

Evaluating Public Sentiment on ADHD and ASD versus Other Mental Health Disorders: Insights from 10 Years of Twitter (X) Data

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Table of Contents

Original Manuscript..... 5

Supplementary Files..... 32

Figures 33

Figure 1..... 34

Figure 2..... 35

Figure 3..... 36

Figure 4..... 37

Figure 5..... 38

Figure 6..... 39

Figure 7..... 40

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Abstract

Background: Neurodevelopmental disorders, especially ADHD and ASD, have seen a marked rise in public attention, yet research on public opinion remains limited. Social media analysis offers real-time, unfiltered insight into public perceptions, enabling empirical examination of public attitudes and opinions.

Objective: This study aims to assess the evolution of public opinion on ADHD and ASD over the past decade by analyzing tweets from X (formerly Twitter; X Corp, San Francisco, CA), comparing perceptions across English and Spanish languages and against other mental health conditions.

Methods: Tweets mentioning keywords related to ADHD and ASD, and control conditions (depression, anxiety, insomnia, bipolar disorder, schizophrenia, suicide, and substance use disorders) were collected from X between 2009 and 2023. The dataset included English and Spanish tweets. Machine learning algorithms were then applied to classify tweet content into predefined categories, including volume of tweets, engagement, personal experiences, trivialization, perceived causes, and perceived treatability. Parametric and nonparametric tests were used to assess for differences by language. Descriptive statistics were presented using tables and graphical representations.

Results: A total of 852,990 tweets were analyzed, with 59.97% in English and 40.03% in Spanish. Overall tweet volume on mental health conditions increased significantly over time. In English, tweets about ADHD (18.98%) and ASD (14.59%) were among the most frequent, while in Spanish, ASD tweets accounted for 14.49%, significantly outnumbering ADHD tweets (5.34%). Engagement analysis indicated a notable increase in likes and retweets per tweet over time, particularly post-2019, with ADHD-related tweets in English experiencing peaks during the COVID-19 pandemic. ASD tweets, however, had comparatively lower engagement across languages. Tweets sharing personal experiences were more polarized in Spanish, with higher proportions of negative and positive experiences compared to mostly neutral English tweets. Trivialization of mental illnesses was less common in Spanish tweets than in English, particularly for ADHD (93.59%) and ASD (84.73%). User-perceived causes included multifactorial factors, biological/genetic factors, substance use, psychological susceptibility, acute psychosocial

stressors, and COVID-19. Perceived treatability varied by language, but consistently included high perceived incurability, limited improvement despite professional help, and low perceived self-manageability except for anxiety.

Conclusions: Analysis of social media discourse showed ADHD attracted significantly higher tweet volumes, particularly during COVID-19, often described with multifactorial causes including substance use and genetics. ASD consistently received lower attention. Both language groups showed low trivialization, awareness of the chronicity of the illness, and limited support for self-management of mental health conditions. These findings underscore social media's value for capturing direct public perceptions to guide future educational and intervention efforts.

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Original Manuscript

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Abstract

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This study aims to assess the evolution of public opinion on ADHD and ASD over the past decade by analyzing tweets from X (formerly Twitter; X Corp, San Francisco, CA), comparing perceptions across English and Spanish languages and against other mental health conditions.

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Tweets mentioning keywords related to ADHD and ASD, and control conditions (depression, anxiety, insomnia, bipolar disorder, schizophrenia, suicide, and substance use disorders) were collected from X between 2009 and 2023. The dataset included English and Spanish tweets. Machine learning algorithms were then applied to classify tweet content into predefined categories, including volume of tweets, engagement, personal experiences, trivialization, perceived causes, and perceived treatability. Parametric and nonparametric tests were used to assess for differences by language. Descriptive statistics were presented using tables and graphical representations.

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Analysis of social media discourse showed ADHD attracted significantly higher tweet volumes, particularly during COVID-19, often described with multifactorial causes including substance use and genetics. ASD consistently received lower attention. Both language groups showed low trivialization, awareness of the chronicity of the illness, and limited support for self-management of mental health conditions. These findings underscore social media's value for capturing direct public perceptions to guide future educational and intervention efforts.

INTRODUCTION

Neurodevelopmental disorders, such as Attention Deficit Hyperactivity Disorder (ADHD) and Autism Spectrum Disorder (ASD), are complex conditions affecting communication, attention, and behavior.¹ Public interest in these disorders has surged in recent years, leading to more frequent diagnoses and widespread discussion about their nature.² Despite their increased visibility, public understanding remains limited and misconceptions persist.^{3–7} Traditional survey methods, including

structured questionnaires and qualitative interviews, while valuable, often fail to capture these nuanced perceptions.^{8,9}

The existing literature suggests that the rise in ADHD and ASD diagnoses may be attributed to changes in diagnostic criteria and greater clinical recognition.² However, this may not translate into broader public understanding of these conditions.^{10–13} Traditional research methods, such as surveys, interviews, and focus groups, often fail to capture the full spectrum of patient beliefs.^{8,9} In contrast, Twitter (rebranded as X in 2023; X Corp, San Francisco, CA) provides a large, more diverse, and spontaneous sample in real time, offering insights without the constraints of structured methodologies.¹⁴ This platform facilitates anonymous communication by eliminating the complexities of face-to-face interactions, including non-verbal cues.¹⁵ By employing advanced machine learning methodologies to analyze tweets, it is possible to quantify and characterize trends in public opinion, providing an alternative approach to traditional survey-based assessments of public perception.¹⁶

In this study, we address the existing gap in understanding public opinion on neurodevelopmental disorders by analyzing a large sample of tweets collected over more than a decade. We hypothesized that, despite higher tweet volumes and engagement, public discourse on ADHD and ASD remains mixed, with differences by condition and language. Our analysis seeks to elucidate current opinions and attitudes, thereby informing future strategies for education and intervention.

METHODS

1. Data collection:

Tweets were gathered using a search engine called Tweet Binder (Social Bro SL, Córdoba, Spain)¹⁷ that has access to the totality of public tweets, covering the period from 2009 to 2023. For consistency, we refer to Twitter as X in this study. The data collection focused on tweets that mentioned the following keywords related to mental illness: ASD/autism, ADHD, depression, bipolar disorder, anxiety, substance use, schizophrenia, insomnia, suicide; in both English and its Spanish equivalent. The dataset included tweets in English and Spanish from all locations. Metadata associated with each tweet, including the date, time, user location (if available), and user

engagement metrics such as likes and retweets, were also collected. The collected tweets underwent filtering to remove duplicates, non-English or non-Spanish tweets, and tweets lacking substantial content (e.g. tweets with only hashtags, emojis, or single words). All data were anonymized.

2. Ethical aspects:

This study was approved by the Research Ethics Committee of Universidad de Alcalá and is compliant with the ethical principles from the World Medical Association Declaration of Helsinki (7th revision, 2013).

3. Machine learning:

Machine learning is essential for analyzing large datasets that are impractical to evaluate manually. As a subset of artificial intelligence, machine learning includes three main approaches: supervised, unsupervised, and semi-supervised learning.¹⁸ In this research, we utilized semi-supervised learning, which combines elements of both supervised and unsupervised methods, using both labelled and unlabeled data. This method extends traditional manual analysis, aiming to develop a model that replicates expert evaluations for classifying millions of tweets.

The machine learning application begins with a pre-processing step where the tweets are normalized by splitting negative contractions, removing special characters and repetitions, and converting emojis into text. Next, two manually classified datasets (one in English and one in Spanish), each consisting of 1,500 tweets, were randomly divided into a 75% training subset (1,125 tweets) and a 25% testing subset (375 tweets). The training subset was used to train a machine learning model for each classification category: *Classification* (distinguishing tweets relevant to mental health discussions from non-relevant content); *Trivialization* (identifying tweets containing terms or expressions that minimize, dismiss, or undermine the seriousness, impact, or legitimacy of mental health conditions); *Personal Experience* (capturing firsthand accounts or self-reported experiences related to a mental health condition); *User Perceived*

Treatability (assessing whether a condition is viewed as incurable, treatable with professional help, or self-manageable); and *Causes* (detecting attributions regarding the origins of mental health conditions, whether multifactorial, biological/genetic, substance-related, or psychosocial). The testing subset was then used to validate the models' performance.

Despite the availability of various pre-trained models for text classification, we opted for the transformer-based BERTweet model¹⁹ for the English dataset and BETO²⁰ for the Spanish dataset. BERTweet, trained on 80GB of text containing over 860 million English tweets, was selected due to its extensive use in the literature^{21,22} and its specific training on English tweets similar to those we evaluated. For the Spanish dataset, we chose BETO, a BERT model trained on a Spanish corpus, which is also popularly used in the literature.^{23,24}

To ensure these models accurately replicate expert analyses, fine-tuning was conducted for each category. This process involves adjusting the parameters of the pre-trained models using data specific to the new task, leveraging the general knowledge acquired during pre-training on large, unlabeled datasets to adapt them for more specialized tasks. The Spanish dataset was used to fine-tune BETO, while the English dataset was used for BERTweet. A common challenge during fine-tuning is the imbalance of options within each category. To address this, we utilized the Easy Data Augmentation (EDA)²⁵ pipeline to generate additional tweets, ensuring balanced representation across categories. EDA generates new tweets by replacing words with synonyms, randomly removing some words, and rearranging word positions.

