



Analysis of Stigma Towards the Mental Health Discussion via Social Media

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Abstract

As social media platforms continue to expand their reach, these platforms can facilitate public health discussions, such as mental health discussions, to a widespread group of individuals. However, the stigma associated with discussing mental health on social media poses one of the largest barriers to mental health conversations and awareness. Our project explored whether the stigma and negative attitudes surrounding the mental health discussion on social media have dissipated in recent years. Study 1 involved collecting and analyzing data from Twitter to determine changes in engagement in the mental health discussion over three different periods, about a decade ago, pre-COVID-19, and post-COVID-19. Findings show that both engagement and sentiment towards mental health discussions have increased over time through Twitter. Study 2 included an experiment where participants viewed and rated their engagement tactics towards four real tweets gathered from Twitter and rated their agreement towards two different scales with one scale geared towards the stigma of posting about an individual's mental health on social media and one scale geared towards the general stigma of individuals who struggle with mental health in general. We found that participants were more likely to engage with positive tweets and that they are more comfortable discussing the mental health of those close to them rather than their mental health.

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Introduction

In the United States, mental illnesses are one of the most common health conditions among the population. A mental illness is a health condition that involves changes in emotions, thinking, or behavior, which in turn affects daily activities such as work and school (U.S. Department of Health and Human Services, 2022). Mental illnesses can alter an individual's mood and how they behave, which can affect how they feel, interact with others, and how they live their daily life. Mental health illnesses may include mood disorders, such as depression or bipolar disorders, anxiety disorders, eating disorders, and psychotic disorders such as schizophrenia. It is estimated that 1 in 5 Americans will experience a mental health illness in a given year and more than 50% of people will be diagnosed with a mental health illness throughout their lifetime (Centers for Disease Control and Prevention, 2021).

As social media platforms continue to expand their reach, these platforms can facilitate public health discussions, such as mental health discussions, to a widespread group of individuals. More specifically, one of the most common social media platforms that is used to discuss mental health is Twitter. The mental health discussion on Twitter facilitated by their users allows individuals to receive messages of hope and support, receive and share information, combat isolation, and help raise awareness (Berry et al., 2017). Along with providing a safe space for expression and an outlet for support, the mental health discussion on Twitter can provide many benefits for the mental health community (Berry et al., 2017).

However, the stigma associated with discussing mental health on social media poses one of the largest barriers to mental health conversations and awareness. This stigma and the stereotypes associated with mental health and mental illnesses often lead to misconceptions or inaccurate beliefs, such as the belief that individuals with mental health illnesses are a danger to

society. While the stigma associated with the mental health discussion is a major roadblock, recent studies suggest that the discussion of mental health, specifically on Twitter, has become more accepted and less stigmatized, and that the number of mental health conversations has significantly increased (Stupinski et al., 2022). These studies however have not shown statistical evidence to support their claims of the decreasing stigma.

The purpose of this project was to explore whether the stigma and negative attitudes towards mental health discussions on social media have decreased throughout the years, as previous studies suggest and to provide significant statistics to support our hypotheses. To measure the possible decrease, we collected data from Twitter, using the hashtag #meantalhealth, from different periods to determine the amount of positive or negative reactions, as well as the types of reactions, that posts related to mental health have been receiving over a given period. This associated stigma is a major cause for negative reactions, as well as reduced awareness and conversations surrounding mental health discussions. Our project aimed to understand whether these conversations are receiving more positive or negative reactions, as well as whether there are stigmatizing attitudes towards those who post about their mental health on social media. This project hoped to emphasize the importance of positive mental health discussions on social media and help individuals understand how these discussions have changed over time. We feel that with our results, we could provide information to WPI's Center for Wellbeing or other groups on campus involved in mental health, to promote awareness and best practices in how to continue to play a role in de-stigmatizing mental health conversations through social media.

Background

2.1 Mental Health on a Broad Scale

Mental health is described as “our emotional, psychological, and social well-being.” (Centers for Disease Control and Prevention, 2021, para. 1). Mental health not only influences cognition and behavior but also influences interpersonal relationships and how individuals handle stress. Poor mental health can significantly change an individual’s mood and how you behave, which can affect how you feel, interact with others, and how you live your daily life. Early signs of someone battling with mental health problems may include eating or sleeping too little, having low energy, feeling hopeless, and experiencing severe mood swings. Emotional and mental health plays a vital part in your life and when one has poor mental health, this can lead to a variety of mental illnesses. Mental illnesses affect millions of people each year and are one of the most common health conditions in the US (Centers for Disease Control and Prevention, 2021). Common mental illnesses include anxiety, depression, post-traumatic stress disorder (PTSD), and eating disorders. In 2019, 301 million people were living with an anxiety disorder, 280 million people were living with depression, and 14 million people were battling with eating disorders (World Health Organization, 2022).

In terms of mental illnesses, two categories can be used to describe different conditions. Any mental illness (AMI) is described as a “mental, behavioral, or emotional disorder.” (U.S. Department of Health and Human Services, 2022, para. 3). With AMI, symptoms can range from none, to moderate, and even severe. The second category is severe mental illnesses (SMI). SMIs are described as “a mental, behavioral, or emotional disorder resulting in serious functional impairment, which substantially interferes with or limits one or more major life activities.” (U.S. Department of Health and Human Services, 2022, para. 4). AMIs and SMIs both severely affect

an individual's overall mental health, which can in turn lead to devastating physical, social, and financial consequences.

2.1.1 Why is Mental Health Important?

Mental health is an essential aspect of everyday living, and it is important to remember that mental health is just as crucial as physical health. Mental health is important because it can lead to rippling effects in one's life. According to the National Alliance on Mental Illness, those with a mental illness are 40% more likely to develop cardiovascular and metabolic diseases than the general population, 21.1% of people experiencing homelessness in the U.S. have a serious mental health condition, and 33.5% of U.S. adults with mental illness develop a substance abuse disorder (National Alliance on Mental Illness, 2023). Amongst the rippling effects, those with mental health problems are also more likely to commit suicide or have suicidal thoughts. According to the World Health Organization, 90% of all suicide victims have battled with some kind of mental health condition (Meyers,2023). Mental health ripples into everything we do and maintaining positive mental health can impact our psychological and emotional well-being. Additionally, it can help us relieve stress, improve self-esteem, increase motivation, and improve our relationships with others.

2.2 The Discussion of Mental Health on Social Media

The explosion of social media platforms and their ability to reach a widespread group of individuals has led to an increase in public health discussions on these platforms, specifically the mental health discussion (McClellan et al., 2017). Very few people living with a mental illness have access to mental health services or care. Social media provides a solution to this lack of care because of its reachability and ability to convey information. Today, social media users can connect with others battling with a mental illness on Facebook or Instagram, or input

#seasonaldepression into Twitter to view posts on the related subject. More specifically, the conversations and topics discussed on Twitter by their users can provide valuable information on a variety of topics, including mental health. The tweets that users may post about mental health have the capability to promote mental health-related information to a widespread audience via likes and retweets, as well as the capability to create conversations surrounding mental health for other users.

