Examining Patient Evaluations of Antidepressant Drug Use and Efficacy

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Introduction

According to the 2015 report "Depression and Other Common Mental Disorders: Global Health Estimates" by the World Health Organization, depression is the leading cause of disability and burden of disease worldwide. Evidence-based guidelines generally recommend that second-generation antidepressants (e.g. selective serotonin reuptake inhibitors and selective norepinephrine reuptake inhibitors)—in conjunction with psychotherapy—be taken as the first line of treatment for depression (Anderson et al., 2008; Qaseem, Barry, & Kansagara, 2016; Won et al., 2014). Given the considerably large array of existing pharmacological treatment options for depression and heterogeneity in risk/benefit trade-offs thereof, it is worth examining critical aspects of patients' subjective treatment experiences across a representative sample of the antidepressant drug landscape.

Research indicates that efforts to maximize treatment benefits for patients with psychiatric illnesses are hampered by poor adherence to prescribed medications (McDonald, Garg, & Haynes, 2002). Among the many different patient factors known to affect adherence to psychiatric treatment (e.g. patient beliefs, stigmas, cost, fears of addiction, etc.), adverse drug side effects are commonly reported as a reason for reluctance to accept or continue pharmacological treatment programs (Fortney et al., 2011; Sansone & Sansone, 2012).

Statement of goals.

1. What is the relationship between perceived effectiveness, perceived side effects and overall satisfaction?
2. What is the relation between perceived side effects and perceived effectiveness?

Why do you care?

TODO

Why should we care?

TODO

Description of your data.

The data we chose to use is the Drug Review Dataset from the UCI Machine Learning Repository. The data focuses on pharmaceutical drug users ratings and written reviews of certain drugs they've taken.

The data was initially compiled by gathering the user reviews from druglib.com, which is "a comprehensive drug database organized by relevance to specific drugs." (TODO make footnote for http://www.druglib.com/). It allows people who have used a specific drug to rate the drug based on their experience, just like a user can review a product from Amazon.

Since we are primarily concerned with people diagnosed with depression, we filtered out every user that did not state they had depressions in the self-reported condition. That cut out about 88% of the data, and left us with 499 observations. We then removed the user typed reviews, so were only left with the following columns:

DrugName: the name of the drug
Satisfaction: Rating (10-point scale, 10 being highest satisfaction)

Effectiveness: 1 - Ineffective; 2 - Marginally Effective; 3 - Moderately Effective; 4 - Considerably Effective; 5 - Highly Effective

Side Effects: 1 - Extremely Severe Side Effects; 2 - Severe Side Effects; 3 - Moderate Side Effects; 4 - Mild Side Effects; 5 - No Side Effects

Type: Chemical type of the drug

Here is a snapshot of our data

```
## # A tibble: 6 x 5
##   drug      rating effectiveness sideEffects type
##   <chr>      <int>         <dbl>       <dbl> <chr>
## 1 effexor        1             2           1 NRI
## 2 effexor        9             5           4 NRI
## 3 lexapro        3             2           2 SRI
## 4 cymbalta       7             4           4 NRI
## 5 effexor       10             5           5 NRI
## 6 paxil          8             4           4 SRI
```

We also simplified drug names when necessary. We simplified "wellbutrin-XL" to just "wellbutrin" because it's the same drug, just higher dosage. The drug type falls into three categories: SRI, NRI, and other. The first two target different chemical receptors in the brain to treat depression. The other category contains seven other drug families, but we condensed them all because their individual counts are so low. These were added independently and were not found in the original data. We also recoded the Likert ratings to be numerical instead of strings for making data manipulation simpler.
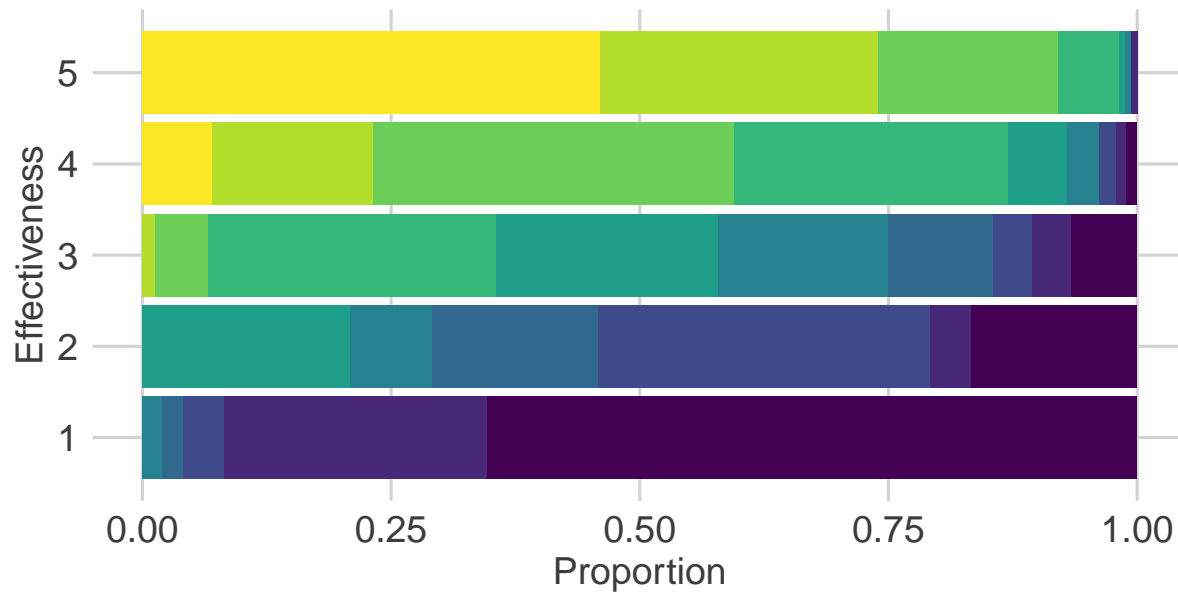

