Uncovering Public Mental Health Signals on Reddit: A Time-Normalized Emotion and Sentiment Study

Zain Baig - 22K4593, Arsalan - 22K4614,
Umer Ahmed - 22K4213, Qasim Naveed - 22K4380,
Maaz Kashif - 22K4518, Abdul Rafay - 22K4192
FAST - NUCES, Karachi

Abstract

Social media has emerged as a powerful lens into public mental health, offering real-time insights into emotional expression and psychological well-being. Reddit, with its pseudonymous structure and active mental health communities, presents an especially rich dataset for sentiment and emotion analysis. However, traditional analyses often overlook temporal imbalances—such as surges in posting during global crises like the COVID-19 pandemic—which can skew results and hinder long-term insights. This study proposes a time-normalized approach to sentiment and emotion analysis of Reddit posts spanning multiple years. By adjusting for uneven data distribution over time, the methodology ensures that findings reflect genuine shifts in public mood rather than volume-driven distortions. Using natural language processing techniques, the research identifies temporal trends, emotional patterns, and sentiment shifts within mental health-related subreddits. The results reveal nuanced changes in public discourse surrounding mental health, offering deeper understanding for researchers, clinicians, and policymakers. This work underscores the importance of normalization in social media analytics to uncover more representative and actionable mental health signals.

1 Introduction

In recent years, social media has become a critical outlet for individuals to express their mental health struggles, offering researchers a window into public emotion and well-being. Reddit, in particular, stands out for its anonymity and topic-specific communities, making subreddits like r/depression, r/Anxiety, and r/MentalHealth valuable sources for large-scale mental health analysis.

This study leverages Reddit's open structure to collect real-time and historical data using the PRAW API, targeting posts and comments spanning multiple years. After preprocessing the text through tokenization, lemmatization, and stopword removal, we applied sentiment analysis (VADER) and emotion classification models to detect underlying emotional states and polarities in user discourse.

A key novelty of this work lies in its time-normalized approach—balancing post volume across months and years to correct for temporal imbalances, particularly around events like the COVID-19 pandemic. This ensures that observed trends reflect genuine shifts in mental health signals rather than posting spikes.

Through this pipeline, we aim to reveal how sentiment and emotion around mental health have evolved over time on Reddit, providing actionable insights for mental health professionals, researchers, and policymakers.

1.1 Literature Review

The study draws on the following peer-reviewed sources to support its foundation:
1. Chen et al. (2018), ACM Transactions on the Web – Sentiment via emoji embedding
2. Bandari et al. (2012), ICWSM – Popularity prediction via engagement 3. Liu, B. (2012), Sentiment Analysis Survey – Core foundation for sentiment mining
4. Sharma & Ghosh (2017), Procedia Computer Science – Real-time analytics with Spark
5. Fan & Gordon (2014), Decision Support Systems – Tool comparison for social analytics
6. Morstatter et al. (2013), ICWSM – Twitter real-time stream processing
7. Zeng et al. (2010), Communications of the ACM – Trends and tools in social analytics

1.2 Problem Statement

Despite the increasing availability of user-generated mental health content on Reddit, accurately analyzing emotional and sentiment trends over time remains a significant challenge. Traditional approaches often overlook temporal imbalances—periods with unusually high or low posting activity—leading to skewed insights that disproportionately reflect short-term events like the COVID-19 pandemic. This bias

hinders our ability to detect long-term or subtle shifts in public mental health.

There is a pressing need for a time-aware framework that can normalize such imbalances and enable consistent, large-scale analysis of mental health discourse. Without this, insights drawn from social media data risk being misleading, underrepresenting critical periods and overemphasizing spikes driven by global events.

This study addresses the problem by developing a pipeline that combines sentiment and emotion analysis with temporal normalization, offering a more balanced and context-sensitive understanding of how mental health expressions on Reddit evolve over time.

1.3   Research Objectives

This study aims to analyze public mental health discourse on Reddit over time using time-normalized sentiment and emotion analysis. The core objectives include:

- Identifying temporal trends in public sentiment and emotional expression related to mental health.