2.2.1 How Does Twitter Facilitate Meaningful Conversations?

As mentioned above, Twitter is one of the most popular social media platforms for discussing mental health-related topics. With over 200 million users, Twitter allows their users to post brief messages, “tweets”, which others can respond to by replying, liking, or retweeting. Users on Twitter can be easily discovered by searching for people to follow. Once a user is followed, they can connect and see posts or tweets that the user posts. Users can communicate with each other using hashtags, which other users can use to view or contribute to the conversation. Additionally, by using hashtags (e.g., #mentalhealth) Twitter users can easily find posts relating to a specific topic or subject. The use of Twitter, in addition to hashtags, can help users “facilitate connections, enable sharing without barriers, and provide the opportunity to voice opinions.” (Berry et al., 2017, p. 2). The global reach of tweets, its capability to facilitate meaningful conversations, and the ease at which users can find posts relating to specific subjects make this social media platform a hub for mental health discussions.

2.2.2 Why is Social Media used to discuss mental health?

There are a variety of reasons why mental health is discussed on social media platforms and it is important to analyze the benefits that this discussion brings for individuals battling with mental illnesses. A recent study analyzed tweets with the hashtag #WhyWeTweetMH to uncover

and understand why individuals use Twitter to discuss mental health (Berry et al., 2017). From the tweets that used #WhyWeTwwetMH, they uncovered key themes analyzing the tweets (Berry et al., 2017). The theme with the highest tweet frequency and the number of retweets was that discussing mental health on Twitter provides a sense of community. Amongst that overarching theme, they found that individuals feel that (1) discussing mental health on Twitter reduces isolation, (2) allows them to receive messages of hope and support, and (3) they can receive and share information (Berry et al., 2017). Other common themes they discovered were that Twitter provides a safe space for expression, helps raise awareness, and provides a sense of empowerment. In addition to understanding why individuals use Twitter to discuss mental health, it is important to examine how those battling mental illnesses and mental health use social media to seek help. In 2012, a study was conducted to understand how those battling mental illnesses currently use social media. The study identified the most enjoyable features of social media sites among those living with mental illnesses (Gowen et al., 2012). The key findings from the study indicated that communicating with other users, making new friends, connecting with those with similar interests, posting items, and viewing resources were amongst the top enjoyable features of social media sites for individuals with mental illnesses (Gowen et al., 2012). The results from the study indicated that those living with mental illnesses do indeed utilize social media as a form of connecting and communicating with others (Gowen et al., 2012).

These findings suggest that Twitter, and other social media sites, can provide a positive community for mental health discussions. While social media is typically viewed as harming mental health, social media platforms, such as Twitter, can provide benefits for the mental health community by providing a safe space for discussions, as well as an outlet for support.

2.2.3 Drawbacks of Discussing Mental Health on Social Media

While the discussion of mental health on social media provides numerous benefits, it is still important to note the drawbacks and challenges of this discussion. Some of the biggest challenges include (1) impact on symptoms, (2) hostile environments, and (3) consequences on daily life (Naslund et al., 2020). Discussing mental health on social media can lead to social isolation, a greater risk of anxiety, misleading information, and cyberbullying (Aschbrenner et al., 2020). Amongst these challenges, the negative stigma associated with discussing mental health on social media poses one of the biggest challenges.

2.3 The Stigma Associated with Discussing Mental Health on Social Media

Stigma poses as one of the largest barriers to mental health. Stigmatization is described as “a process involving stereotypes, prejudice, and discrimination that operates within an environment of power.” (Parrot et al., 2020, p. 150). The stereotypes associated with mental health and mental illnesses often lead to misconceptions or inaccurate beliefs, such as the belief that those experiencing poor mental health are dangerous or violent. Those battling with mental health may also be drawn away from reaching out for help because of the fear that they will be negatively stigmatized and labeled as ‘mentally ill’.

In 2018, a study was conducted to investigate the stigmatizing attitudes surrounding mental health discussions on social media (Robinson et al., 2019). Throughout the study, tweets associated with mental and physical health conditions were collected and categorized according to the number of stigmatizing attitudes present. From the results, they found that mental health conditions were 1.54 times more likely to experience stigma than physical conditions (Robinson et al., 2019). Additionally, the average prevalence of stigma for physical conditions was 8.1%,

while it was 12.9% for mental health conditions. Sub-themes were also identified from the stigmatizing tweets. Robinson's (2019) study uncovered the following sub-themes:

(1) negative descriptor (using the illness to describe something in a negative light); (2) wishing illness upon someone (wishing harm upon someone by way of contracting the target condition); (3) negative characteristics (associating the illness with undesirable attributes); (4) joking (demeaning the target condition by joking about it) and (5) stereotyping (associating the illness with grossly inaccurate stereotypes) (p. 54).

From this study, it is clear that the stigma associated with mental health is common on social media and that mental health conditions are more prone to experiencing stigma than physical health conditions.

In addition to measuring the amount of stigma present on social media regarding mental health, it is important to understand how mental health is understood by the general public. Oftentimes, the difference in how people perceive, or frame 'mental health' can lead to an increase in stigma and a decrease in mental health awareness (Pavlova & Berkers, 2020). In 2020, a study was conducted to investigate how mental health was defined on Twitter in terms of frames, emotions, and stigma. The study uncovered seven mental health frames, which include: (1) Awareness, (2) Feelings and Problematization, (3) Classification, (4) Accessibility and Funding, (5) Stigma, (6) Service, and (7) Youth (Pavlova & Berkers, 2020).

Of the seven frames, the 'Feelings and Problematization' and 'Stigma' frames experienced the highest amount of stigmatizing vocabulary and emotions. For each of these frames, there were significantly more negative emotions than positive ones, as well as a higher negative sentiment. From their analysis of each frame, the findings from the study are as follows: (1) awareness about mental health is prone to low-quality information, (2) the conversation of

mental health can heighten social issues and social anxiety, (3) the mental health discussion revolves around mental illness, (4) the ‘Stigma’ frame is associated with violence and fear, and (5) mental health is often associated with politicized topics such as gun violence (Pavlova & Berkers, 2020). An understanding of how mental health is perceived and publicly framed can help us better understand why stigma occurs on social media.

Based on the information provided above, the team came up with a set of hypotheses for our research study relating to stigma and user reactions toward social media posts involving mental health-related issues. These hypotheses include:

H1: Participants who present non-stigmatizing attitudes towards someone who posts about their mental health on social media will be more likely to engage (i.e., like, retweet, comment) with mental health-related tweets than participants who present stigmatizing attitudes.

H2: Mental health-related tweets that are positive will have higher engagements compared to tweets that are negative.

2.3.1 The Negative Effects of the Mental Health Stigma

The stigma and negative stereotypes associated with mental health can often cause those who post about their mental health to receive negative attitudes and behaviors from their peers. Individuals and users who post about mental health-related topics are often reluctant to receive support because their peers often “desire to maintain a distance from at-risk peers to save their identity from stigmatization online.” (Hong et al., 2021, p. 9). In a recent study that aimed to understand how college students react to and perceive mental health problems in their peers on social media, the results showed that 41.3% of participants did not respond or provide support to mental health posts even though they had concerns about the user. Additionally, many of the

participants had a negative perception of those who self-disclosed mental health-related problems and wanted to keep away from the person displaying mental health issues because they did not want to be associated with the post (Hong et al., 2021). This stigma not only affects how individuals are perceived by their peers but also discourages those from providing support and guidance on social media sites. The mental health stigma negatively affects the exchange of peer support on social media and often prevents these users from receiving the mental health care resources that they need.