Answering Our Questions.
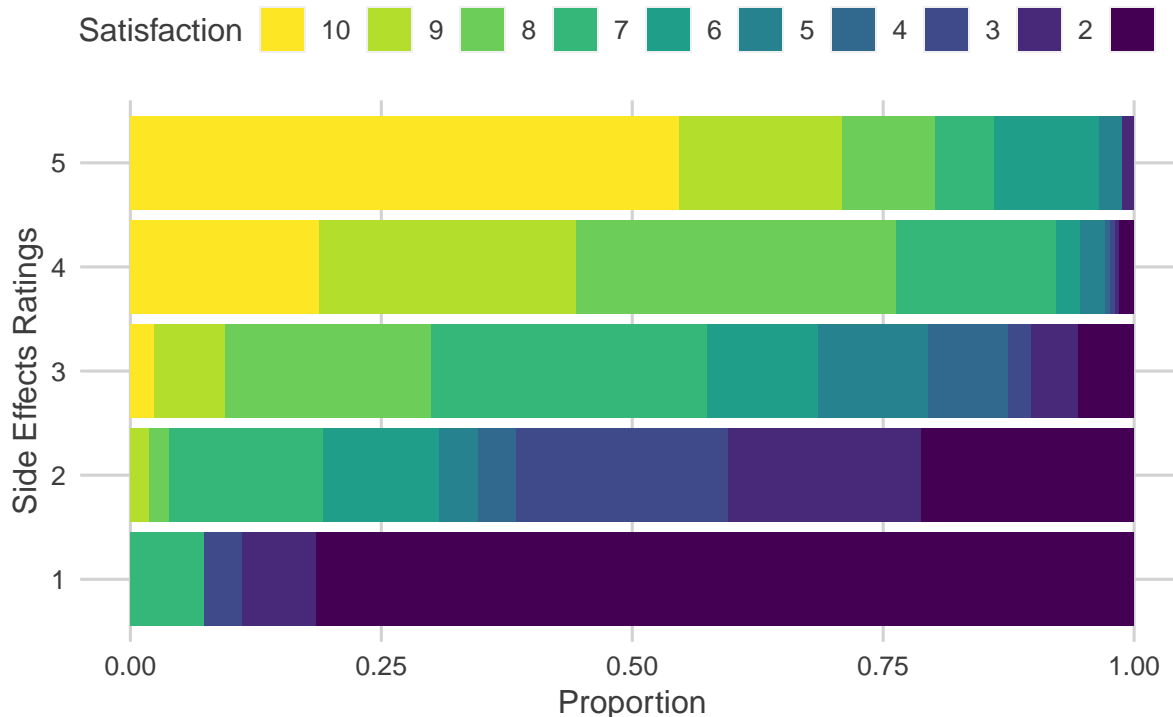
The above plot shows that the worse the side effects are, the least satisfied the subjects were. (TODO more explanation maybe)