The performance of the fine-tuned models was evaluated using the test datasets, with the F1-score used to measure accuracy across all categories. The English dataset models achieved the following F1-scores: Classification (0.78), Trivialization (0.70), Personal Experience (0.69), User Perceived Treatability (0.78), and Causes (0.65). Similarly, the Spanish dataset models presented an equivalent performance: Classification (0.79), Trivialization (0.78), Personal Experience (0.69), User Perceived Treatability (0.70), and Causes (0.66). After confirming the models' effectiveness, they were deployed to classify the remaining tweets. First, the Classification category was applied to both datasets, and only the tweets classified as relevant

were further analyzed across the other categories; those classified as irrelevant were discarded.

Statistical analysis:

Statistical analysis of the data was performed using both parametric and nonparametric tests to assess between-group differences in categories associated with mental illness on X by language. Initially, we verified the completeness of the data by confirming the absence of missing data on relevant variables.

To test for statistical assumptions, the Shapiro-Wilk test was used to assess the normality of the residuals, and Levene's test evaluated the homogeneity of variances between groups. Since the assumptions required for ANOVA were not fully met, alternative methods were chosen. A simplified ANOVA was performed to confirm initial findings, and the Kruskal-Wallis test was applied as a nonparametric alternative. The results were subsequently adjusted using the Benjamini-Hochberg method to control for the false discovery rate and the Holm method to adjust for the type I error rate. To further explore differences between specific groups within each category, Dunn's test was used for pairwise comparison.

Additionally, the Chi-square test (χ^2) was used to determine whether the observed differences between the frequencies of categories associated with different illnesses by language and the expected frequencies were statistically significant.

Descriptive analysis:

Descriptive statistics were presented both in tables and in different forms of graphical representation, including line graphs for temporal evolution of tweet frequencies, and clustered bar charts for comparing different categories of tweets by language. These analyses were performed using the Python programming language (version 3.10.12).

To assess the impact of ADHD and ASD on X, we analyzed the number of tweets over the past decade compared to other common psychiatric diagnoses. Specifically, we included anxiety disorders, schizophrenia, bipolar disorder (BD), depressive disorders, substance use disorder (SUD), insomnia, and suicide.

RESULTS

Number of tweets related to ADHD, ASD, and other mental illnesses

From the total dataset of tweets for all conditions, 852,990 were deemed classifiable for analysis. Among these classifiable tweets, 511,510 (59.97%) were in English and 341,480 (40.03%) were in Spanish, with no significant difference ($p= 1.0$). Overall, the number of tweets about mental health conditions grew significantly over the years (**Figure 1**). In English, 97,084 tweets were related to ADHD, representing 18.98% of the total, and 74,619 tweets related to ASD, which accounts for 14.59%. In Spanish, ADHD-related tweets totaled 18,223 (5.34%), while ASD-related tweets amount to 49,475 (14.49%).

In English tweets, the most mentioned conditions were Anxiety with 100,723 tweets (19.69%), ADHD with 97,084 tweets (18.98%), and Suicide with 96,817 tweets (18.93%). In Spanish, the most mentioned conditions were Anxiety with 105,780 tweets (30.98%), Insomnia with 70,561 tweets (20.66%), and ASD with 49,475 tweets (14.49%).

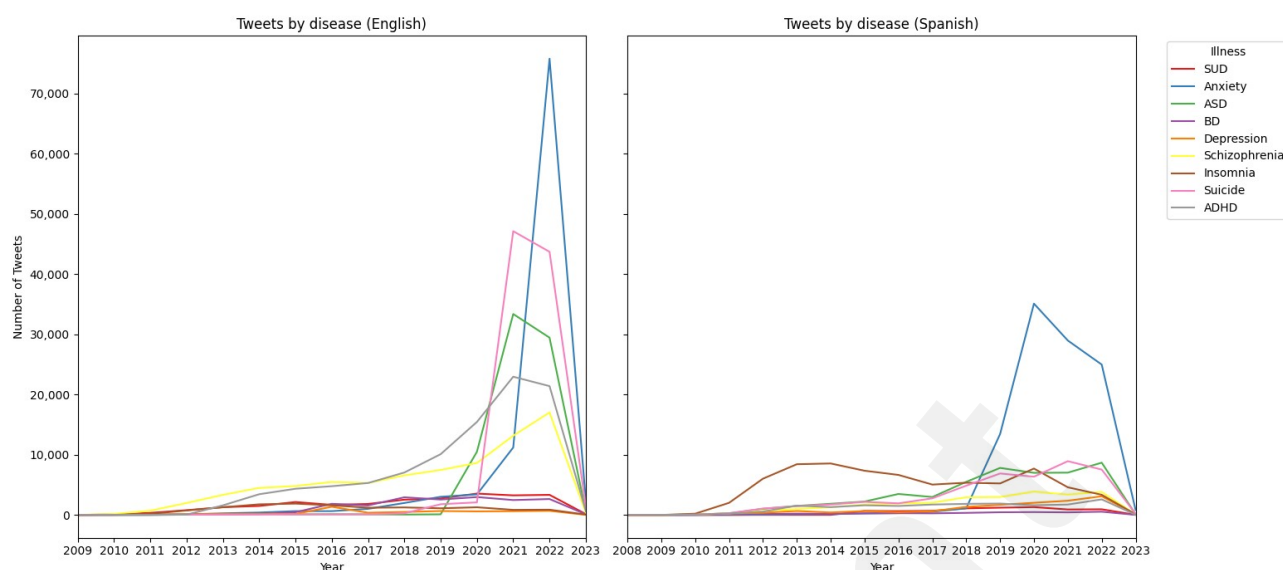


Figure 1. Annual number of tweets by mental health condition. Left panel: tweets in English. Right panel: tweets in Spanish.

Engagement analysis

Figure 2 presents line graphs illustrating the number of likes per tweet over time for various mental health conditions in both English and Spanish tweets. Overall, an increasing trend in likes per tweet was observed across conditions, particularly after 2019. In English tweets, ADHD experienced a significant increase in engagement, peaking around 2021, with likes per tweet reaching over 1,200. This period coincides with the COVID-19 pandemic. ASD, however, did not receive the same level of attention as ADHD, with engagement levels remaining relatively low compared to other conditions. Among the other conditions, anxiety, SUD, and suicide maintained steady engagement over the years, with several conditions surpassing 500 likes per tweet at their peaks. In contrast, ADHD engagement in Spanish tweets was much lower than in English and only slightly exceeded ASD at its peak in 2022. Anxiety, SUD, and insomnia showed significant engagement, peaking during the pandemic. Depression, schizophrenia, and suicide follow similar trends with an increase in likes around 2020-2021.