In 2020, another study was conducted to determine how mental health practitioners view the impact that social media has on mental health (Koehler & Parrell, 2020). When asked whether they believe in the “correlation between heavy use of social media and adverse mental health consequences” all 95 mental health practitioners surveyed answered “yes” (Koehler & Parrell, 2020). In addition to these findings, the study also identified the major negative impacts that the participants believed social media has on mental health. Amongst the negative impacts, the most prominent included low self-esteem, increased depression, and increased anxiety. While these practitioners also identified positive aspects that social media can have on mental health, the study found that social media has adverse effects on mental health, such as individuals comparing their lives to others, negative self-image, social anxiety, and cyberbullying (Koehler & Parrell, 2020).

Social media presents many risks and potential harms to mental health. The mental health stigma can lead to negative reactions, including hostile interactions (Aschbrenner et al., 2020). A recent study identified the challenges with social media for mental health and amongst the challenges identified was cyberbullying (Aschbrenner et al., 2020). Cyberbullying can be harmful to one's mental health and can lead to situations where “individuals may be victimized

by negative comments or posts.” (Aschbrenner et al., 2020, p. 250). These harmful situations can lead to increased depression, increased anxiety, and even aggression toward these individuals. While the number of individuals battling with mental health who use social media to access mental health resources has increased, it is important to identify the risks which can adversely lead to potentially harmful situations and increased stigma (Aschbrenner et al., 2020).

2.3.2 Is the Mental Health Stigma Dissipating?

There is a stigma associated with mental health, however, research has found that the stigma associated with discussing mental health on social media may be decreasing. The discussion of mental health, specifically on Twitter, has become more accepted, as well as that the number of mental health conversations has significantly increased over the last 10 years (Stupinski et al., 2022). To measure these perceived changes in the discussion, tweets were collected from 2010 to 2021. The results from the study indicated that the phrase *mental health* increased by two orders of magnitude from 2012 to 2018, which indicates that the number of discussions regarding mental health has dramatically increased. Additionally, the study found that mental health awareness messages have been amplified on social media and that “a larger number of individuals feel comfortable making mental health disclosures publicly” (Stupinski et al., 2022, p. 9). Their findings provide evidence that the number of mental health conversations has significantly increased and illustrate that mental health discussion has changed over the years. These findings suggest there has been a reduction in the stigma surrounding mental health since the mental health discussion on social media has increased over time. To investigate whether these findings are true, we explored whether the stigma associated with the mental health discussion on Twitter has or has not increased over the years, as well as the associated feelings and reactions regarding mental health on social media.

In an additional study, they analyzed how peer-to-peer connections on popular social media sites, such as Twitter and Facebook, among individuals with mental illnesses and mental health issues can promote mental and physical well-being (Naslund et al., 2016). The results from the study indicated that interacting with peers online provides these individuals with numerous benefits, such as challenging stigma, greater social connectedness, and the opportunity to access support from their peers (Naslund et al., 2016). In terms of stigma, the study found that online communities serve as a powerful way for these individuals to “challenge stigma through personal empowerment and providing hope.” (Naslund et al., 2016, p. 166). When those battling with their mental health internalize their feelings, this can lead to negative consequences, such as greater depressive symptoms. However, those that reach out to online communities on social media sites, can share positive stories of recovery, which in turn challenges the stigma by addressing the myths associated with discussing mental health on social media sites (Naslund et al., 2016).

In addition to online communities and peer-to-peer connections, coming out about one’s mental illness and mental health battles also mediates the effects of stigma which may improve quality of life (Corrigan et al., 2010). In another study, they sought to measure the effects that coming out had on individuals battling mental health issues. The results from the study indicated that those who come out experience less self-stigma and an increase in quality of life. (Corrigan et al., 2010). By coming out and sharing their mental health experiences, these individuals experience higher levels of personal empowerment as well as being more satisfied with their life. While coming out and sharing mental health experiences may be daunting, it can diminish the effects of stigma by increasing awareness and reducing social withdrawal (Corrigan et al., 2010).

With the assumption that the mental health discussion has changed over time and that there has been an increase in awareness and acceptance of mental health-related posts on social media, the team developed additional hypotheses for our research study. These hypotheses include:

H3: The majority of participants will present non-stigmatizing attitudes towards someone who posts about their mental health on social media.

H4: The overall sentiment of mental health-related tweets has increased over the past seven years.

H5: The number of tweets related to mental health has increased over the past seven years.

H6: The engagement towards tweets about mental health will have increased over time.

2.4 How Can Social Media Analytics Help Address Mental Health?

To understand whether the stigma and negative reactions associated with mental health on social media is dissipating, there needs to be an understanding of social media analytics. The following section outlines how social media analytics, and its associated tools and techniques can be used to measure changes in sentiment, user reactions, and engagement on social media platforms, specifically on Twitter.

2.4.1 Overview of Social Media Analytics

Social media analytics is described as the process of collecting and analyzing data on social media to extract patterns, and information, as well as to facilitate meaningful conversations (Gordon & Fan, 2014). As of 2022, it is estimated that there are around 4.74 billion social media users, which equates to 59.3% of the total global population (Kemp, 2023). Just amongst teenagers, 97% use the Internet daily and 54% of teenagers in the U.S. say that it

would be hard to give up social media (Vogels et al., 2022). Social media platforms essentially serve as a “conversational, distributed mode of content generation, dissemination, and communication among communities” (Zeng et al., 2010, p. 13). With billions of users using their platforms every day, social media sites such as Facebook, Twitter, and Instagram can provide rich information and conversations that can be used to extract telling patterns and intelligence. Additionally, it is estimated that more and more adults in the U.S. are beginning to trust information from social media sites as much as they would from a national news outlet (Liedke & Gotfried , 2022). With this rise in trust for information found on social media sites and the vast amount of people using social media, the range of possibilities for social media analytics has grown and will continue to do so. Social media analytics can help brands and companies increase their value and performance by providing insights into consumer behaviors, campaign/post effectiveness, and user engagement. This process not only allows businesses to connect better to their audience but also allows for continuous improvement of their social media content strategies (Gordon & Fan, 2014).

2.4.2 The Three Phases of Social Media Analytics

Social media analytics involves three phases: capture, understand, and present (Figure 1).

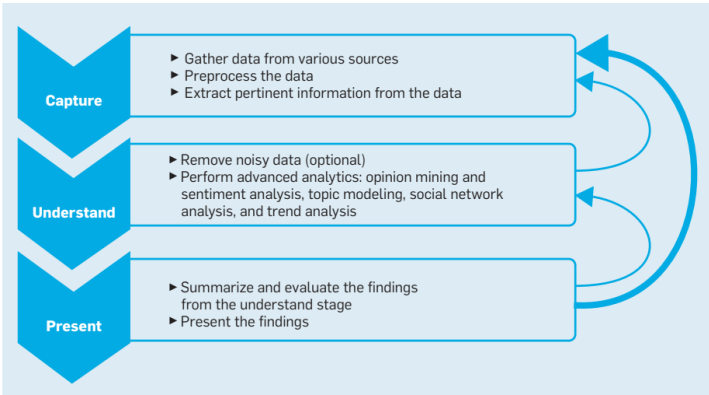


Figure 1: Social Media Analytics Process (Gordon & Fan, 2014).