Perceived Drug Effectiveness and Overall Satisfac

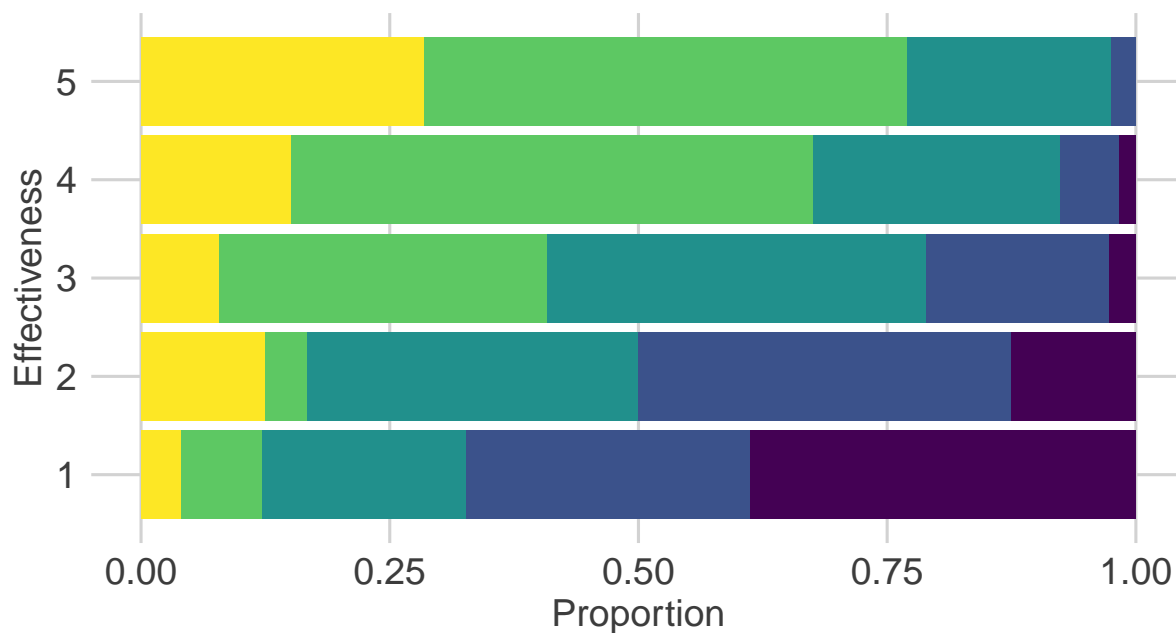1 – Ineffective, 2 – Marginally Effective, 3 – Moderately Effective, 4 – Considerably Effective, 5 – Highly Effective
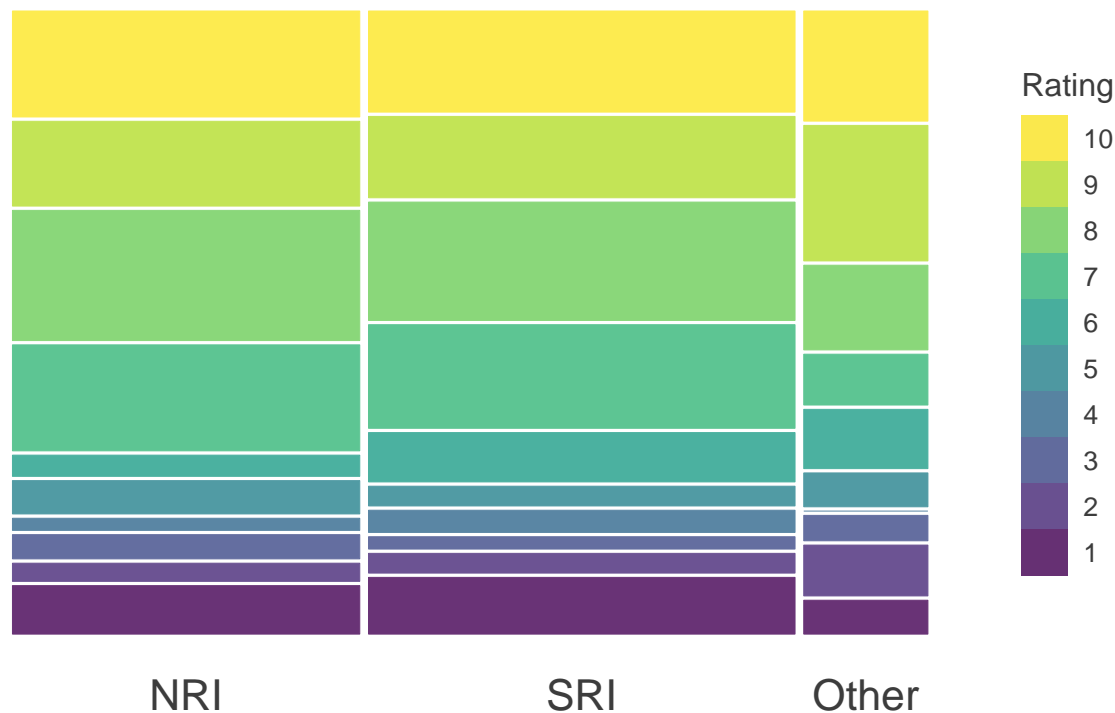