- Addressing temporal skew in social media datasets to reveal long-term psychological shifts.

- Comparing sentiment-emotion correlation across mental health subreddits.

- Generating actionable insights for mental health professionals, policymakers, and platform moderators.

1.4   Significance of the Study

The findings can help stakeholders understand how public mental health evolves in response to global events and societal changes. By using a time-normalized pipeline, the study ensures that subtle yet critical trends aren't masked by data surges during events like COVID-19. This work emphasizes the importance of context-aware digital mental health monitoring.

1.5   Limitations and Delimitations

While the study uses advanced models like RoBERTa and Hartmann's transformer for sentiment and emotion classification, it is limited to text-based Reddit posts from specific mental health subreddits. Non-English content, deleted posts, and user demographic information are not considered. Additionally, while time normalization helps with post density, it may still miss micro-trends within high-activity periods.

2   Methodology

This study followed a structured pipeline to collect, process, analyze, and interpret Reddit data related to mental health. The process was divided into four main stages: data collection, preprocessing, emotion and sentiment analysis, and insight generation.

2.1   Data Collection

We used the PRAW (Python Reddit API Wrapper) library to fetch public Reddit posts from mental health-related subreddits, including r/depression, r/Anxiety, and r/MentalHealth. The dataset spans multiple years to capture evolving mental health discourse. Posts were filtered based on relevance, language (English), and length to ensure quality and consistency.

2.2   Data Preprocessing

To prepare the raw text for analysis, we applied standard NLP preprocessing techniques including:

- Lowercasing and punctuation removal

- Tokenization and stopword removal using a custom stopword list

- Lemmatization for word normalization

- Filtering posts with too little semantic content (e.g., URLs only, empty posts)

This step also involved caching preprocessed data to avoid recomputation, especially helpful during iterations and model testing.

2.3   Emotion and Sentiment Analysis

We used two state-of-the-art transformer-based models:

- **Sentiment Analysis**: A fine-tuned RoBERTa-base model, known for its contextual understanding, was used to classify posts into positive, negative, or neutral sentiments.

- **Emotion** Detection: We used the Hartmann et al. emotion classifier, which categorizes text into Ekman-inspired emotions like joy, sadness, fear, anger, surprise, and disgust. This model is optimized for capturing emotional nuance in social media language.

2.4   Time-Normalized Analysis

A critical part of our methodology involved temporal normalization. Reddit activity is not uniformly distributed—some months or years, particularly during major global events (e.g., COVID-19), had spikes in
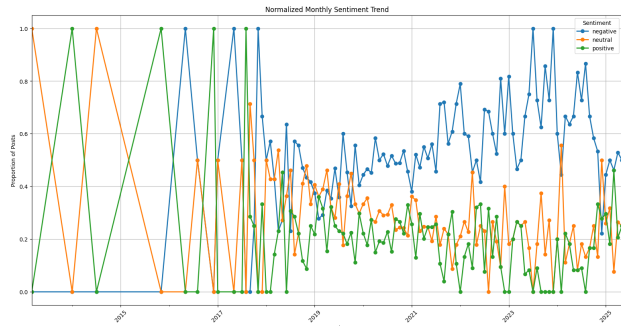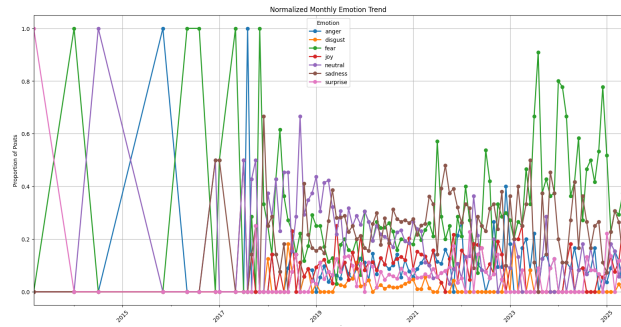
Figure 1: Monthly Sentiment Trend Line Chart

Figure 2: Monthly Emotional Trend Line Chart

mental health discussions. To correct this, we normalized metrics such as sentiment/emotion frequency by total posts per month, enabling fair comparisons over time.