In the capture phase, all relevant social media data is collected across thousands of various social media sources and platforms. These platforms may include Facebook, Twitter, YouTube, and LinkedIn, as well as news sites and blogs. The capture phase allows a business to “identify conversations on social media platforms related to its activities and interests (Gordon & Fan, 2014, p. 76). Steps such as data modeling, dataset cleaning, and feature extraction are also involved in the capture phase to prepare the data for the understanding phase. In the understanding phase, metrics are used to assess the meaning behind the data collected. This phase is the core of the social media analytics process and involves various techniques such as sentiment analysis and data modeling, which will be discussed in the next section. The results collected from this phase affect future decisions that a business may undertake in the present phase. In the present phase, the results are summarized and presented in an easy-to-understand format. The information and findings are displayed using various data visualization techniques.

2.4.3 Tools and Techniques

An important aspect of social media analytics, as mentioned above, is the analytic techniques used. Opinion mining and sentiment analysis are considered two of the core techniques. These two techniques utilize “computational linguistics, natural language processing, and other methods of text analytics to automatically extract user sentiment or opinions from text sources at any level of granularity (words or phrases, up to entire documents)” (Gordon & Fan, 2014, p. 77). Opinion mining and sentiment analysis serve as a method to study and understand people's opinions, views, and attitudes toward a certain topic or event. Additionally, sentiment analysis can be a useful tool for understanding emotional expression (Wongkoblaph et al., 2017). Texts extracted and analyzed using sentiment analysis can be then categorized into different categories, such as positive and negative. Topic modeling is another common technique that

involves examining large bodies of text to uncover themes and topics. Uncovering these themes can provide useful information about user interests, as well as emerging topics on social media platforms (Gordon & Fan, 2014). The third technique is social network analysis. This method “studies the relationships between persons, organizations, interest groups, states, etc., by analyzing the structure of their connections.” (Bruns et al., 2014, p. 105). Social network analysis can identify key influencers on different social media platforms and examine the social structure and interdependencies among individuals. The last technique that we will discuss is trend analysis. By detecting patterns in historical data, trend analysis can provide meaningful information that can be used to predict future behaviors or reactions. In addition to trend analysis, feature extraction can also aid in predicting future behaviors or symptoms, such as predicting symptoms of mental disorders (Wongkoblak et al., 2017). Feature extraction “isolates a subset of features” from an initial set of data to make predictions by using other techniques such as Pearson correlation coefficient and correlation-based feature extraction (Wongkoblak et al., 2017, p. 7).

Methods

3.1 Study 1: Twitter Data Collection

3.1.1 Using the Twitter API

Twitter allows for free and open-source use of their API for downloading bare-bones content but also offers a subscription for \$100 a month for more developer key access to download information generated by the user. The information that can be gathered from the tweets includes usernames, geolocations, timestamps, content (text, images, videos), and hashtags. The API also allows for gathering the number of likes, comments, and retweets.

Knowing the number of likes, comments, and retweets will help paint a better picture when using our sentiment analysis.

3.1.2 Queries

Our team used the Tweet Downloader feature provided by Twitter to examine our data based on the hashtag we chose, #mentalhealth. Additionally, our team used timestamps as the main attribute for querying. For the remainder of the data, our group used the scrape library to gather tweets from February 19-26, 2015. The use of timestamps allowed our team to determine trends in the data from a decade ago to three years ago, to now. Utilizing a period from many years ago (2015), one pre-Covid (2019), and one post-Covid (2022) gave our group the ability to see the trends from long ago, a period before a traumatic event for all, as well as after the traumatic event. For each of these years, we collected data from February 19-26, May 19-26, August 19-26, and November 19-26. We chose these four weeks to account for the seasonal affects on mental health. We also queried on the keyword #mentalhealth to ensure the tweets stayed relevant to the mental health discussion, as well as being vague enough to have substantial data for each time period including tweets that contained the #mentalhealth to gather as much information as possible. This gave us tweets that described the scope of the mental health discussion on Twitter. Our group also collected all of the fields that are available to gather as we were trying to obtain as much information as possible. These fields provided us with the information we needed to analyze the data effectively. After gathering the tweets, we imported the data into a data frame Python.

3.1.3 Sentiment Analysis

In conjunction with the use of timestamps, we assessed the sentiment of tweets themselves during these three periods of time. To determine the sentiment of a tweet, we used a

natural language processor, or NLP for short. NLP's grant computers the ability to analyze text languages, such as English or Spanish, and quantify them. One use for an NLP is known as sentiment analysis. Our group utilized a popular NLP package known as TextBlob through Python. TextBlob is a well-known NLP that has built-in sentiment and subjectivity functions, giving us access to the sentiment and subjectivity scores of each individual tweet. Sentiment analysis through TextBlob takes the text given and applies the sentiment score and subjectivity score. The sentiment score is generated on a scale from -1 to +1, based on predetermined scores for words used in movie reviews (Shah, 2020). Any score below zero is deemed negative, whereas any score above zero is deemed positive, and a score of zero is deemed neutral. Analyzing the trends in the data aided in determining how the stigma of discussing mental health has changed over time from steady societal changes and the effects of COVID-19.

3.1.4 Topic Modeling

We utilized topic modeling to view the different conversations surrounding mental health discussions on Twitter and if they have been increasing over the chosen time periods. We analyzed the topics using different keywords that appeared often in the mental health sphere. To find these common keywords, our group used an additional popular NLP library known as SpaCy. SpaCy allows for the ability to tokenize the words in the tweets that we gathered, allowing us to remove the most common words such as the, he, she, they, etc. Removing these common words provided a more accurate result on the final topic model. From the tokenized words we created a word dictionary to use along with a corpus object. By using the word dictionary and corpus object, our group instantiated an LDA model. An LDA (or latent Dirichlet allocation) model "is a three-level hierarchical Bayesian model, in which each item of a collection is modeled as a finite mixture over an underlying set of topics" (Blei et al., 2003, p.

994). The LDA model generated 3 groups, or topics, of words that were linked together. The keywords were then grouped into four main mental health categories: a sense of community, safe space, empowerment, and raising awareness. We used these categories and the keywords associated with them based on the research of past articles such as “#WhyWeTweetMH Understanding Why People Use Twitter to Discuss Mental Health Problems” (Berry et al., 2017).

Along with the topic model, we identified the most commonly used hashtags that are used in conjunction with #mentalhealth. Finding the changes in the hashtags that are being used gave our group a deeper understanding of how the discussion of mental health topics on Twitter has transformed.

3.1.5 Engagement Analysis

We analyzed the engagement metrics made available by Twitter (likes, replies, retweets, quote tweets, total tweets) to aid our examination of these different time periods. We calculated both the averages and variances of these individual metrics for each week in the respective month and year. To calculate the averages, we took the sum of each metric and divided that by the length of the column in the data frame. The NumPy library in Python has a built-in variance function that our group used on the data frame columns. These metrics provided a better understanding of how engagement in the discussion of mental health has changed over time and allow us to see if there is a connection between these engagement levels and the perceived stigma of social media users.

3.1.6 Zero-Inflated Negative Binomial Analysis

Our group employed a zero-inflated negative binomial model to develop an understanding of the relationship between the sentiment of a tweet and the amount of

engagement it receives. We chose a zero-inflated model due to the extremely high number of tweets with zero engagement. By analyzing the changes in this relationship over time, our group showed how the conversations around mental health on Twitter have become more or less stigmatized. To accomplish this, our team employed the StatModels API and used its built-in zero-inflated negative binomial function. Because the function struggled with negatives in the independent variable (sentiment) and only positives for the dependent variable (like count), our team changed the sentiment scale from negative one to one, to zero to two, by adding one for each sentiment score and then proceeding with our analysis.