The above plot shows that the more effective, the more satisfied the subjects were. (TODO more explanation maybe)
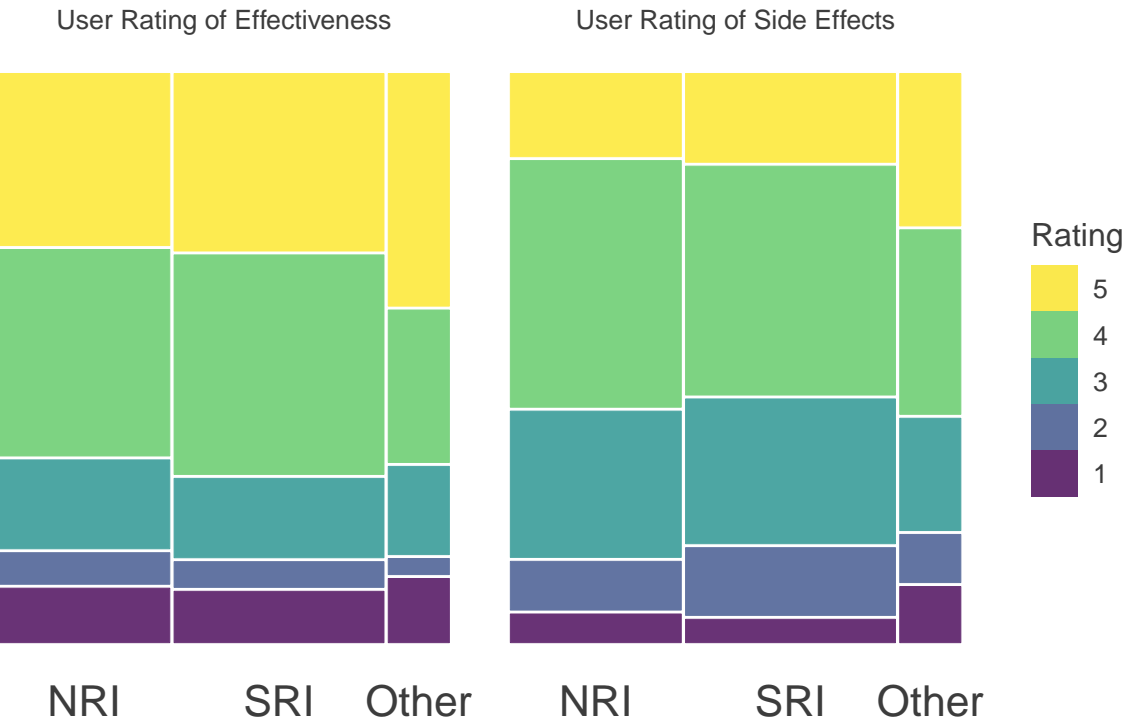
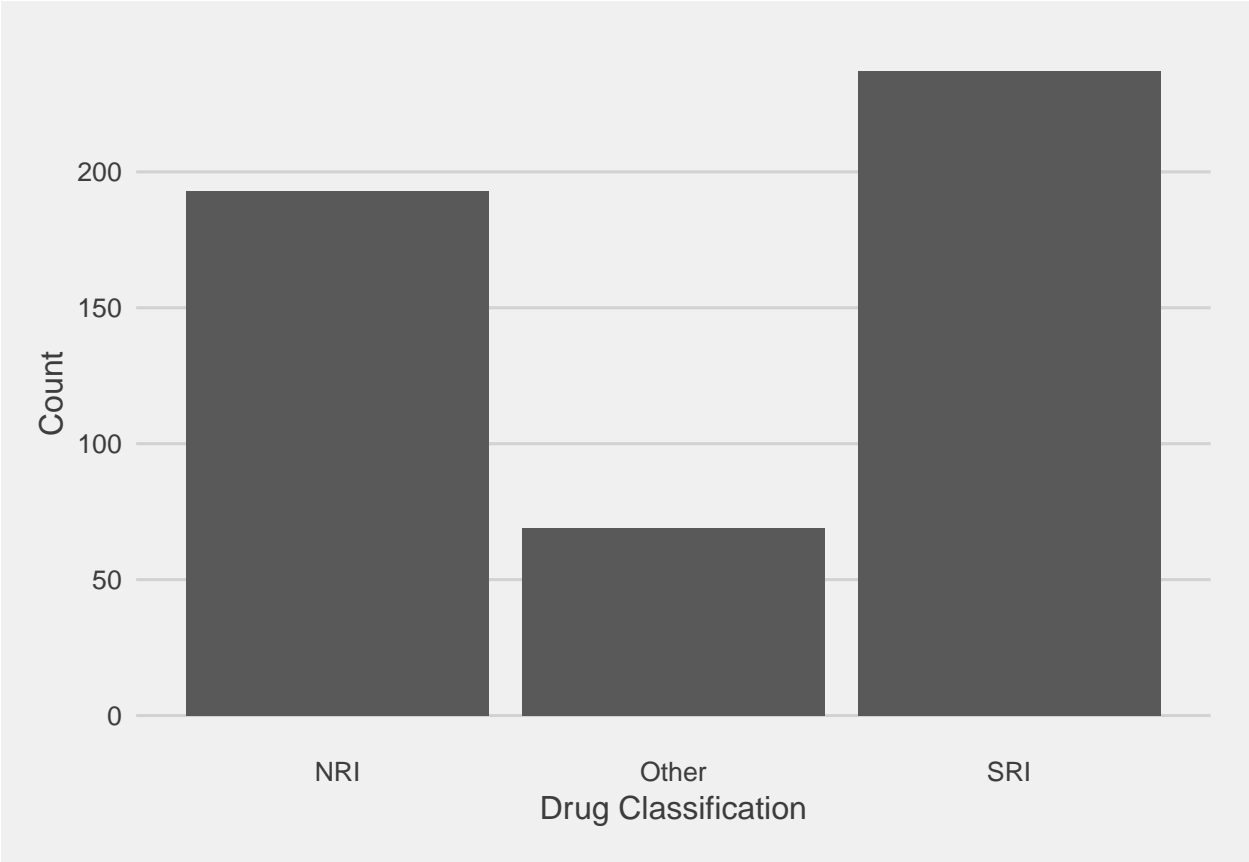# Perceived Drug Effectiveness and Side Effects

