Tracking Bipolar Mood States with Survey Data
Individual Project: Proposal

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1 BACKGROUND AND SIGNIFICANCE

Bipolar disorder is a debilitating psychiatric mood disorder characterized by states of mania and depression; mania often presents as hyperactivity, mental hyperactivity, and irritability, while depression can present as sadness, fatigue, and reduced physical capability (Goldstein, 2010). Throughout the course of illness patients can sequentially or simultaneously experience any combination of these states, often with intervening periods of euthymia (Koenders, Nolen, Giltay, Hoencamp, & Spijker, 2015).

Bipolar disorder is one of the most common psychiatric disorders; identified in more than 4% of Americans (Kessler & Berglund et al., 2005), a Harvard study reported that 2.8% of the population was directly and negatively affected by bipolar disorder over twelve months (Kessler, Chiu, Demler, Merikangas & Walters, 2005). Bipolar patients commit suicide more than 3 times as often as patients with major depressive disorder (Baldessarini et al 2019), and conservatively nearly ten times the general population (Dutta et al., 2007). Bipolar disorder is estimated to have caused a direct and indirect economic burden of $45 billion in 1991, and patients suffer a variety of personal, professional, and legal concerns (Hirschfeld & Vornik, 2005).

2 PROBLEMS

To evaluate a patient's current mental state, clinicians often use extant subjective depression rating scales to identify periods of risk or state transitions. Traditionally these have taken the form of paper surveys, which are then at best scanned and stored in a patient's file. Surveys such as the Montgomery-Asberg Depression Rating Scale (MADRS) and the Hamilton Depression Rating Scale (HAM-D), are designed and validated primarily in the context of unipolar depression; the Bipolar Depression Rating Scale (BDRS) includes bipolar-specific symptom scoring (Berk et al., 2007). These observations are challenging to share with other

providers, and understanding patterns and relationships using a paper history is complex at best.

Beyond observational surveys, clinicians often ask for periodic qualitative assessments using short surveys filled out by the patient; these 'mood trackers' provide additional information that contributes to diagnosis. While there are many electronic mood trackers, few of them make consolidated data available to clinicians, and most of them track only a single state variable (Van Ameringen, Turna, Khalesi, Pullia, & Patterson, 2017). For patients suffering from bipolar disorder these single-metric mood trackers do not provide enough data to identify transitions or mixed states as they occur (Matthews, Murnane & Snyder, 2017).

3 PROPOSED SOLUTION

Proposed is a care dashboard that provides an easy-to-read visualization of historical clinician- and patient-reported survey responses. This dashboard will include a time-based chart comparing observational and subjective results, allowing clinicians to better understand qualitative reporting by patients and the ultimate levels of mood swings during disease progression. Since patient-reported surveys happen outside scheduled appointments, a clinician has an additional view of patient's mood state both before and after their own subjective analyses; this encourages early interventions and enables informed discussion during psychotherapy. By viewing a patient's historical mood transitions a practitioner and patient may also be able to find and isolate triggers like environmental or seasonal changes, improving patient care when situations may lead to a destabilized mood.

4 COMPLEXITY AND EFFORT

Patient survey input will accept multivariate mood input data in the form created and validated by Perez-Arribas, Saunders, Goodwin, & Lyons (2018). This will be implemented as a patient-facing SMART on FHIR application. This application will be implemented using JavaScript. Data will be stored in a FHIR server using standard FHIR resources and tied to a patient using the implicit SMART on FHIR context (Mandel, Kreda, Mandi, Kohane & Ramoni, 2016).

Providers, likewise, will have a SMART on FHIR application containing an input form to create BDRS records based on the validated paper format of the survey

(Berk et al., 2007); as for the patient-facing application, data will be saved into standard FHIR resources. However, providers will also have access to historical data in both numeric and visual formats based on historical patient information contained in the FHIR server. Visualization and charting could use Plotly for Python, chart.js for JavaScript, or possibly some other appropriate charting package. The provider-facing application will be implemented either in Python 3 or using JavaScript within the context of a SMART on FHIR web application.

Because the input data for both patient and provider surveys include diverse values, an ongoing challenge of this project will be finding useful ways to display correlative data points. Additionally, there is limited public data containing actual multivariate mood state reporting, and few studies correlating self-reported mood states with provider-scored surveys. This will present a significant challenge for generating a realistic demonstration dataset.

Because authorization, authentication, and collected information is inside the context of SMART on FHIR or the FHIR server itself, there are minimal data access concerns for the real environment. There are some policy concerns to be addressed: if the tool turns out to be effective at tempering bipolar mood states and becomes popular, perhaps the flagrantly self-destructive and psychotic actions of bipolar politicians and other public figures might be more effectively controlled; it is hoped that this tool has a calming effect on health care policy specifically and the general political landscape in general. It is also foreseeable that there will be additional knock-on effects due to diminished requirements for muckraking and other forms of rag journalism, yielding reduced employment possibilities and other negative externalities for certain fYouTube and political commentators.

5 CONCLUSION

Bipolar disorder is a chronic illness that has a long-established standard of care yet continues to be characterized by poor outcomes and high direct and indirect medical cost. Proposed is a patient survey tool and a parallel care provider interface that gives temporal insight into historical provider- and self-reported metrics about patient mood state. It is hoped that this will improve patient understanding and help providers recognize and address critical mood transitions before they become catastrophic.

6 REFERENCES

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