3.2 Study 2: Measuring Attitudes and Reactions to Mental Health on Social Media

3.2.1 Participants

The participants came from two online platforms ($N = 268$). One sample ($N = 210$) from Cloud Research received monetary compensation of \$1 for their time. The remaining sample came from a college university in the northeastern United States ($N = 58$) and received psychology course credit for participating. From the college university sample, two participants were excluded and from the Cloud Research sample, two participants were also excluded. We excluded participants from both samples who had a significantly shorter response time and answered incorrectly to our two attention check questions. The total number of participants used for analyses from the college university sample was ($N = 56$) and the total number of participants from Cloud Research was ($N = 208$) Of the usable sample of 264, approximately 51% were female, 44% were male, with the remaining 4% being non-binary or prefer not to say. 26.9% of participants were in the 18-24 age range, 22.3% in the 25-34 range, 16.3% in the 35-44 range, 15.5% in the 45-54 range, 14.4% in the 55-64 range, and 4.5% were 65 or older. The race and ethnicity of our participants ($N=276$) consisted of 0.7% American Indian or Alaskan Native,

6.1% Asian, 11.5% Black or African American, 9.3% Hispanic or Latino, 11.1% White (Middle Eastern or North African Origin), 0.7% Native Hawaiian or other Pacific Islander, 59% White (European), and 1.6% responded “other”. Out of the responses for whether the participant was enrolled in a college or university, 26.2% responded yes to being enrolled in a college or university while 73.8% responded no. The breakup of the 67 college or university student participants consisted of 28.4% graduating in 2023, 20.9% graduating in 2024, 34.3% graduating in 2025, 14.9% graduating in 2026, and 1.5% were Graduate students.

3.2.2 Materials

This study was conducted using the Qualtrics online survey platform, with a within-participants design comparing data collected from a college university in the northeastern United States and from participants through Cloud Research. The questions and the content were identical for both sets of participants. To get a sense of our participants’ general social media usage, we used a sample of questions from several articles that explored mental health among social media users. The majority of our questions in this section were taken from both (Naslund et al., 2016) and (Hong & Kim, 2021).

3.2.2.1 Positive and Negative Mental Health Tweets

To get a sense of any stigma the participants may have towards posting mental health content on social media, we decided to include real tweets from Twitter users in our survey. To find these tweets, we searched through tweets including the hashtag #mentalhealth and chose two that appeared more negative and two that were more positive in nature regarding posting and general mental health content. For a tweet with a “positive tone” we chose two that were either raising awareness or promoting healthy habits to others with a mental illness. A tweet with a “negative tone” we felt that would include either negative depictions of someone with a mental

illness or downplaying one's experience with a mental illness (refer to Figures 2, 3, 4, 5 for tweets).

We first sent out a pretest survey that received 16 responses to ensure we would be collecting the necessary data for our study. We wanted to make sure that the four chosen tweets that we selected matched our thoughts of two tweets leaning towards more of a negative tone and two having more of a positive tone (see Figures 2, 3, 4, 5 for the tweets included). We displayed the four tweets we wanted to include in our final survey and the results had shown that the participants did agree with our perceived ratings of the tones of the tweets as tweets one and three leaned towards a more positive tone and tweets two and four leaned more negative. The first tweet had an average positive rating of 3.56 and an average negative rating of 2.56, tweet 2 had a positive rating of 2.75 and a negative rating of 3.25, tweet 3 had a positive rating of 3.38 and a negative rating of 2.75, and lastly, tweet 4 had a positive rating of 2.69 and a negative rating of 3.31. We ran two-sample t-tests to determine if there were significant differences in the ratings for each tweet and we concluded that the positive tweets were statistically significantly different although the two negative tweets were not statistically significantly different, we still went ahead with including them in the survey based on our initial rating of the tone.

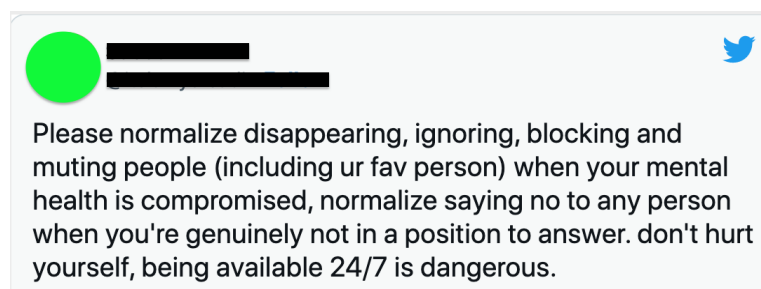


Figure 2: Tweet 1 (Positive)

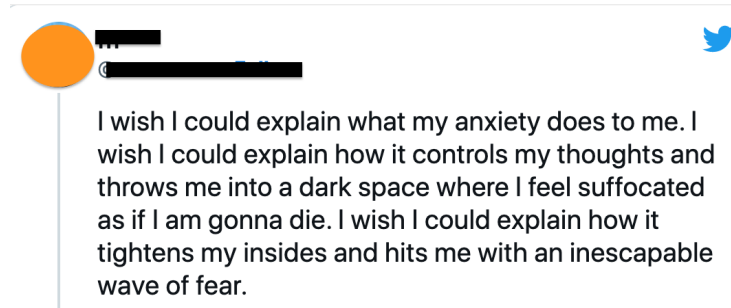


Figure 3: Tweet 2 (Negative)

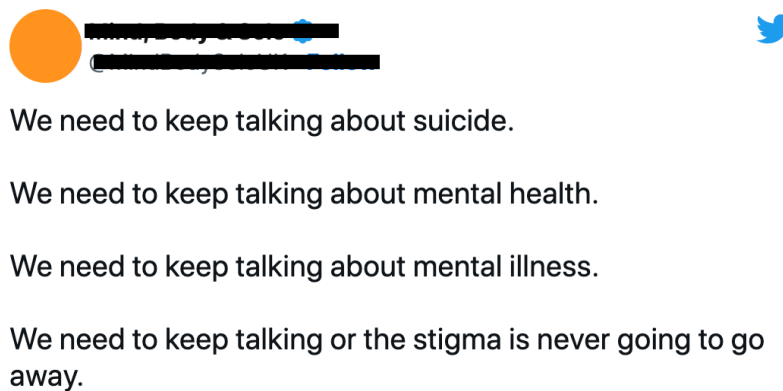


Figure 4: Tweet 3 (Positive)

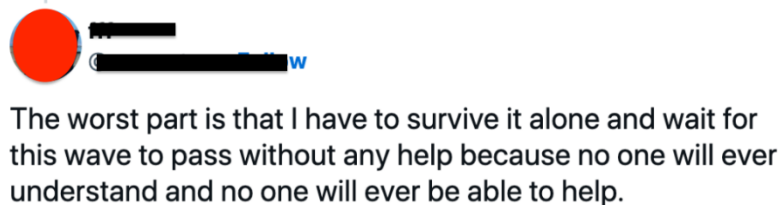


Figure 5: Tweet 4 (Negative)

Following the tweets, we asked the participants to rate both how positive they felt the tone of the tweet was and how negative they felt the tone of the tweet was (1 being not pos/neg at all, 5 being very pos/neg). We also included a matrix table that measures their engagement tendencies with each tweet. Using the same 1-5 Likert scale, we asked how likely they were to like, retweet, and/or reply to each tweet. The purpose of including the engagement piece was to

make possible connections to the interactions and attitudes the participants may have to the tweets themselves, and their responses to the stigma scale towards the end of the survey.

