

CASE STUDY

Natural Language Processing & Suicide Prevention: Ensuring No One Falls Through the Cracks

The Challenge

Each year as many as 1.2 million individuals attempt suicide. Many have a relationship with their healthcare provider; 38% of those who attempted suicide had some kind of healthcare visit within a week of their attempt. 64% of individuals had a healthcare visit within a month before attempting suicide. These stats reflect a failure to identify and support at-risk individuals when they need it most.

Suicide significantly impacts the healthcare system and creates societal and economic burdens. It's estimated that [suicide and attempted suicide cost the U.S. \\$490 billion](#) in 2019, including medical costs, work-loss costs, and quality of life costs. In order to address this growing crisis, both providers and payors must play a role in helping identify and support at-risk individuals before they reach the point of self-harm.

Identifying and preventing self-harm and suicide is challenging. Individuals may not disclose their thoughts of self-harm due to stigma or fear of consequence. Using a Patient Health Questionnaire (PHQ-9) or other screening tool and having a protocol for individuals who indicate suicidal thoughts is a critical part of prevention. Unfortunately, depression screening rates remain incredibly low in the U.S., falling [below 2% nationally](#).

Even after providers and payors establish regular and widespread screening protocols, there remain numerous hurdles to providing life-saving interventions, including disingenuous assessment responses or declines in well-being in between assessments. All told, this can lead to disastrous results. The solution lies in a comprehensive strategy that engages individuals between appointments, providing care teams greater insight into their needs.

PRIMARY OBJECTIVE

Identify individuals who are at risk for suicide that aren't identified in a PHQ assessment.



53% of individuals who triggered an NLP urgent alert were not flagged by a PHQ assessment in the 30 days prior to the alert

2X

Individuals who triggered an NLP urgent alert were 2X more likely to be at risk for suicide than individuals with PHQ urgent alerts

The Solution

NeuroFlow engages individuals on a regular basis through a combination of validated assessments, mood trackers, and other measures to ascertain well-being. These data insights inform a proprietary **severity score** that allows NeuroFlow to analyze well-being over time and alerts care teams of sudden increases in severity that may indicate the potential for self-harm.

Individuals trigger either at-risk or urgent alerts when their severity score increases. NeuroFlow differentiates at-risk and urgent alerts based on the severity of the risk and urgency for direct outreach.

NeuroFlow additionally utilizes Natural Language Processing technology (NLP), a form of artificial intelligence that understands word meaning using computational linguistics and machine learning. NLP from journaling in the NeuroFlow app informs severity scoring and indicates potential for self-harm or suicidal ideation. The technology can understand the context of language, making it a critical tool in identifying high-risk words or phrases and evaluating the level of risk, eliminating false positives.

When NLP identifies language related to self-harm, an alert is generated, simultaneously informing care team members of potential risk and referring individuals to local and national crisis resources or relevant in-app support content.

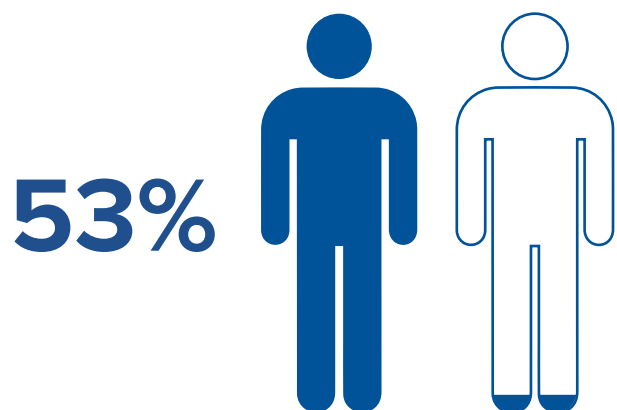
After receiving an urgent alert, a care team member contacts the individual and administers a Columbia Suicide Severity Rating Scale (C-SSRS) to determine the level of suicide risk. Recognizing that not all healthcare organizations have the staffing to provide timely outreach, NeuroFlow offers Response Services—a team staffed by crisis professionals who contact individuals on behalf of the care team to administer this workflow. Based on C-SSRS scores of low, medium, or high risk, NeuroFlow Response

Coordinators direct that person to the appropriate level of care.

“NLP-triggered urgent alerts are a life-saving feature within the NeuroFlow platform,” says Faith Best, LCSW, Clinical Services Senior Manager at NeuroFlow, “Many of these alerts are triggered in between PHQ assessments, meaning the individual would not have received support for weeks without the intervention of NLP, putting them at greater risk for self-harm or suicide.”

The Results

To demonstrate how suicide prevention can be enhanced using both NLP and PHQ-9 identification, NeuroFlow analysts reviewed urgent alerts triggered by NLP and PHQ-9 scores (within 30 days), and evaluated to what degree the 346 users who triggered NLP alerts would have also been identified via PHQ-9 assessments. They found that 53% of users who triggered an NLP urgent alert either did not take a PHQ-9 or did not indicate thoughts of self-harm on the PHQ-9 in the 30 days leading up to the urgent alert. **This means that over half of individuals who triggered NLP alerts would not have been identified otherwise.**



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In an effort to continually improve the NLP algorithm, NeuroFlow analysts monitored risk severity of urgent alerts triggered by NLP versus urgent alerts triggered by PHQ-9, using the C-SSRS. **Individuals who triggered NLP urgent alerts were at a medium or high risk for suicide at nearly double the rate of individuals who triggered PHQ-9 urgent alerts.** This is particularly important because not only does NeuroFlow's NLP technology identify more individuals who are at risk compared to PHQ-9 assessments, but it also identifies higher risk individuals who require more immediate and hands-on interventions.



"We are highly encouraged by this data because it validates our unique approach to identification and suicide prevention. Using A.I. technology like NLP and connecting individuals to resources through our compassionate Response Services team, we ensure that at-risk individuals get the care that they need when they need it most."

- Bill Lynch
Senior Director of Data Science at NeuroFlow

Looking Ahead

It's important to note that although the sample size of this particular use case was relatively small, the impact is significant. Identifying any high-risk individual sooner can result in a saved life. Because of these promising findings, NeuroFlow continues to invest in and improve our risk detection technology. We regularly collect feedback from users to validate the level of risk associated with flagged excerpts in order to continually learn and improve the NLP algorithm. We look forward to reporting further insights as we collect more data on this topic and advance our mission to ensure no one falls through the cracks.

Learn more about how NeuroFlow prevents suicide through high-tech and high-touch solutions.