This allowed us to identify true emotional shifts, rather than just volume spikes, by calculating emotion/sentiment ratios instead of raw counts.

2.5 Insight Generation and Iteration

We visualized and interpreted trends over time using charts and aggregated statistics. Initial results, however, revealed that some emotion labels (e.g., surprise, disgust) were too sparse for meaningful insight and were eventually excluded from deeper analysis. Similarly, raw sentiment scores without normalization often misrepresented trends, prompting multiple trial-and-error adjustments.

Only actionable, time-consistent patterns—such as sustained increases in sadness or fear—were retained for final discussion.

3 Findings and Discussion

This section presents key insights derived from time-normalized sentiment and emotion analysis of Reddit posts related to mental health. Results are contextualized by global events and interpreted for their broader implications. Visual figures accompany each subsection.

3.1 Longitudinal Trends in Mental Health Discourse

Increasing Negativity Over Time

- A gradual rise in **negative sentiment** is observed across the years, especially post-2020.

- The **COVID-19 era shows clear spikes**, particularly in 2020 and 2021, coinciding with lockdowns, isolation, and global uncertainty.

- A second notable uptick occurs in 2024, likely linked to stressors such as geopolitical conflicts
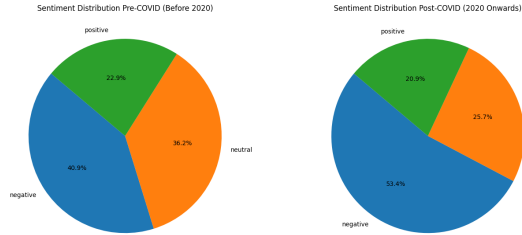
Figure 3: Side-by-Side Pie Charts (Pre vs Post COVID) - Sentiment

(Ukraine–Russia, Israel–Palestine), economic inflation, and employment instability.

Actionable Insight:
Mental health professionals and policymakers should consider reinforcing support systems during known global crises, as sentiment analysis shows direct psychological impact.

3.2 Emotional Evolution in Online Mental Health Communities

Rising Fear and Sadness Emotions

- A gradual rise in **Fear and sadness** both show upward trends over time, closely mirroring the negative sentiment graph.

- Peaks align with pandemic years and again in 2024, indicating sustained psychological toll even beyond the health crisis.

Actionable Insight:
Emotional tracking can serve as an early indicator of collective distress. Intervention programs should ramp up during emotion spikes, not just after crises are visible externally.

3.3 Pre- vs Post-COVID Emotional Shifts

Sentiment and Emotion Distribution Comparison

Figure 4: Side-by-Side Pie Charts (Pre vs Post COVID) - Emotion

Figure 6: Sentiment by Subreddit Bar Chart

Figure 5: Sentiment-Emotion Heatmap

Figure 7: Fear Emotion Word Cloud

- A gradual rise in **Negative sentiment rose from 40.9% (pre-COVID) to 53.4% (post-COVID)**, indicating a lasting impact on online mental health expression.

- The **Sadness increased from 21% to 26%, and fear from 19% to 27%.**

- Positive sentiment and emotions saw corresponding declines.

Actionable Insight:
This sharp shift suggests that pandemic-induced mental health damage has had a **residual effect**, extending well beyond its active years. Recovery programs should be longitudinal in design.

3.4 Sentiment–Emotion Correlation Validates Analysis

Sentiment vs Emotion Cross Tabulation

- A gradual rise in **Sadness and fear emotions correlate strongly with negative sentiment** (each 0.3 of total negative posts).

- Joy aligns with positive sentiment (0.37).

- This complementary pattern validates that the two separate models (RoBERTa and Hartmann) are capturing coherent emotional signals.

Insight:
The overlap supports methodological reliability and encourages multi-model approaches in digital mental health studies.

3.5 Subreddit-Specific Sentiment Patterns

Sentiment Distribution by Different Subreddits

- **r/SuicideWatch** has the **highest negative sentiment**, as expected due to the subreddit's focus.