3.2.2.2 Mental Health Posting Stigma Questions

The last section of the experiment addresses the potential for any presence of stigma towards individuals who post about their mental health on social media sites as well as general stigma on individuals who struggle with their mental health. We included 16 out of the 28 seven-point Likert scale statements from “Day’s Mental Illness Stigma Scale” (Day et al., 2007) but reworded some of the content to gauge if they had stigma towards the idea of posting about mental health on social media as well as cutting the Likert scale to only five points (1-strongly disagree, 5-strongly agree). The study in this article measured public attitudes towards individuals with mental illness and which specific illnesses are stigmatized (Day et. al., 2007). We wanted to measure participants' attitudes, reactions, and comfortability with the discussion of mental health on social media sites as well as their perception of and attitude towards those who post about mental health on social media sites. We used the original scale as an outline and modified it to fit our objective. For instance, we used the original question, “I don't think that it is possible to have a normal relationship with someone with [a mental illness]” (Day et al., 2007, pg. 2218), and modified it to say, “I don't think that it is possible to have a normal relationship with someone who posts about their mental health on social media”. Similarly, the researchers from this article were able to compare their results and perceived levels of stigma among their two different studies as well as their two different samples to draw conclusions and connections within their data.

3.2.2.3 General Mental Health Sigma Questions

The last set of questions for our participants to answer was the Stigma 9 questionnaire (STIG-9) (Gierk et al., 2018). The Stig-9 scale was created to explore mental-health-related

stigma based on the modified labeling theory and the idea that Westernized cultures perceive the label of having a mental disorder with a negative connotation (Lowe et al., 2018). We decided to use this scale since we wanted to explore if that negative connotation has decreased through the mental health discussion via social media. The scale consisted of a 4-point Likert scale (0-disagree, 4-agree) which we had changed to a five-point Likert scale as we had used for our previous scale. We changed the statements a little bit to make the tone geared towards an individual who battles with mental illness. For example, one statement read, “I think most people consider someone who has been treated for a mental illness to be dangerous”, and we changed it to read, “ I think that most people consider someone battling with mental health issues to be dangerous” (refer to Appendix E for scale).

3.3 Procedure

Participants first read carefully through the informed consent form. After agreeing to participate, participants completed questions about their general use of social media within the last six months. We asked which sites the participants have used, what reasons they use social media (Kim & Hong, 2021), and how frequently they use social media (Naslund et al., 2019) to possibly draw any conclusions between certain social media usage aspects and responses to the scales later on in the survey. If they responded “No” to using social media in the past six months, they were sent to the end of the survey, excluding them from our data collection since we are measuring aspects of recent social media usage. After answering the general social media usage questions, the participants viewed the same four pretested tweets involving content about general mental health topics. After each tweet they were to answer the engagement scale as well as a question asking if they felt the tone of the tweet seemed more negative or positive on a 1-5 scale to confirm our results from our pretest.

In the last two sections, the participants responded to two scales that measured their stigmatizing attitudes towards posting about mental health-related topics on social media as well as stigma towards Individuals with mental health issues in general. For the stigma about posting, we included the 16 stigma scaling statements that were taken from “Day’s Mental Illness Stigma Scale”. For this section, we kept the statements generally about mental health topics, rather than the tweets addressing our concerns on levels of engagement with the mental health discussion on social media. To gauge the participant’s general stigma of mental health-related topics, we included the Stig-9 scale at the end since the rest of the survey was measuring mental health stigma via social media. Lastly, the participants answered demographic questions regarding their age, ethnicity/race, gender, and if they are enrolled in a college or university. After the content of the survey, they were provided with a debriefing statement. The statement explained the purpose of our study and included links to articles we utilized most in our research.

Results

4.1 Study 1: Twitter Data Results

4.1.1 Topic Modeling

Given that our group hypothesized a decrease in stigma, we expected there to be a change toward more positive discussions on Twitter. However, we identified that the general topics of the mental health discussion on Twitter remained largely the same. The categories from Berry and colleagues (2017) identified the main topics of the mental health discussion throughout all three years. Given the keywords generated for each topic by our model, our group classified the topics based on previous studies’ keyword groupings of why Twitter users tweet about mental health (Berry et al., 2017). The most common discussions included raising awareness, spreading

information, connecting/reaching out, and sharing experiences/offering support. An example of the keywords generated by the model output can be seen below:

```
----- Topic 0 -----  
support life help wellness today work people mentalhealthawareness love mindfulness  
  
----- Topic 1 -----  
depression anxiety help new people issue life stress talk work  
  
----- Topic 2 -----  
depression day help anxiety mentalhealthawareness veteran need mentalillness survive read
```

Figure 6: Topic Model Output

4.1.2 Engagement Analysis

To further understand if the stigma regarding mental health on Twitter has decreased, we analyzed the engagement on tweets using #mentalhealth. Engagement includes the number of likes, retweets, replies, etc., as well as the total number of tweets. The number of total tweets using the hashtag #mentalhealth increased significantly from year to year; thus H5 was supported. In the four weeks in 2015, there was a total of 92,741 tweets, with 96% of those having zero engagement. In 2019 there was a significant jump to 166,687 tweets, 94 % of those having zero engagement, almost double that of 2015. In 2022, there is another noticeable increase in the number of tweets that grew to 257,114, 94% of those with zero engagement, an increase of almost 25,000 tweets per week using #mentalhealth.

We see a similar increase from 2015 and 2019 in regards to the engagement of average likes per tweet and the average replies per tweet. In 2015 the average likes per tweet never went above 0.5 likes per tweet and stayed around 0.05 replies per tweet. In 2019 the average number of likes per tweet increased to 1.7 likes per tweet and 0.12 replies, a significant increase from 2015. However, contrary to our sixth hypothesis; the engagement towards tweets about mental health will have increased over time; the like and retweet averages in 2022 remained similar to 2019, decreasing in average likes from 1.7 to 1.6, but increasing in reply averages from 0.12 to

0.16. The figures below show the average number of likes tweets per month per year and the total tweets per month per year.

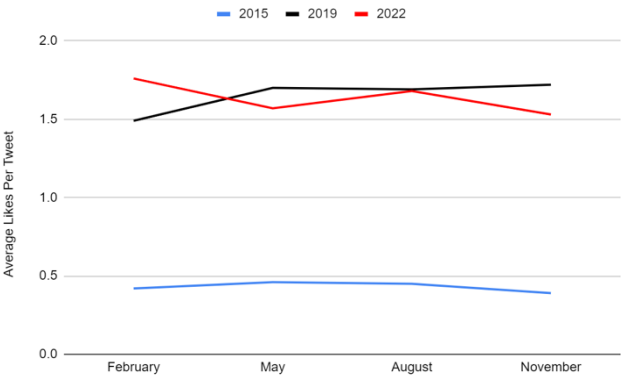


Figure 7: Graph of Like Averages

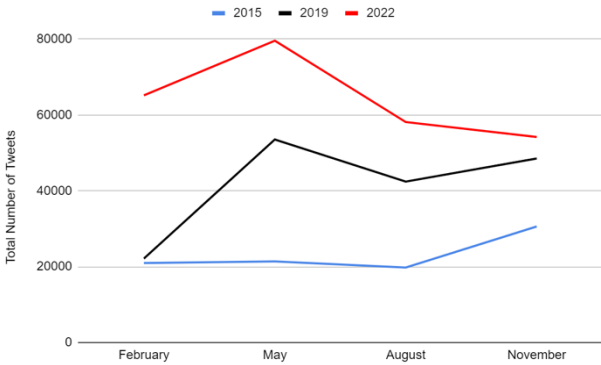


Figure 8: Graph of Total Tweets in Sample

4.1.3 Sentiment Analysis

As we hypothesized (H4), the tweets showed a higher amount of tweets with a positive sentiment than negative sentiment. In 2015, the percentage of tweets labeled as positive was around 40%, the percentage of tweets labeled as negative was around 15.5%, and the rest were labeled neutral. In 2019, the percentage of positive tweets increased to 55%, while the percentage of negative tweets only marginally increased to 16.5%. In 2022, however, there was a drop in the percentage of positive tweets to around 50% and a slight increase to 17% of negative tweets, both still up from 2015. We see similar trends in the subjectivity averages and sentiment