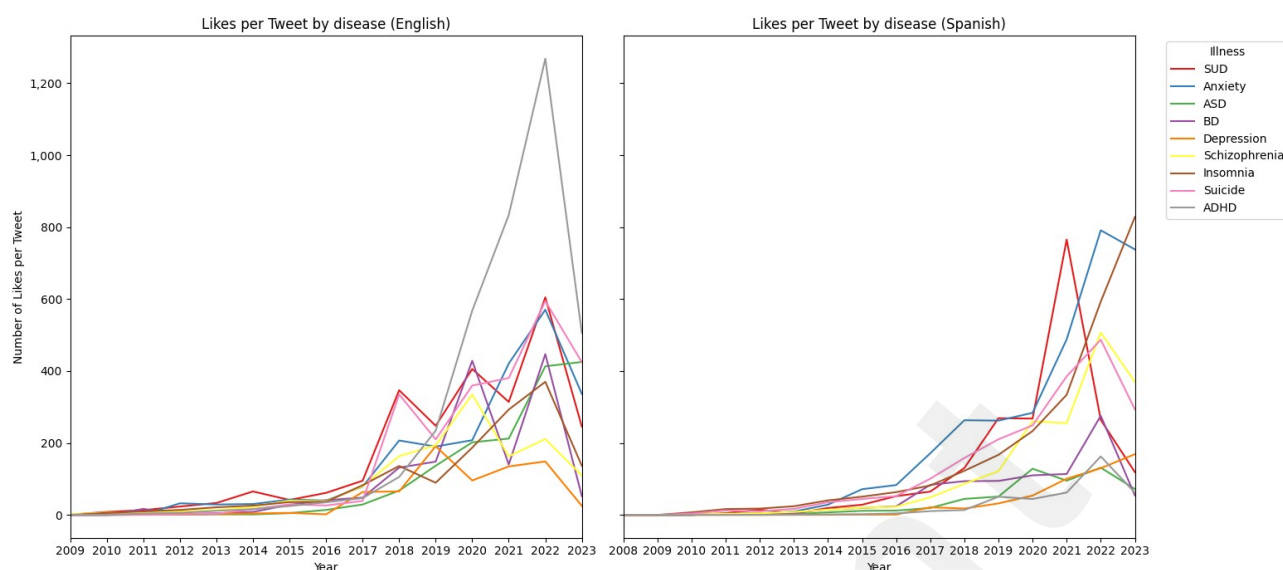
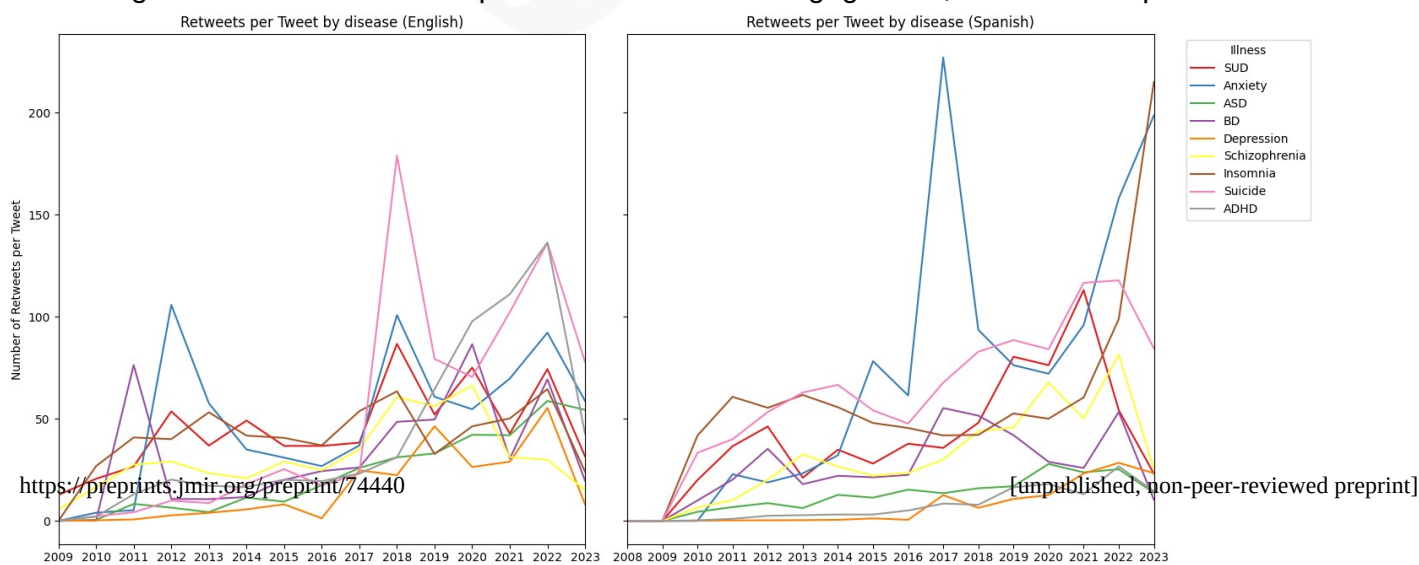


Figure 2. Line graphs illustrating the number of likes per tweet over time for various mental health conditions in both English (left) and Spanish (right) tweets.

Figure 3 presents line graphs illustrating the number of retweets per tweet over time for various mental health conditions. Overall, there was a noticeable increase in retweets-per-tweet over time. In English tweets, ADHD showed notable engagement, with a pronounced increase between 2018-2022. ASD did not receive the same level of attention, with engagement levels remaining relatively low. Suicide had the highest peak in engagement, with the number of retweets-per-tweet nearing 200 around 2018, and another significant but smaller peak around 2022. Anxiety also experienced a significant increase in engagement, with peaks around 2012, 2018, and 2022. SUD maintained steady engagement over the years, with noticeable peaks in 2018, 2020, and 2022.

In Spanish tweets, ADHD showed increased engagement but did not reach the high levels observed in English. ASD remained less prominent in terms of engagement, similar to the pattern observed in



English. In Spanish tweets, anxiety showed the most significant increase in engagement, with retweets per tweet peaking in 2017 and again in 2022. A similar pattern was observed with insomnia. SUD also showed notable engagement, with a peak around 2021.

Figure 3. Number of retweets per tweet over time for various mental health conditions in both English (left) and Spanish (right).

Types of personal experiences in tweets about ADHD and ASD compared to other mental illnesses

Figure 4 illustrates the distribution of tweets sharing personal experiences. Among ADHD-related tweets in English, 4.51% described negative experiences, including stigmatization; 69.79% were neutral, and 2.03% conveyed positive experiences. For ASD, 6.10% of tweets indicated negative experiences, 54.43% were neutral, and 9.18% were positive.

Among other mental illnesses, including anxiety, bipolar disorder, depression, insomnia, substance use disorder (SUD), schizophrenia, and suicide, the distribution followed a similar trend, with an average of 6.30% negative experiences (SD 3.99, range 1.60–13.13), 71.77% neutral (SD 16.17, range 44.38–89.46), and 3.33% positive (SD 3.01, range 0.74–8.12).

When comparing languages, Spanish tweets about ADHD showed a higher percentage of both negative (6.22% vs. 4.51%) and positive (3.99% vs. 2.03%) experiences, but fewer neutral experiences (37.89% vs. 69.79%) than English tweets. Similarly, Spanish tweets about ASD contained more negative (13.49% vs. 6.10%) experiences, but fewer positive (5.51% vs. 9.18%) and neutral (28.29% vs. 54.43%) experiences than their English counterparts. Spanish tweets were more polarized, showing more negative and positive experiences, while English tweets were more often neutral. This pattern was consistent across various mental illnesses.

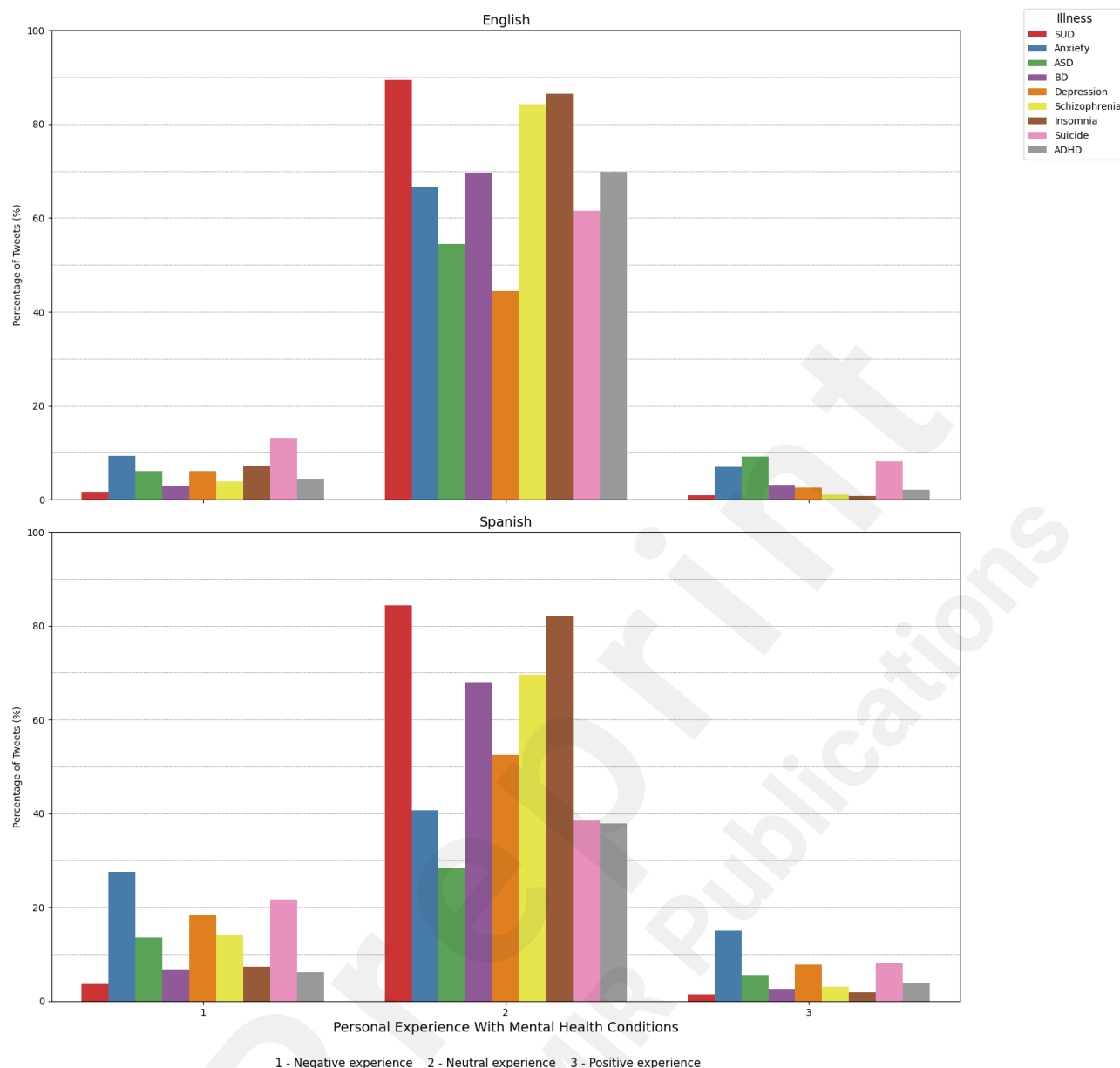


Figure 4. Distribution of tweets that published personal experiences with mental health conditions.

