Objectively Identify New Depressive Episodes

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SPRINGBOARD: INTRODUCTION TO DATA SCIENCE COURSE

The Goal

Can we detect, or detect when this patient will have a major depressive episode?

Overview

- Single patient with an 8.5 year history of major depression
- Eight month study broken down into 5 phases
  - Phase 1 - Baseline period lasting four weeks where the medication dosage was kept constant 150 mg.
  - Phase 2 - The researchers called this a double-blind phase. The medication dosage was not modified and lasted for two weeks.
  - Phase 3 - A double-blind period lasting eight weeks where the medication dosage was gradually decreased on a schedule randomly chosen by a pharmacist.
  - Phase 4 - A post-assessment period lasting eight weeks in which the patient was completely off the medication.
  - Phase 5 - A twelve week follow-up period.

Depression Assessment

- Questionnaires administered at different intervals
  - Several times a day
  - Once a day
    - Morning
    - Evening
  - Once a week
- In total there were 75 questions the patient was asked to complete
- The multiple times a day questions mostly had to do with the patients mood, feelings of self worth, and physical symptoms
- Daily questions related to quality of sleep and assessment of the day
- Weekly, on Mondays, the patient was asked to respond to the depression scale portion of the SCL.90.R questionnaire

Dataset Challenges

How do we measure depression?

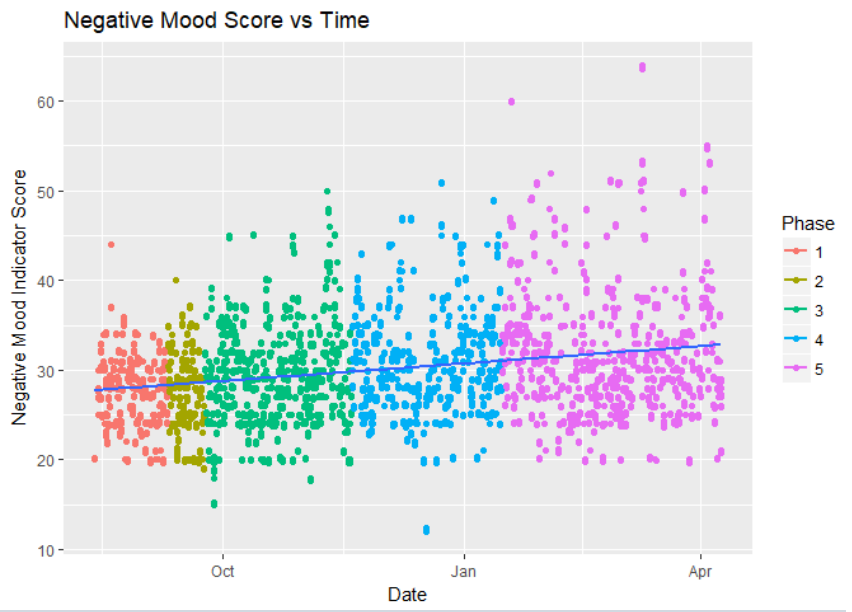
- Created a new variable which is the sum of the 13 SCL.90.R depression scale question scores
  - Original dataset contained a variable for the average of the 13 questions. This was not chosen because it was felt that using an average would diminish the granularity or sensitivity of the measurement

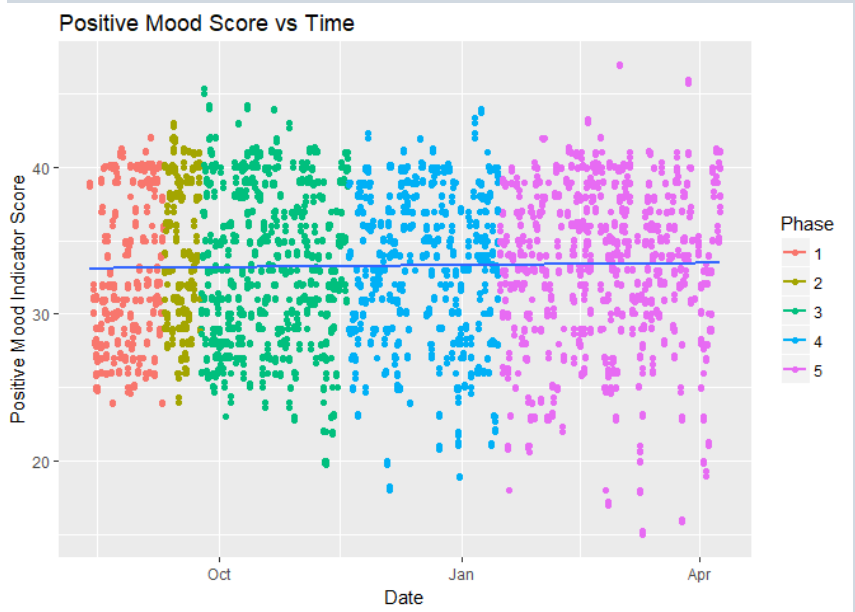
With so many variables, how do we decide which ones directly contribute to identifying a depressive episode?