Overall Satsifaction By Drug Type
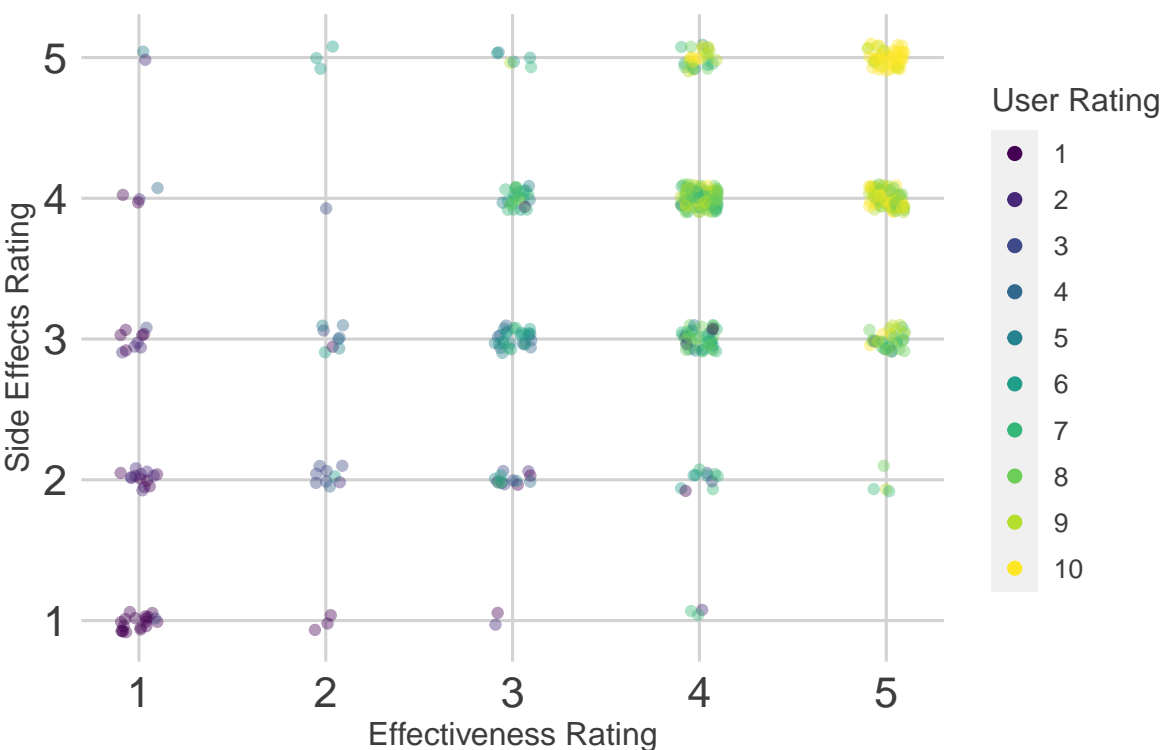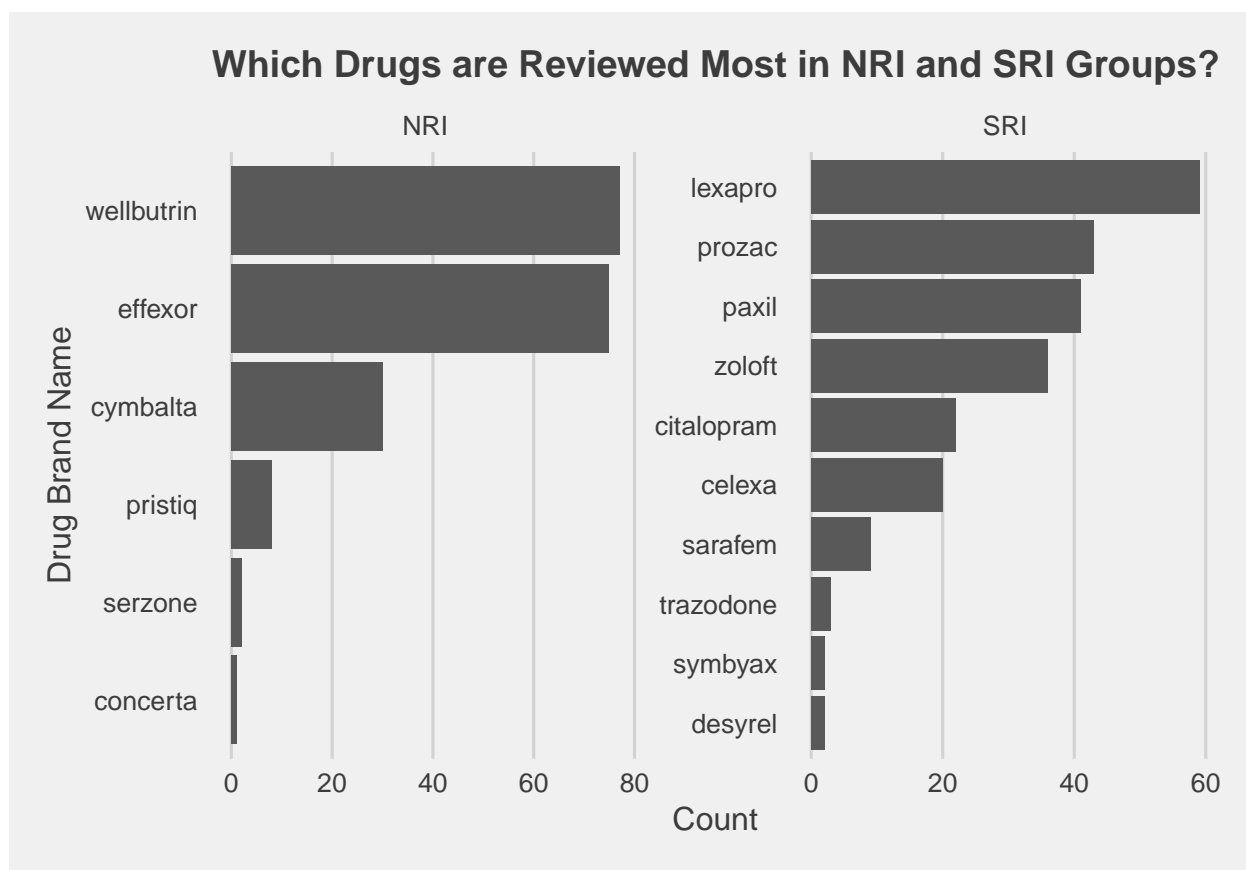