Top panel: tweets in English. Bottom panel: tweets in Spanish.

Trivialization of ADHD and ASD in tweets compared to other mental illnesses

Figure 5 shows that non-trivializing tweets were more common overall, with this trend being even more pronounced in Spanish tweets. In English, non-trivializing tweets accounted for an average of 61.77% (SD 15.24, range 41.24–89.51). ADHD and ASD followed this pattern, with 58.42% and 62.60% of tweets being non-trivializing, respectively.

In Spanish, the percentage of non-trivializing tweets was higher, averaging 78.86% (SD 17.67,

range 41.08–96.97). For ADHD and ASD, non-trivializing tweets made up 93.59% and 84.73% of the total, respectively.

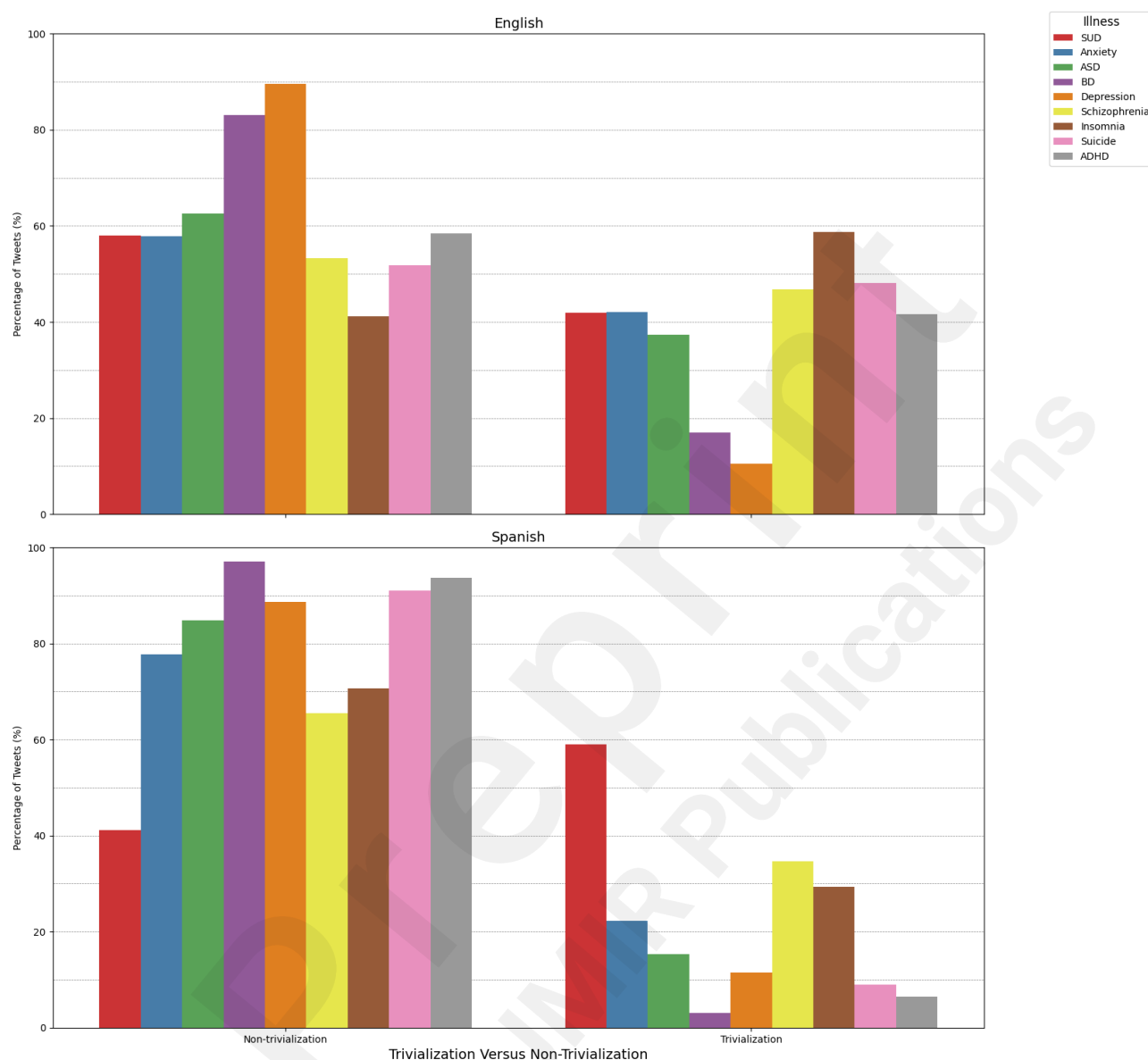


Figure 5. Comparison of non-trivializing versus trivializing tweets about mental health conditions. Top panel: tweets in English. Bottom panel: tweets in Spanish.

User-perceived causes of mental illness analysis

Figure 6 illustrates user-perceived causes of mental illness. For ADHD in English tweets, the most commonly attributed causes are multifactorial factors (61.93%), followed by substance use (15.74%) and psychological susceptibility (12.95%). For ASD, the leading causes are multifactorial factors (60.50%), acute psychosocial stressors (18.04%), and psychological susceptibility (10.12%).

Notably, substance use is associated with ADHD in 15.74% of English tweets, whereas in Spanish tweets, this association is much lower (4.42%). For other psychiatric conditions in English tweets, multifactorial causes are the most frequently cited for anxiety (32.54%), bipolar disorder (41.62%), depression (37.55%), insomnia (77.26%), SUD (35.45%), schizophrenia (40.00%), and suicide (37.52%). Psychological susceptibility is the most common perceived cause for anxiety (37.32%) and is the second most common cause for schizophrenia (24.07%) and suicide (31.31%). Unsurprisingly, substance use is the most frequently cited cause for SUD (48.49%), while it is also commonly mentioned in bipolar disorder (37.80%).

In Spanish, tweets show some differences in perceived causes. For ADHD, the most attributed causes are multifactorial factors (73.65%), followed by biological/genetic factors (17.35%) and substance use (4.42%). For ASD, the leading causes are multifactorial factors (81.04%), biological/genetic factors (12.84%), and COVID-19 (2.50%). For other psychiatric conditions in Spanish, multifactorial causes are the most frequently cited, with higher percentages than in English tweets for SUD (74.63%), suicide (72.87%), depression (67.89%), insomnia (55.38%), bipolar disorder (47.60%), anxiety (45.77%), and schizophrenia (41.32%). Biological/genetic factors are the second most frequently cited cause for bipolar disorder (32.39%) and SUD (9.44%), while substance use is the second most cited cause for schizophrenia (30.21%). Psychological susceptibility is most frequently cited for anxiety (31.01%) but is attributed less frequently to other conditions.

