The suicide crisis is troubling, to say the least:
- Suicide rates over 2000 lives daily.
- Suicide deaths have risen by more than 30% since 2000.
- Suicide-related emergency room visits have increased by 50.6% since the COVID-19 pandemic.

70 years of revolution—and the same old risk identification and treatment:
We haven't made much progress in the last 70 years. Suicide risk assessment is woefully inaccurate and rigid, and inaccessible.

Suicide risk assessment is only 5.5% accurate:
The Bi-Polar Project's DSM-5 is woefully inaccurate and rigid, and inaccessible to the public.

Treatment identification is...
- DSM labels do not refer to etiology—treatment decisions are trial-and-error guesses.
- Evaluations are hard to get, both in the developing and developed worlds.
- DSM labels on risk and final treatment of a patient they had never seen.

The Big Issue
Suicide risk assessments and treatment determination have not improved over the past 70 years, so current suicide risk assessments—woefully inaccurate and rigid—and inaccessible interview-based treatment approaches have reached their limits.

Purpose
Digital phenotyping seems to fit the bill:
- Writing patterns shift with emotions, thinking styles, and social concerns (Schubert, 2019).
- Digital phenotyping = using data as input to determine risk factors and predict illness. It has been successful in diagnosing and treating:
  - breast cancer (Delire et al., 2022)
  - abnormal heart rhythms (Lee et al., 2021)
  - Alzheimer's disease (Gregory et al., 2022)
  - abnormal heart rhythms (Lee et al., 2021)
  - electroconvulsive therapy

Syntax: the arrangement of words to form phrases and sentences
- words per sentence
- 3rd person plural
- impersonal pronouns

This study considers two dimensions of writing:
- Semantics: the tone of and meaning behind words
- fullfilled
- conversational
- authentic

Research Question
Can the syntactic and/or semantic features of an individual's writing be used to predict their suicide risk and optimal treatment modality in real-time?

Hypothesis
A patient's semantics reflect their underlying phenotype better than their syntax = a risk and treatment identifier based on semantics (Model M) would be more accurate than one based on syntax (Model X).

Design and Methodology
Participants (n=411) were administered...

<table>
<thead>
<tr>
<th>Description</th>
<th>Model X</th>
<th>Model M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suicide Status Form-4 (SSF-4)</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Suicide risk treatment modality</td>
<td>75%</td>
<td>75%</td>
</tr>
<tr>
<td>Syntax/semantics, suicide risk, and treatment:</td>
<td>60%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Syntax and semantics were analyzed with computational linguistic software:
The Linguistic Inquiry and Word Count (LIWC-22) program read diary entries to crunch over 100 syntactic and semantic dimensions.

Finding associations between syntax/semantics, suicide risk, and treatment:
80% of the 5181 events (n=4170) were used to train Model X and Model M to identify patterns in syntax and semantics that predicted suicide risk and final treatment.

Testing those associations:
The other 20% of the events (n=1011) were used to check whether Model X and Model M could accurately predict the suicide risk and final treatment of a patient they had never seen before, based on only their syntax or semantics.

Results
Efficacy
- Model X: 90% accuracy, 80% precision, 90% recall, and F1 score of 0.75.
- Model M: 80% accuracy, 70% precision, 80% recall, and F1 score of 0.65

Kruskal-Wallis test: There are significant differences (p < .05) in the accuracy, precision, recall, and F1 score of suicide risk assessment between Model X and Model M.

Discussion
Conclusion
Model M's accuracy (98.15%) for risk assessment, 87.65% for treatment determination, precision (.97, .73), recall (.97, .72), and F1 scores (.97, .72) were considerably higher than Model X’s, supporting the hypothesis.

Model M was integrated into SuiSensor—a one-stop shop for clinicians:
- SuiSensor continuously analyzes writing to provide patient risk reports, with confidence ratings, at user-selected intervals.
- SuiSensor recommends a local clinical evaluation at a concerning risk level.

Addressing SuiSensor's limitations:
Aggregation: SuiSensor pooled all subjects, but sub-populations may have different relationships between writing and suicidality.

What's next for SuiSensor?
- SuiSensor will clarify its reasoning, characterize its weaknesses, and report how it will act in the future.

Framework: This approach could be extended to detect and treat other under-diagnosed conditions like major depressive disorder or schizophrenia.

SuiSensor upturns risk assessment:

- Moment-by-moment tracking to find and treat suicidal behavior before it is too late.
- Crunching 73 semantic features to predict risk without biased human inputs.
- Centering the patient's unique context for custom predictions.

SuiSensor revolutionizes treatment identification:

- Delays: 80.1% of patients wait months, years, or even decades to get the right treatment, but SuiSensor can get it right the first time.
- Debts: SuiSensor centralizes care to happen anywhere in the world, chipping away at the annual $148 billion bill for mental health care.
- Deaths: Unlike the DSM, SuiSensor delivers care that aligns with a patient's etiology, addressing the underlying issues—not the symptoms.

All figures, charts, and graphs were generated by the student researcher.