Mosaic plot of user ratings of drug effectiveness and side effects by drug type (SRI vs NRIs)

Ratings of Effectiveness & Side Effects Across Drug

User Rating of Effectiveness   User Rating of Side Effects

Effectiveness and Side Effects Rating with Overall User Rating

**Which Drugs are Reviewed Most in NRI and SRI Groups?**

I created three models all trying to predict rating. They all have side effects and effectiveness. The first model only uses those two, the second model takes into consideration drug type, and the third model takes into consideration the drug itself. The first model has the lowest Akaike information criterion (AIC). "[It] is an estimator of the relative quality of statistical models for a given set of data. Given a collection of models for the data, AIC estimates the quality of each model, relative to each of the other models. Thus, AIC provides a means for model selection.(stolen from wikipedia (https://en.wikipedia.org/wiki/Akaike_information_criterion)". So even though it doesnt have the lowest residual deviance, it is still the best model to use. Adding the sentiment analysis might improve it, however.

Show polr plot with only single predictor using Side Effects to predict Overall Satisfaction
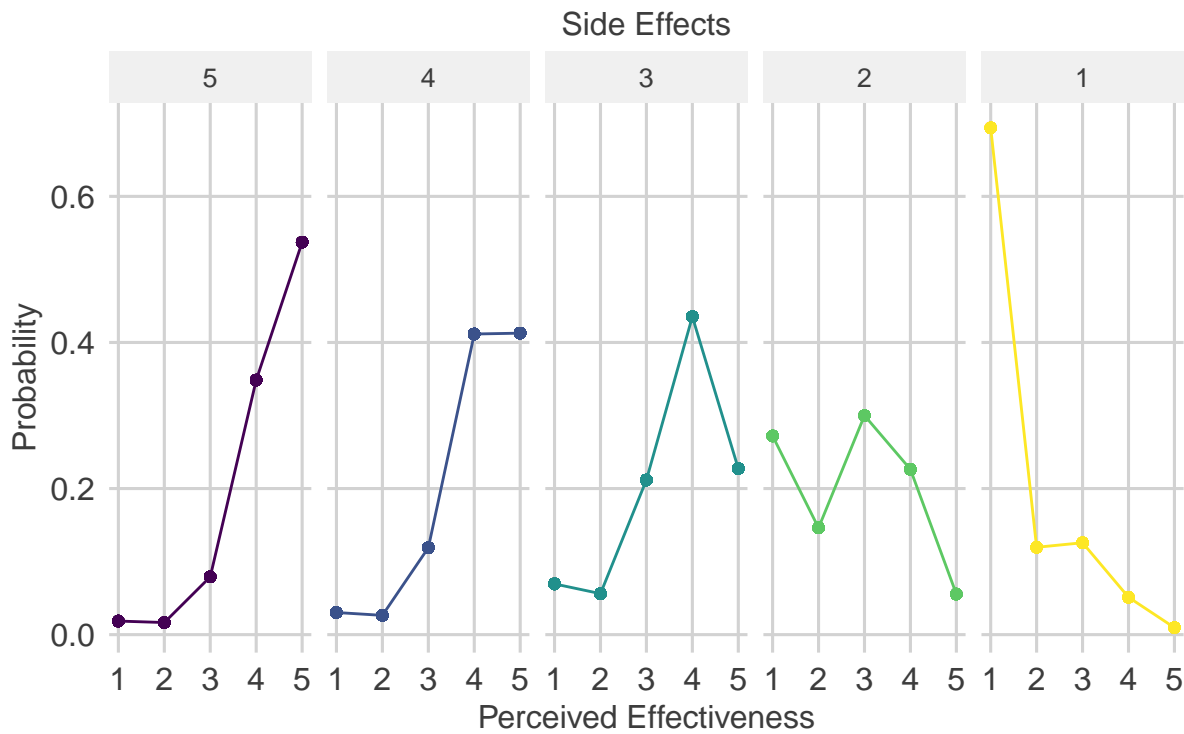
Ordinal Logistic Model Probabilities