- **r/depression**, **r/ptsd**, and **r/stress** also show dominant negativity.

- Surprisingly, **r/bipolar** shows a higher ratio of positive sentiment, perhaps reflecting recovery or hypomanic phases.

Actionable Insight:
Platforms and moderators could use sentiment tagging to prioritize support or highlight recovery-oriented content in specific subreddits.

3.6 Lexical Signals of Mental Distress

Word Clouds Reveal Thematic Patterns

- Fear-based posts often include terms like "panic," "alone," "stop," and "symptom."
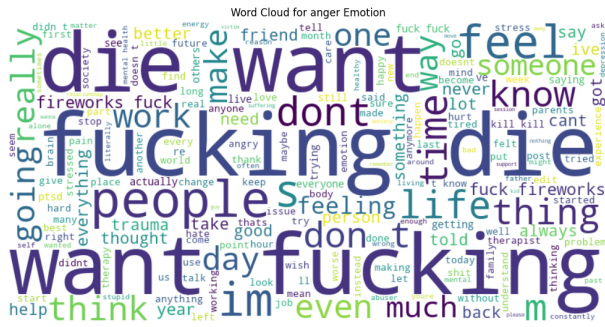
Figure 8: Anger Emotion Word Cloud

- Anger clouds reveal recurring themes around injustice, frustration with systems, and self-directed rage.

Insight:
Word-level patterns help identify emerging vocabulary of distress, useful for refining moderation tools or triggering automated support prompts.

4 Conclusion

- **Temporal Insights into Public Mental Health**
  This study investigated how mental health discourse has evolved on Reddit by applying time-normalized sentiment and emotion analysis. Using robust NLP models—RoBERTa for sentiment and Hartmann's classifier for emotions—we extracted meaningful psychological signals while correcting for temporal skew that often biases social media data.

- **Emotional Impact of Global Events**
  A consistent increase in negative sentiment—especially sadness and fear—was observed over time, with distinct peaks during and after the COVID-19 pandemic. Another sharp rise was evident in 2024, likely triggered by ongoing geopolitical conflicts, economic challenges, and job insecurity. These trends reflect how external stressors directly influence online emotional expression.

- **Community-Specific Mental Health Signals**
  Subreddit-level analysis revealed varying emotional intensities across communities. Highly negative sentiment was dominant in support-focused subreddits like r/SuicideWatch and r/Depression, whereas unexpectedly positive expressions were more frequent in r/Bipolar. This suggests that user intent and community purpose significantly shape the emotional landscape.

- **Reddit as a Barometer of Well-being**
  Reddit's anonymous and open nature makes it a powerful platform to observe shifts in public mood and mental health. By analyzing these discussions through a temporally aware lens, we can detect early warning signs of widespread psychological distress.

- **Toward Actionable Social Monitoring**
  Our findings underscore the potential for digital platforms to inform mental health strategies, offering real-time insights to policymakers, therapists, and public health officials. To maximize impact, future work must ensure ethical data use while enhancing model accuracy and interpretability for actionable deployment.

5 Recommendations

- **Crisis Monitoring Systems**
  Integrate sentiment and emotion tracking into real-time monitoring dashboards for mental health organizations to detect surges in negative discourse during global crises.

- **Platform-Level Interventions**
  Reddit and similar platforms should implement automated flagging or support prompts when users exhibit signs of emotional distress, especially in subreddits like r/SuicideWatch and r/Depression.

- **Policy and Outreach Timing**
  Mental health awareness campaigns and support services should be proactively scaled during periods of known societal stress—pandemics, conflicts, or economic downturns—as these correlate with increased negative sentiment.

- **Community-Level Engagement**
  Encourage balanced discourse by fostering peer-support and recovery narratives in highly negative subreddits, and promote positive mental health subcommunities.

- **Future Research Expansion**
  Extend this framework to include demographic metadata, real-time streams, and multimodal data (e.g., images, videos) for a more holistic view of public mental health trends.