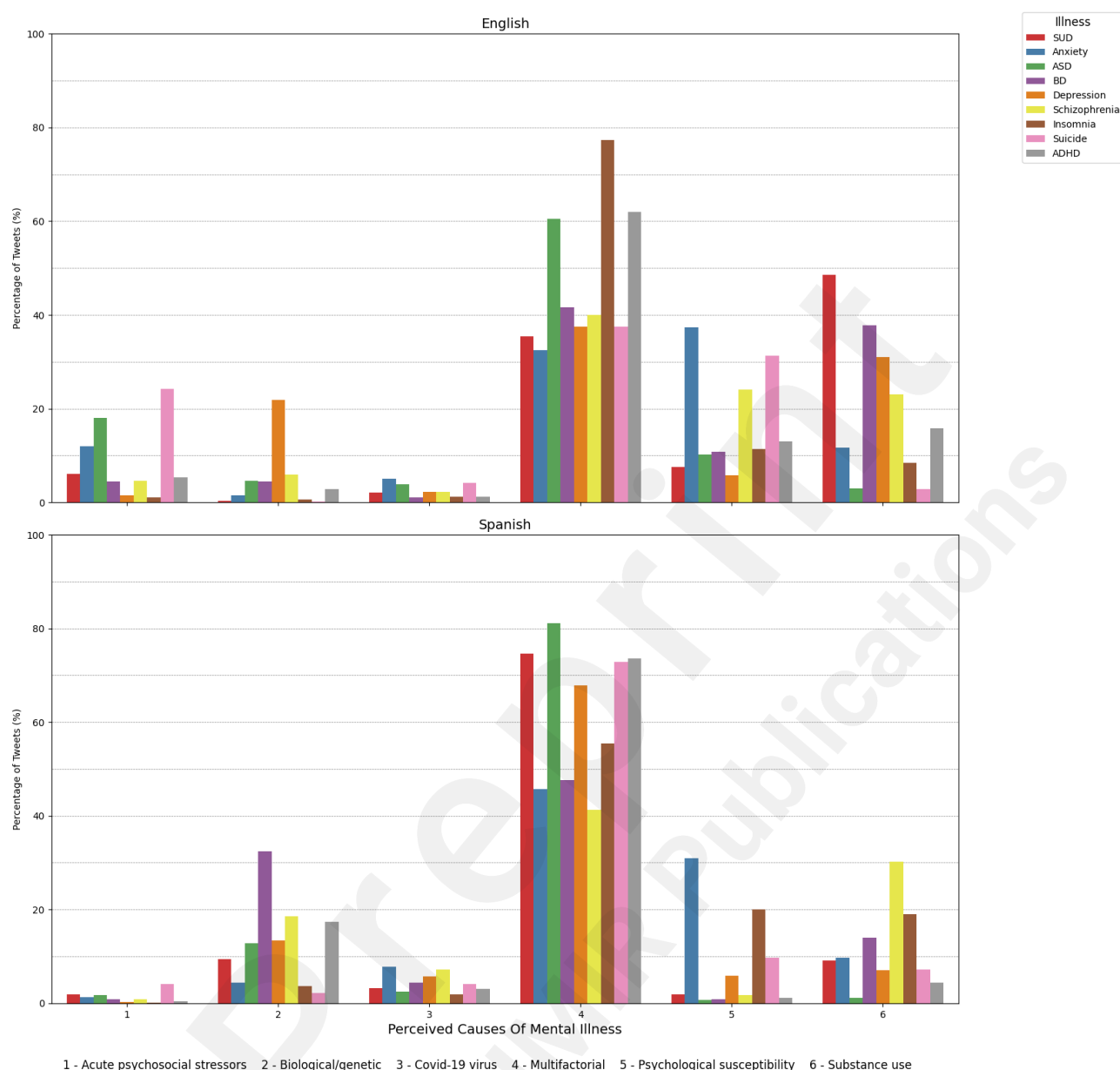


Figure 6. User perceived causes of mental illness. Top panel: tweets in English. Bottom panel: tweets in Spanish.

Percentage of user-perceived treatability of mental illnesses in tweets about ADHD and ASD versus other mental illnesses

Figure 7 illustrates user-perceived treatability of mental illnesses. Among English tweets about

ADHD, 75.35% of users view it as incurable, 18.96% describe it as treatable with professional help, and 5.69% mention that it can be self-managed. For ASD, the perception of incurability is even higher at 81.42%, with 15.62% mentioning it is treatable with professional help and 2.96% referring to it as self-manageable. For other psychiatric conditions, English tweets reflect a high perception of incurability, averaging 82.22% (SD 7.88, range 68.12–91.04). The perception that these conditions are treatable with professional help averages 13.13% (SD 5.92, range 5.33–21.12), while self-manageability averages 4.65% (SD 5.73, range 0.71–17.10). Anxiety stands out, with 17.10% of users stating it can be self-managed, significantly higher than the 3.01% average for other conditions when anxiety is excluded.

In Spanish tweets, some differences emerge. For ADHD, 78.83% of users perceive it as incurable, slightly higher than in English tweets, while 18.95% believe it is treatable with professional help. The perception of self-manageability is lower at 2.22%. For ASD, the perception of incurability is even higher at 82.93%, while 14.93% believe it is treatable with professional help, and only 2.15% think it can be self-managed. For other psychiatric conditions, Spanish tweets indicate a similarly high perception of incurability at 82.49% (SD 7.60, range 71.56–92.32). However, the perception of treatability with professional help is lower at 10.81% (SD 6.43, range 2.99–19.05), while the perception of self-manageability is slightly higher at 6.70% (SD 7.10, range 1.10–18.90).

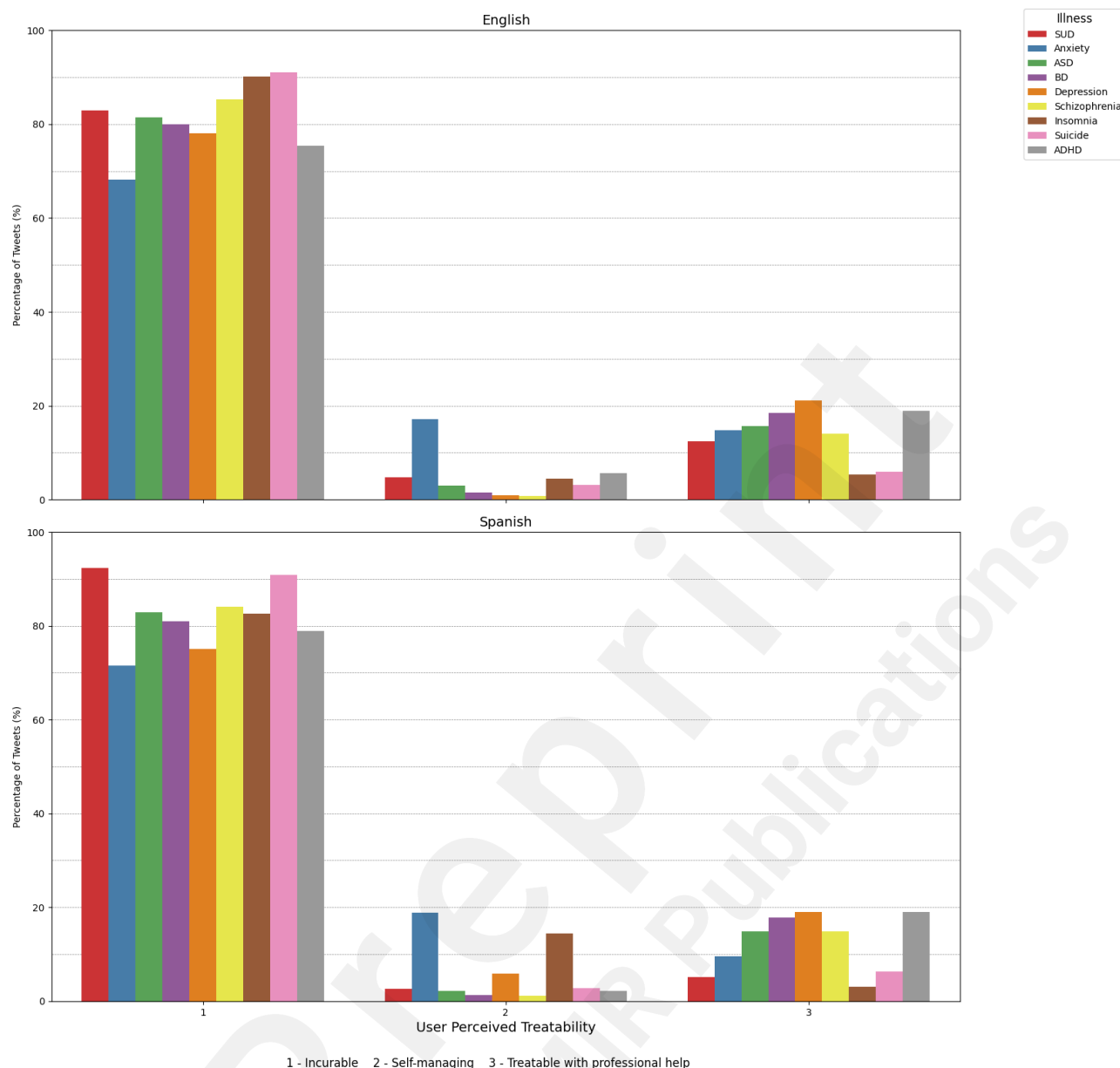


Figure 7. User perceived treatability of mental illnesses. Top panel: tweets in English. Bottom panel: tweets in Spanish.

DISCUSSION

The study employed machine learning techniques to analyze data from X on public perceptions of ADHD and ASD, with other mental illnesses included as comparators. Our analysis of 852,990 tweets revealed a substantial increase in tweet volume and engagement over the past decade. Notably, ADHD-related tweets in English experienced a marked surge in engagement (likes and retweets) during the COVID-19 pandemic, with likes per tweet exceeding 1,200 between 2020 and

2023. In contrast, ASD consistently received lower engagement in both English and Spanish tweets. Personal experiences differed by language, with ADHD tweets predominantly negative in both languages and ASD tweets mostly positive in English but largely negative in Spanish. Overall, tweets conveyed a non-trivializing attitude toward neurodevelopmental disorders, particularly in Spanish. Perceived causes also varied, with English tweets frequently citing substance use and psychological factors, while Spanish tweets emphasized biological/genetic causes, including substance use as secondary for ADHD and COVID-19 for ASD. Users generally viewed mental health conditions as chronic with limited optimism for treatment; fewer than 7% believed in self-management, except for anxiety. Professional help was rarely endorsed, though ADHD was viewed as more treatable than ASD. These insights can inform clinicians and researchers about public attitudes and experiences regarding neurodevelopmental disorders, particularly ADHD and ASD, underscoring the value of social media analysis in providing real-time, unfiltered, and empirically derived data in areas where traditional research methods may encounter limitations.