Side Effects
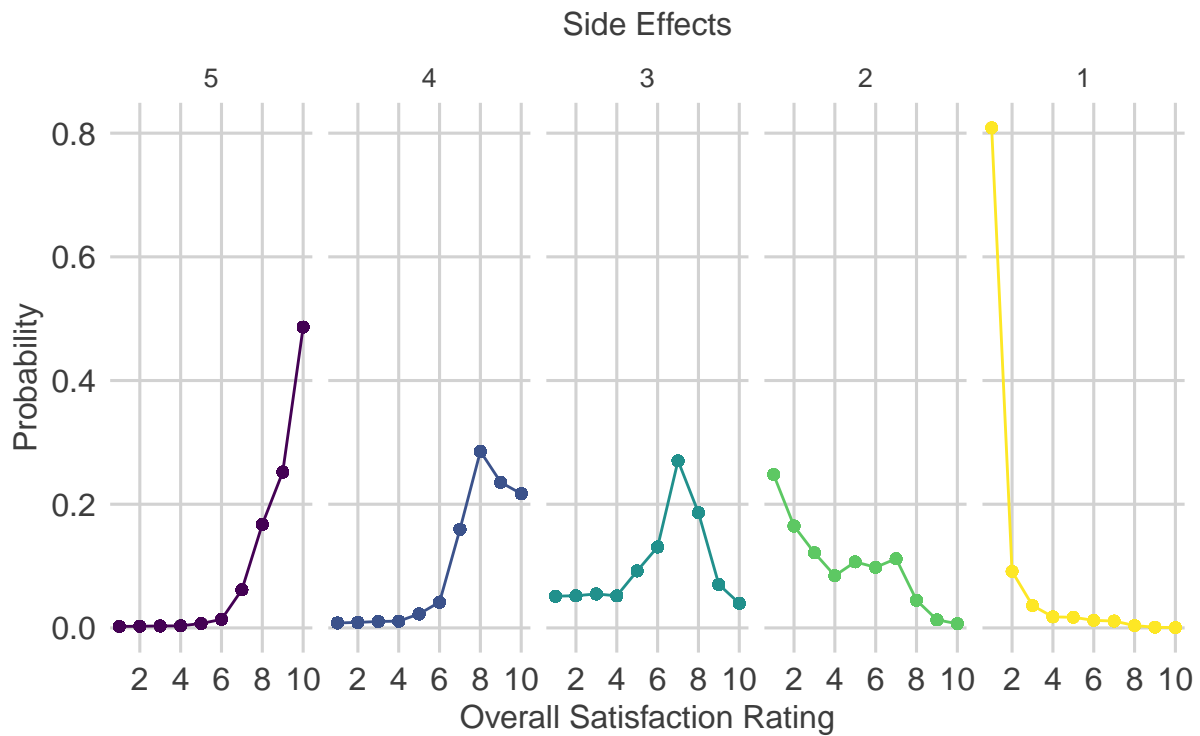
Ordinal Logistic Model Probabilities
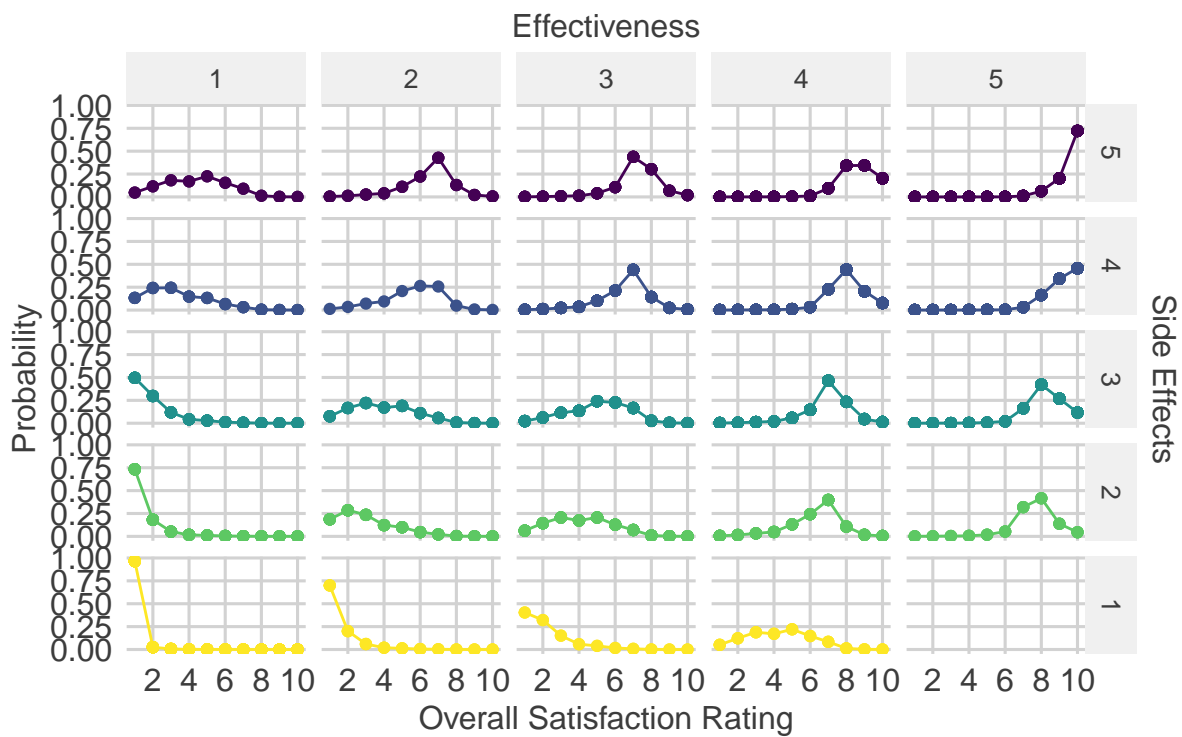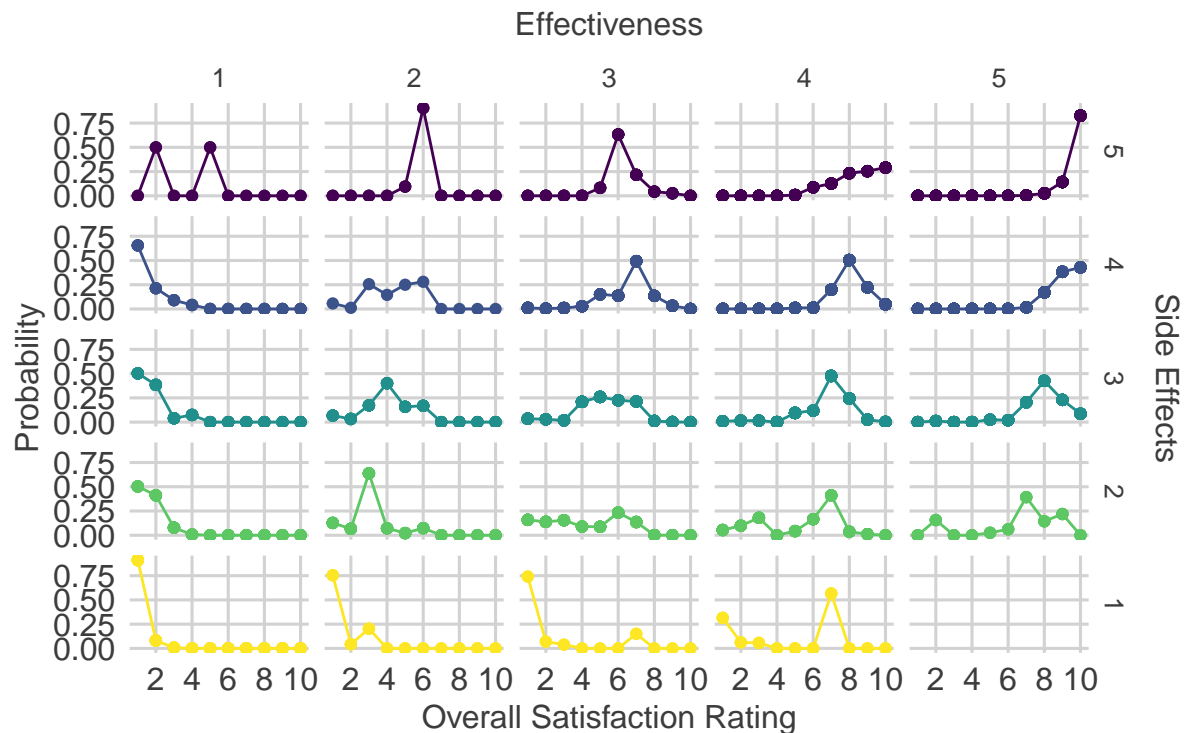
Effectiveness

Show polr plot predicting effectiveness using side effects as predictor; how strongly do side effects predict perceived drug effectiveness?

Ordinal Logistic Model Probabilities

Multinomial Logit Model #1 (2 predictors): SatisfactionRating ~ Effectiveness + SideEffects

Multinomial Logistic Model Probabilities

Multinomial logit model 1 and 2 not very different based on AIC (1380.239 vs 1383.26 respectively), whereas model 3 has lowest deviance but considerably higher AIC (1879.28). Could go with m1, since it has lowest AIC.

State answers to your questions;

Describe how you came to these answers;

Explore the implications to your answers. For example, if your answer is a non-trivial model, plot the fit and describe what's going on in words.

Identification of work left to do/limitations.