarvis on other platforms and evaluate the lead compounds we discover.

## Acknowledgments

We thank the Reddit community for their contributions and insights and the Department of Emergency Medicine at Weill Cornell Medicine.

## Further Reading