The findings suggest growing public interest in ADHD over the past decade, while ASD received comparatively less attention.²⁶ Diagnostic criteria changes in DSM-5 (2013)²⁷, including older age-of-onset, fewer symptom requirements for adults, and addition of age-appropriate clinical examples, likely contributed to the increase in ADHD awareness and prevalence.^{28,29} Social media proliferation of ADHD content may have further boosted public engagement.³⁰ Further, the COVID-19 pandemic may have exacerbated ADHD symptoms, increasing recognition and diagnosis.^{31,32} Butt et al. found ADHD-related visits in Ontario increased 32% compared to pre-pandemic, especially among females aged 5-9 and 20-55 years.² Conversely, ASD awareness has grown but not to the extent of ADHD, possibly due to autistic individuals favoring limited social interactions during the pandemic.³³ Pandemic lockdowns may have reduced social demands, easing certain stressors for individuals with ASD.³⁴ Thorell et al. reported that distance learning negatively impacted children with ADHD more than those with ASD. In the same study, ASD families even reported some positive effects, such as reduced social pressure.³⁵ Additionally, it is possible that ASD individuals participate more in private online communities that are not captured by mainstream social media.^{36,37}

While awareness of ADHD and ASD has increased, experiences shared online reveal persistent challenges. ADHD was associated predominantly with negative experiences in both languages, consistent with previous findings.^{12,38,39} Mueller et al. noted significant ADHD-related stigma, including bullying and social withdrawal.¹² ASD elicited mostly positive experiences in English but predominantly negative experiences in Spanish. Morgan et al. highlighted systemic barriers, including language, cultural obstacles, and issues with translated screening tools, limiting timely ASD diagnosis for Spanish speakers and increasing negative experiences.⁴⁰ Griffiths et al. reported autistic adults experienced higher rates of negative life events, such as abuse and financial exploitation, leading to increased anxiety, depression, and reduced life satisfaction.⁴¹ Similarly, Cooper et al. found autistic individuals had lower self-esteem and higher depression and anxiety compared to non-autistic peers.³⁸ Families also reported stigma and discrimination, negatively impacting their mental health and ability to provide support.⁴²

It is unclear whether increased awareness of ADHD and ASD has significantly reduced stigma and trivialization.^{10–12} Social media has likely enhanced visibility, empathy, and acceptance through authentic portrayals and advocacy.^{30,43} Educational initiatives and the more recent neurodiversity movement also reinforced positive attitudes.⁴⁴ Dillenburger found ASD awareness among school peers increased from 50% in 11-year-olds to 80% in 16-year-olds; half knew someone with autism, while about 3% self-identified as autistic.⁴⁵ However, Alsehemi et al. found that although 88% of respondents had heard of ASD, 41% admitted limited understanding.⁴⁶

Although most users endorsed multifactorial causes, the perceived contributing factors for ADHD and ASD varied by language. English-language tweets often linked mental illness to substance use and psychological vulnerability, while Spanish-language tweets emphasize biological and genetic explanations. ADHD was frequently described as multifactorial in English tweets, with substance use and psychological factors cited, aligning with literature on ADHD's complex genetic and environmental etiology.⁴⁷ In contrast, Spanish tweets primarily attributed both ADHD and ASD to biological/genetic causes, with secondary mentions of substance use for ADHD and COVID-19 for ASD. These findings align with research on ADHD's complex etiology, involving genetic and

environmental influences.⁴⁷ Other studies have also noted frequent user emphasis on behavioral outcomes, such as self-medication and mental health struggles.⁴⁸ The perception of ASD as multifactorial echoes findings by Mitchell and Locke, who reported that the public often cites genetic and neurological causes for this condition.⁴⁹

Our study found the public typically views mental health conditions as chronic, with limited optimism about treatment outcomes. However, ADHD is uniquely seen as more treatable, comparable to depression, likely reflecting its documented responsiveness and generally improved prognosis into adulthood.⁵⁰ Conversely, ASD is perceived as less amenable to significant improvement. The limited interest in professional support expressed in tweets contrasts with other findings, such as Angermeyer et al., who reported high public regard for professional help.⁵¹ This discrepancy may result from survey biases, including social desirability—respondents providing socially acceptable answers—and selection bias, as more engaged individuals typically participate.⁵² Anxiety was an exception regarding perceived self-manageability. This may be due to its high lifetime prevalence of 28.8%⁵³ and broad public awareness.⁵⁴ The perception may also be influenced by the widespread availability of self-help resources, including books, websites, and apps,⁵⁵ as well as by the demonstrated effectiveness of non-pharmacological interventions such as CBT, which can often be self-administered.^{56,57}

Using X offers advantages over traditional surveys, which may suffer from response distortion and non-response bias.^{8,9} X provides real-time, unsolicited opinions from a broad user base, potentially yielding more naturalistic and representative insights into public views on mental health. This study has limitations. X users may not represent the general population, as they skew younger and more tech-savvy.⁵⁸ Only English and Spanish tweets were analyzed, excluding other language groups. Keyword-based collection may have missed relevant tweets, and despite data cleaning, misclassification and noise remain risks. Patient experiences based solely on text may miss emotional nuance, and the study's observational design limits causal interpretations. Future research should expand to additional social media platforms and incorporate a broader range of languages to capture more diverse perspectives. Incorporating advanced sentiment analysis

techniques, such as context-aware and emotion-specific models, could further deepen our understanding of public attitudes toward mental health.

CONCLUSION

This study applied machine learning to X data to examine public perceptions of ADHD and ASD. ADHD-related content saw a surge in engagement during the COVID-19 pandemic, while ASD received less attention. Although most tweets were neutral, negative experiences—particularly for ADHD—were more common. Users generally viewed mental health conditions as chronic and difficult to treat, with fewer than 7% expressing belief in self-management, except for anxiety. In English-language tweets, perceived causes of ADHD and ASD were largely multifactorial, often citing substance use and psychological factors. Spanish-language tweets followed similar patterns in tone but emphasized biological and genetic explanations.

These insights can inform clinicians and researchers about public attitudes and experiences regarding neurodevelopmental disorders, particularly ADHD and ASD, underscoring the value of social media analysis in capturing real-time, unfiltered, and empirically derived data—especially in areas where traditional research methods may be limited by response biases or restricted reach.

Conflict of interest

None declared.

List of Abbreviations

ADHD: Attention Deficit Hyperactivity Disorder

ASD: Autism Spectrum Disorder

BD: Bipolar Disorder

SUD: Substance Use Disorder

X: Social media platform formerly known as Twitter

COVID-19: Coronavirus Disease 2019

BERTweet: Transformer-based language model pre-trained on English tweets

BETO: Transformer-based language model pre-trained on Spanish text

EDA: Easy Data Augmentation

ANOVA: Analysis of Variance

SD: Standard Deviation

F1-score: Harmonic mean of precision and recall used to evaluate model performance

χ^2 : Chi-Square test

DistilRoBERTa: Distilled version of the RoBERTa model used for emotion detection in English tweets

Robertuito: Transformer-based language model used for emotion detection in Spanish tweets