averages. Our group found that in 2015, the average sentiment per tweet was 0.11 and the subjectivity average was 0.30. We found that the averages increased in 2019 to 0.15 for sentiment and 0.38 for subjectivity. In 2022 both the sentiment average and subjectivity average decreased to 0.14 and 0.36, respectively. The figures below show the sentiment averages per month per year, as well as the sentiment percentages for each month and year.

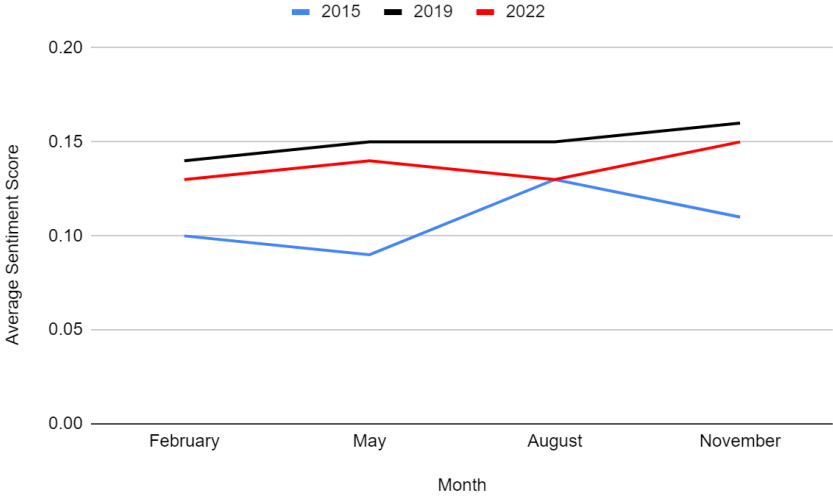


Figure 9: Graph of Sentiment Averages

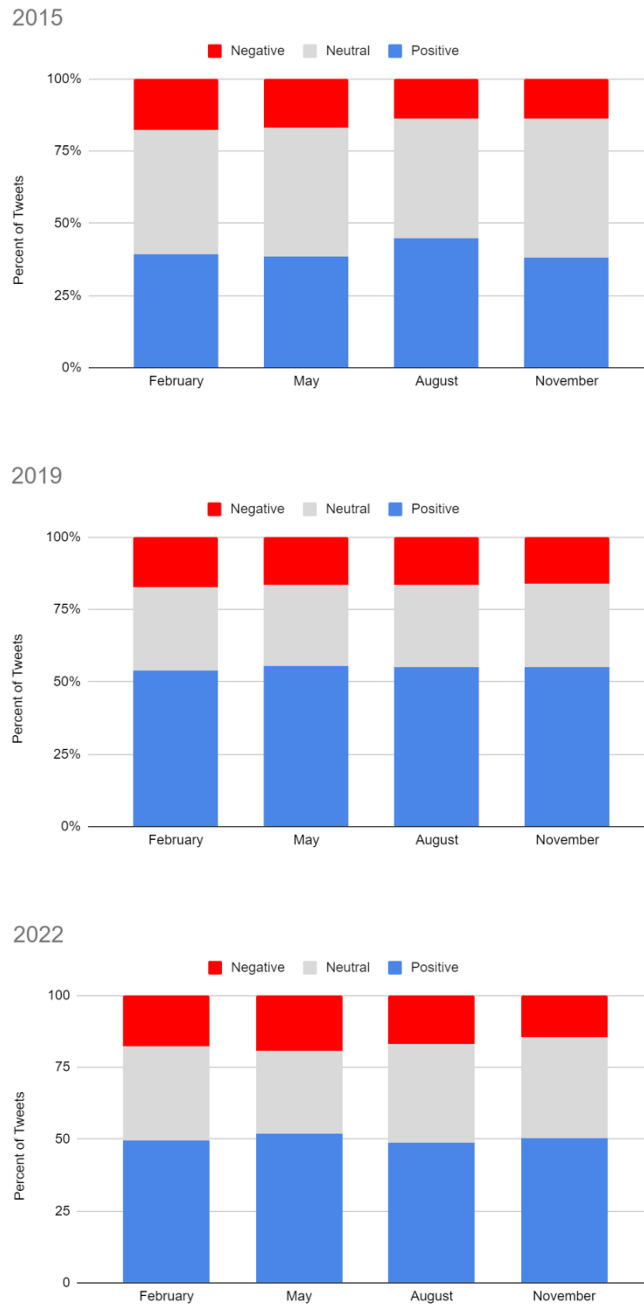


Figure 10: Percent of Tweets Classified as Positive, Neutral, or Negative for Each Year (2015, 2019, 2022)

4.1.4 Zero-Inflated Negative Binomial Regression Analysis

The zero-inflated negative binomial regression analysis found that there was a negative relationship between the sentiment of the tweet and the amount of engagement it received in

2015. In Table 1, the negative “inflation_const” serves as an intercept in the inflation model, removing the excess zeroes. The “alpha” coefficient in the model refers to the likelihood of having excess zeros in the response variable that cannot be explained by our independent variable. A high alpha value suggests that there is a high probability of excess zeros. The “sentimentone” coefficient is the independent variable or predictor. A negative number in “sentimentone” suggests a negative correlation between sentiment and like count. The p-values lower than .05 suggest the statistical significance of the given coefficient. Statistically significant p-values and a small pseudo-R-squared value suggest that the model is a strong fit, but only for a small portion of the variance. In 2015 the sentiment of the tweet predicted a negative relationship with the engagement it received, sentiment one: $b = -0.45$, $z(20969) = -8.782$, $p < .001$. In 2019 we observe a shift in the correlation, going from a negative correlation to a positive correlation, $b = 0.46$, $z(65175) = -40.595$, $p < .001$. In 2022, the positive correlation remains, $b = 0.49$, $z(53538) = 46.492$, $p < .001$. These statistics support our hypothesis H2: Mental health-related tweets that are positive will have higher engagements compared to tweets that are negative. See Table 1 for regression results.