- In order to simplify, the questions that were asked multiple times a day were grouped into 3 new categories for analysis:
  - Positive Mood and Self Esteem Indicators - Questions such as, "I feel cheerful", and "I like myself“
  - Negative Mood and Self Esteem Indicators - Questions such as, "I am anxious", and "I feel worried“
  - Physical Indicators - Questions such as, "I am tired", and "I am in pain"

Histograms and scatterplots of the newly created grouping variables were examined

- Histograms yielded mostly normal distributions
- Scatterplots of the summed depression scores vs the 3 new grouped variables showed an increase over time in symptomology which was suspected


Negative Mood Score vs Time
Negative Mood Indicator Score
Date
Oct
Jan
Apr
Phase
1
2
3
4
5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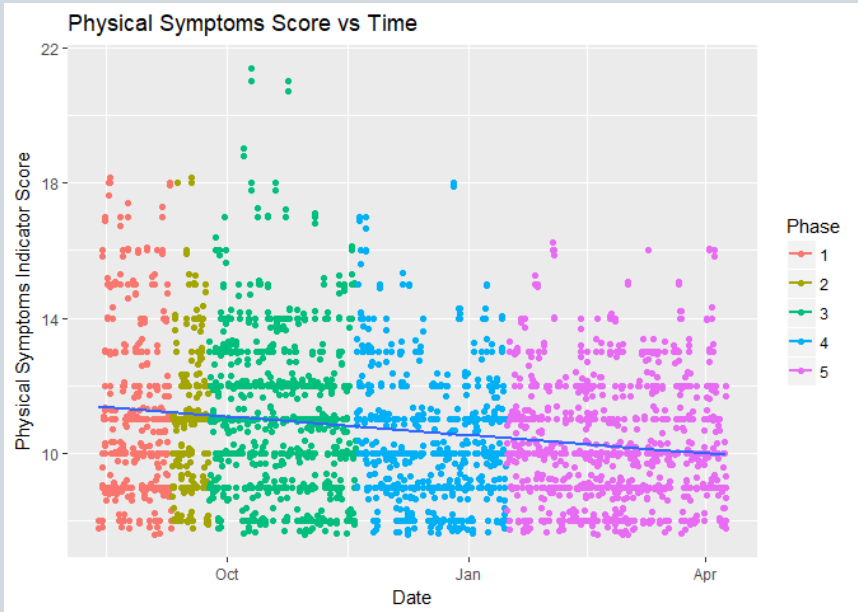
Physical Symptoms Score vs Time
Physical Symptoms Indicator Score
Date
Oct
Jan
Apr
Phase
1
2
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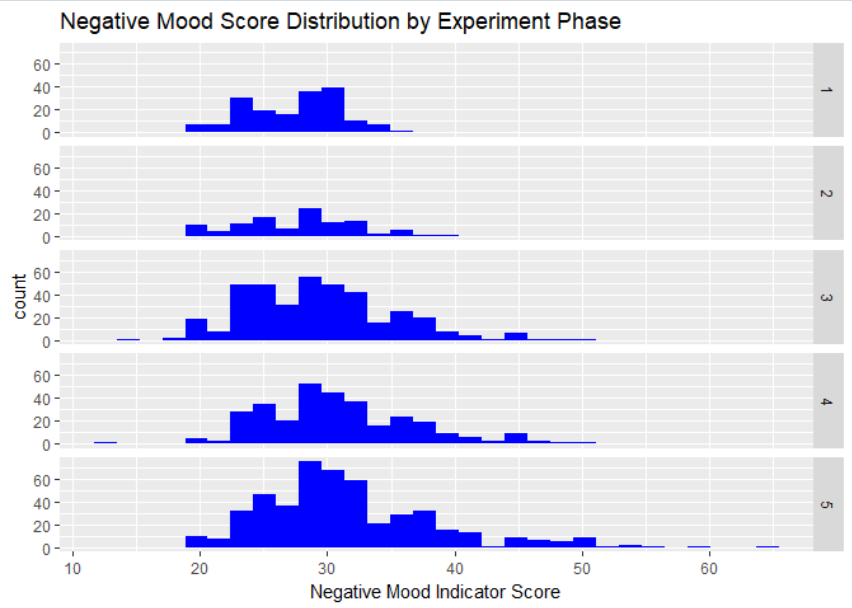
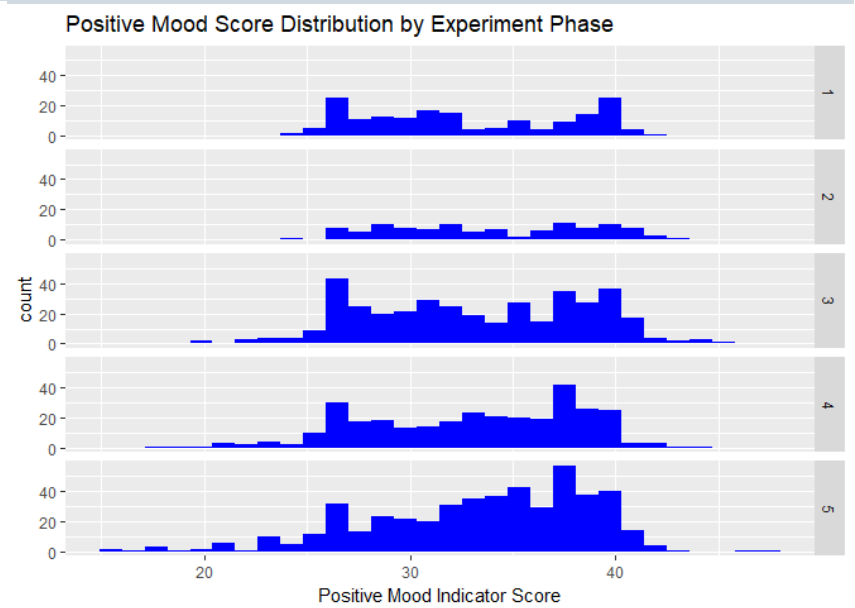
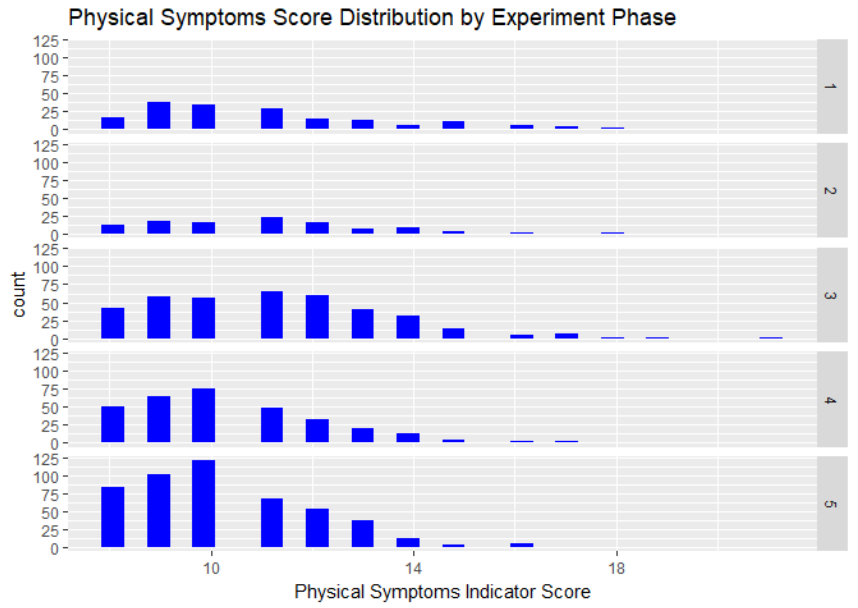