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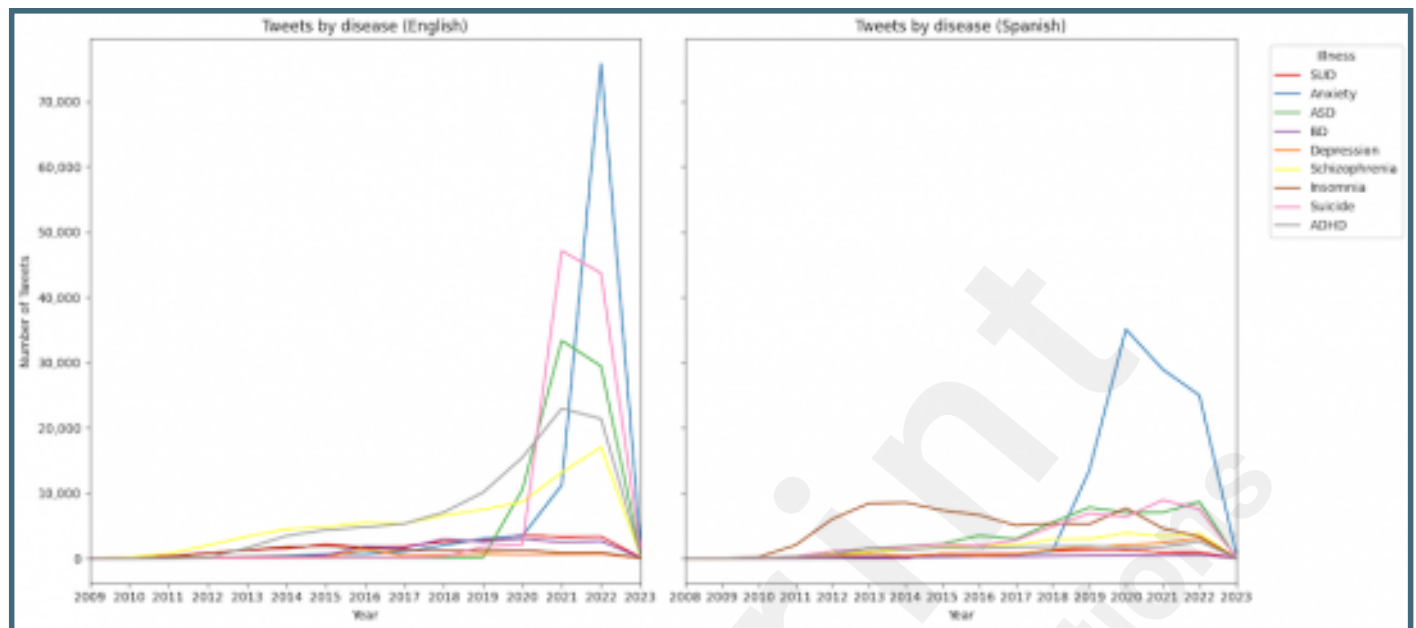
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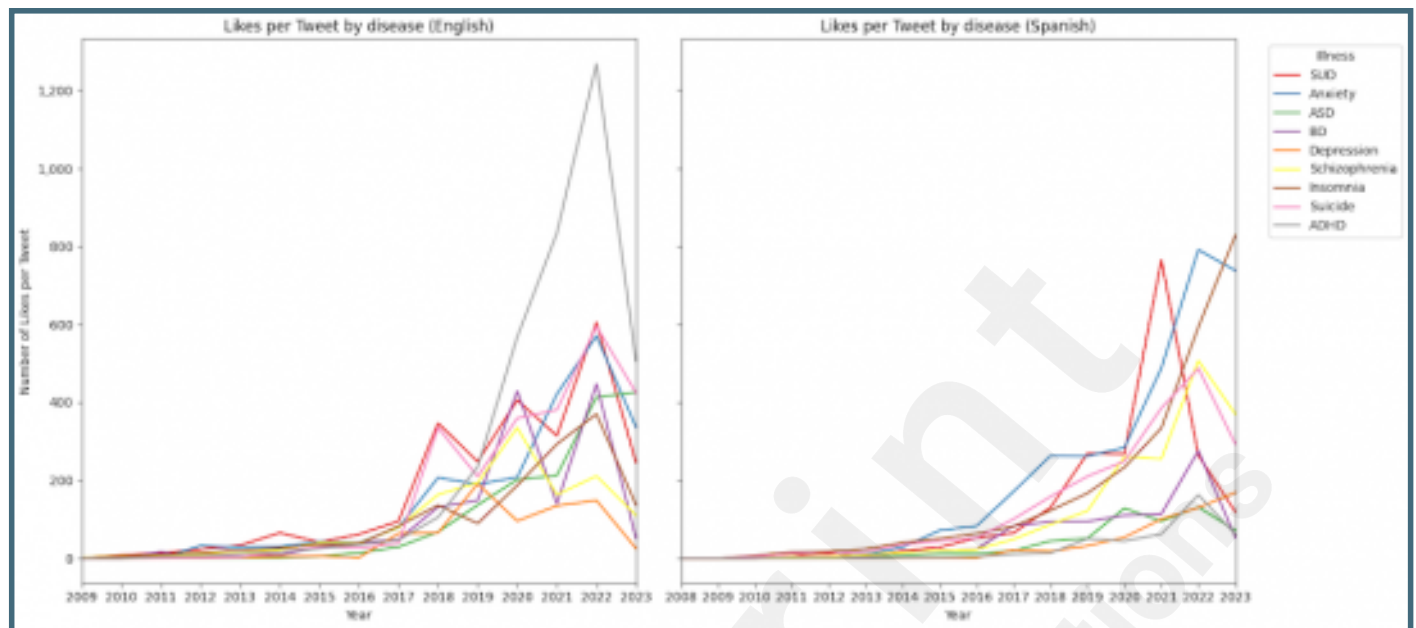
Supplementary Files

Figures

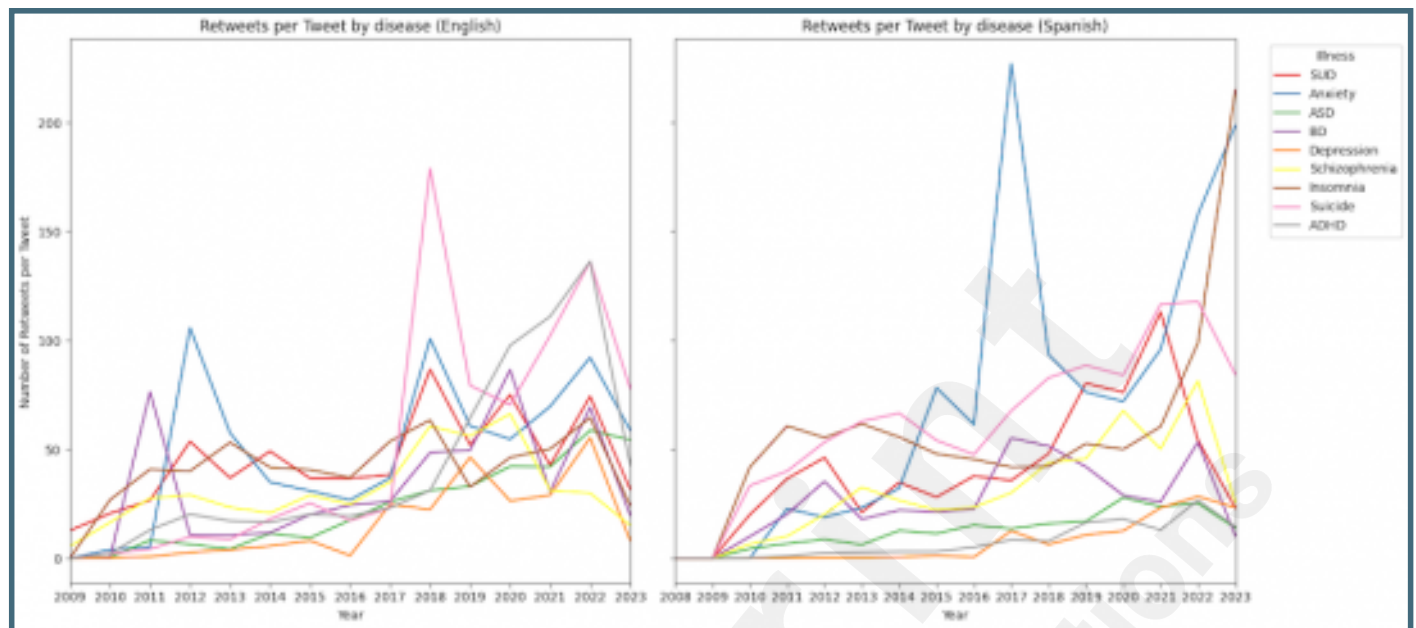
Annual number of tweets by mental health condition. Left panel: tweets in English. Right panel: tweets in Spanish.



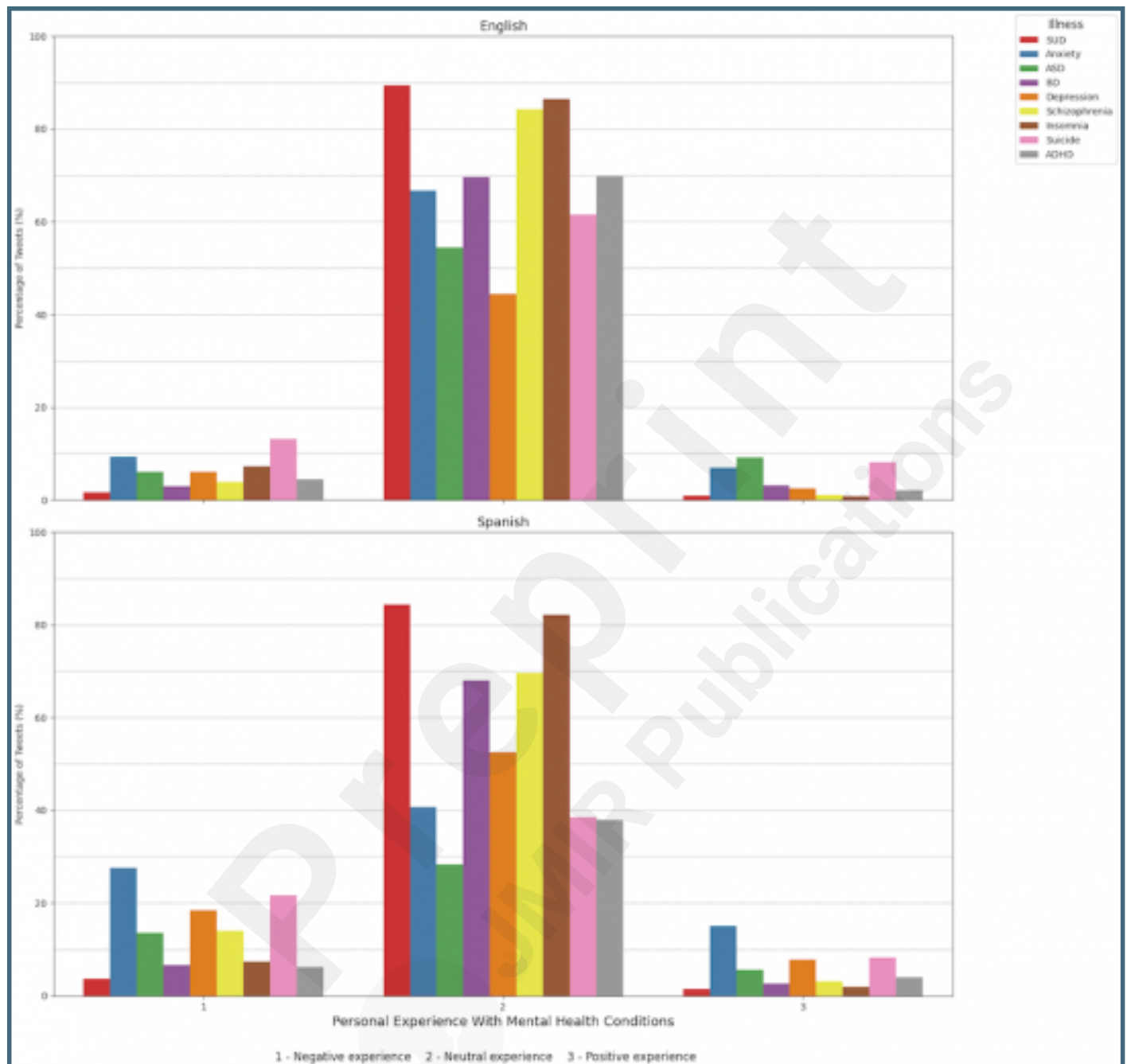
Line graphs illustrating the number of likes per tweet over time for various mental health conditions in both English (left) and Spanish (right) tweets.



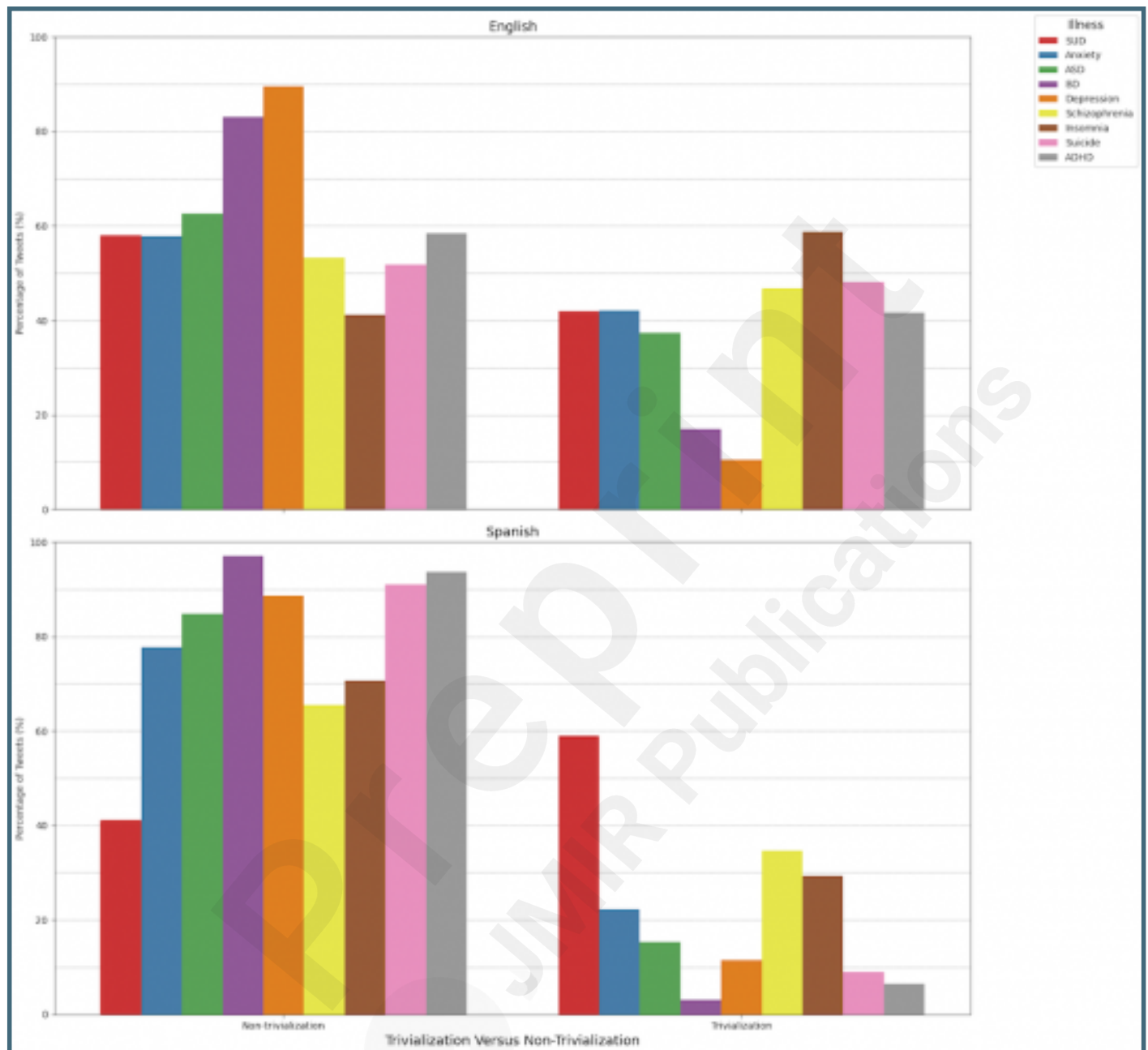
Number of retweets per tweet over time for various mental health conditions in both English (left) and Spanish (right).



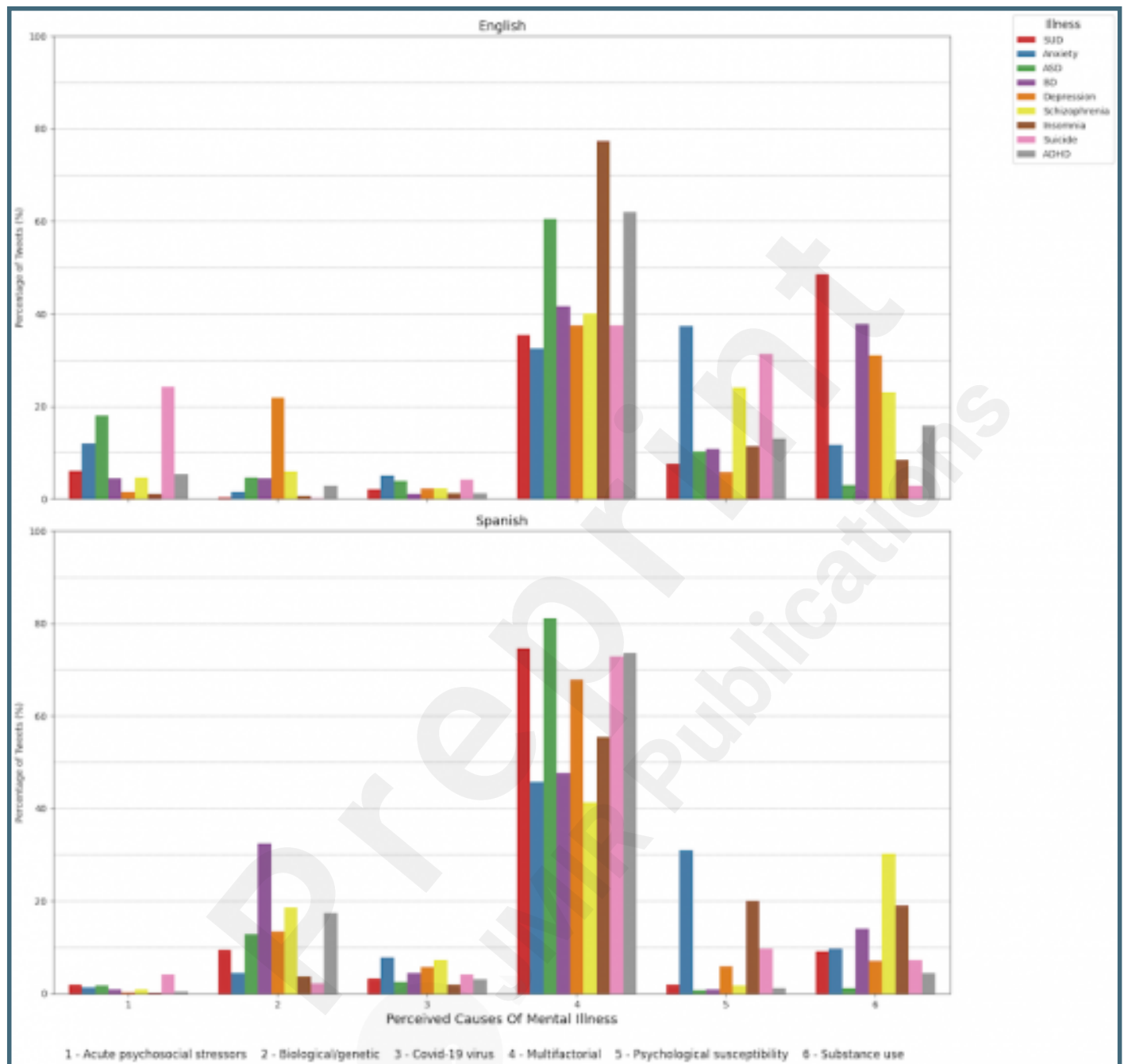
Distribution of tweets that published personal experiences with mental health conditions. Top panel: tweets in English. Bottom panel: tweets in Spanish.



Comparison of non-trivializing versus trivializing tweets about mental health conditions. Top panel: tweets in English. Bottom panel: tweets in Spanish.



User perceived causes of mental illness. Top panel: tweets in English. Bottom panel: tweets in Spanish.



User perceived treatability of mental illnesses. Top panel: tweets in English. Bottom panel: tweets in Spanish.