Negative Mood Score Distribution by Experiment Phase
count
Negative Mood Indicator Score


Positive Mood Score Distribution by Experiment Phase
count
Positive Mood Indicator Score


Physical Symptoms Score Distribution by Experiment Phase
count
Physical Symptoms Indicator Score

Data Analysis

Because the SCL.90.R questions used to determine the depression score relate to how the patient felt over the previous 7-day period, a new data frame had to be created to match the weekly depression score with the average of the grouped variable scores from the previous week.

This allowed the regression of the grouped scores upon the dependent depression score variable

Data Analysis

The first pass through the data showed the model with the grouped negative mood and physical symptom indicators was reasonably strong

These grouped variables were uncoupled into their individual components and the quality of sleep variables were tested to see if improvement could be made to the model.

After multiple iterations, the model that predicted a depressive episode the best focused on the patients response to two questions:

1. ***"I worry…"***
2. ***"How long did I lie awake this morning before I got up?"***

Clinical Discussion and Recommendations

It cannot be stressed enough the exploratory nature of this study. These findings are only valid for this individual, at this point in time.

Larger and more diverse populations of patients would have to be included in order to make more concrete observations and potentially use the data for predictive purposes.

Recommendations

It is clear from the data focusing on two questions can assist the healthcare provider in predicting depressive episodes and intervening appropriately.

1. ***"I worry…"***
    - Be aware of the patients reports of feeling worried. For this patient increased feelings of worry showed the strongest correlation with increased depression score.
    - Worry in itself is more an expression of anxiety over things that may happen in the future. It is the chronic state of this anxiety that manifests into depression.
    - Giving the patient tools to recognize this pattern, then switching their focus from the future (worry) they created in their mind to the present moment can be an affective tool in breaking this pattern.

Recommendations

2. ***"How long did I lie awake this morning before I got up?"***
    - Pay attention to the patients sleep patterns. All of the sleep variables increased the strength of the model as one would expect.
    - I chose the variable that measured how long it took the patient to get out of bed upon waking for the model because it affected the Adjusted R-squared the most and was the most statistically significant.
    - It is clear better sleep corresponds with less depression. Here, increased physical activity, relaxation techniques, and meditation would all help.

Finally, while not included in the final model for mathematical reasons, the patients reports of feeling dizzy should also be taken into consideration.

In the context of this study, dizziness could have been a function of the side effects experienced when withdrawing from long-term antidepressant medication usage.

If it is a withdrawal symptom of the medication it should subside after a couple of weeks, otherwise some other intervention may be required.