Table 1

Zero Inflation Regression Results for February 2015, May 2019, and February 2022

February 2015						
		std err	z	P< z	[0.025	0.975]
inflate_const	-1.036	0.224	-4.621	0.000	-1.476	-0.597
sentimentone	-0.450	0.051	-8.782	0.000	-0.551	-0.350
alpha	5.7051	0.450	12.671	0.000	4.823	6.588
<i>Note:</i> NOBS = 20970, pseudo R-squared = -0.004238						
May 2019						
		std err	z	P< z	[0.025	0.975]
inflate_const	-11.7708	15.926	-0.739	0.460	-42.986	19.444
sentimentone	0.457	0.011	40.595	0.000	0.435	0.479
alpha	8.9256	0.093	95.928	0.000	8.743	9.108
<i>Note:</i> NOBS = 53539, pseudo R-squared = 0.0008612						
February 2022						
		std err	z	P< z	[0.025	0.975]
inflate_const	-9.2121	3.719	-2.477	0.013	-16.501	-1.923
sentimentone	0.492	0.011	46.492	0.000	0.472	0.513
alpha	9.3424	0.088	105.899	0.000	9.169	9.515
<i>Note:</i> NOBS = 65176, pseudo R-squared = 0.0007461						

4.2 Study 2: Survey Results

4.2 Overview

4.2.1 Social Media Use

As expected, the entire sample from the participant pools ($N= 264$) reported using social media in the last six months. Additionally, nearly the entire sample from both participant pools reported using social media daily ($N= 228$). The top four social media sites used were Instagram, Snapchat, Twitter, and TikTok.

4.2.2 Mental Health Resources and Social Media

Participants' social media use to seek mental health resources is listed in Table 2. When asked the question “Have you ever used social media to seek mental health resources?”, only 34.47% ($N= 91$) responded yes. Of the 264 participants, 36.74% ($N= 97$) have used social media to post or discuss their mental health, and 39.39% ($N= 104$) have used social media to post or discuss mental health topics for those close to them. Table 2 shows the topics they discussed.

Table 2**Social Media Use to Seek Mental Health Resources**

Social Media and Mental Health Resources Used	Total Respondents (%) <i>N</i> = 264
Have you ever used social media to seek emotional support?	
Yes	
No	53.78 (<i>N</i> = 142)
	46.21 (<i>N</i> = 122)
Have you ever used social media to seek mental health resources?	
Yes	
No	34.84 (<i>N</i> = 92)
	65.15 (<i>N</i> = 172)
Have you ever used social media to post or discuss anything about your mental health?	
Yes	36.74 (<i>N</i> = 97)
No	63.25 (<i>N</i> = 167)
Topics Discussed	
Information on specific mental illness(es)	15.15 (<i>N</i> = 40)
Resources for assistance regarding mental health	14.01 (<i>N</i> = 37)
Mental Health memes (comedic relief)	22.34 (<i>N</i> = 59)
Providing support or encouragement for others	26.51 (<i>N</i> = 70)
Seeking support or encouragement from others	121.59 (<i>N</i> = 57)
Other	.38 (<i>N</i> = 1)
Have you ever used social media to post or discuss anything about mental health topics that affect those close to you?	
Yes	39.77 (<i>N</i> = 104)
No	60.22 (<i>N</i> = 159)
Topics Discussed	
Information on specific mental illness(es)	23.86 (<i>N</i> = 63)
Resources for assistance regarding mental health	15.53 (<i>N</i> = 41)
Mental Health memes (comedic relief)	17.04 (<i>N</i> = 45)
Providing support or encouragement for others	26.51 (<i>N</i> = 70)
Seeking support or encouragement from others	17.04 (<i>N</i> = 45)
Other	0 (<i>N</i> = 0)
How often do you use social media to search for information about mental health?	
Never	46.97 (<i>N</i> = 124)
Once a week	39.77 (<i>N</i> = 105)
2-3 times a week	7.57 (<i>N</i> = 20)
4-6 times a week	3.41 (<i>N</i> = 9)
Daily	2.27 (<i>N</i> = 6)

4.3 Hypothesis Testing

4.3.1 Hypothesis H1: There will be more participants who disagree with the stigma questions regarding posting about mental health on social media than those who agree.

To measure whether there were more participants who disagreed than those who agreed with the associated stigma questions, data was analyzed using a chi-square test. The median split was used to determine whether they agreed or disagreed with the stigma questions. The median split was used to reduce the effect of outliers. If the participants disagreed with the stigma questions, they were categorized as displaying non-stigmatizing attitudes towards someone who posts about their mental health on social media. Consequently, if they agreed, they were categorized as presenting stigmatizing attitudes.

From the college student pool, the proportion of users who disagreed with the stigma questions regarding posting about mental health on social media differed from those who agreed, $\chi^2(31, N = 56) = 56.00, p = .004$. Of the 56 participants, 31 presented non-stigmatizing attitudes and 25 presented stigmatizing attitudes. From the general public participant pool, the proportion of users who disagreed with the stigma questions regarding posting about mental health differed from those who agreed, $\chi^2(52, N = 208) = 189.77, p < .001$. Of the 208 participants, 131 presented non-stigmatizing attitudes and 77 presented stigmatizing attitudes.

These findings support hypothesis H1, that there are more participants that disagree with the stigma questions regarding posting about mental health on social media than those who agree.

4.3.2 Hypothesis H2: Participants who present non-stigmatizing attitudes towards someone who posts about their mental health on social media will be more likely to engage with mental health-related tweets compared to participants who present stigmatizing attitudes.

To test hypothesis H2, data was analyzed using a One-Way ANOVA, with the dependent variable being the participant's engagement score and the independent variable being whether the participants presented stigmatizing or non-stigmatizing attitudes towards someone who posts about their mental health on social media. Similarly to hypothesis H1, the median split was used to determine whether the participant presented stigmatizing or non-stigmatizing attitudes. The engagement score was calculated by taking the average of the participant's likelihood to reply, like, and retweet the mental health-related tweet.

From the college student pool, the effect of whether participants presented non-stigmatizing or stigmatizing attitudes towards someone who posts about their mental health on social media was found for engagement. The One-Way ANOVA revealed a significant effect, $F(1, 54) = 15.701, p < .001, \eta^2 = .255, 95\% \text{ CI } [.058, .395]$. Participants who presented non-stigmatizing attitudes ($M = 2.29, SD = .781$) reported higher levels of engagement than participants who presented stigmatizing attitudes ($M = 1.46, SD = .52$). From the general public pool, the One-Way ANOVA also revealed a significant effect, $F(1, 206) = 19.801, p < .001, \eta^2 = .088, 95\% \text{ CI } [.028, .167]$. Participants who presented non-stigmatizing attitudes ($M = 2.54, SD = 1.04$) reported higher levels of engagement than participants who presented stigmatizing attitudes ($M = 1.92, SD = .87$).

These findings support hypothesis H2 that participants who present non-stigmatizing attitudes are more likely to engage with mental health-related tweets than participants who present stigmatizing attitudes.

4.3.3 Hypothesis H3: Mental health-related tweets that are positive will have higher engagements compared to tweets that are negative.

To test hypothesis H3, data was analyzed using a One-Way ANOVA, with the dependent variable being the participant's engagement score and the independent variable being the tone of the mental health-related tweet (positive or negative) that was manipulated. Similarly to hypothesis H2, the engagement score was calculated by taking the average of the participant's likelihood to reply, like, and retweet the mental health-related tweet.

From the college student pool, there was a significant effect of the tone of a tweet on engagement levels at the $p < .05$ level for the two conditions, $F(1, 110) = 15.222, p < .001, \eta^2 = .122, 95\% \text{ CI } [.030, .238]$. Tweets that were perceived as “positive” ($M = 2.38, SD = 1.01$) reported higher levels of engagement than tweets that were perceived as “negative” ($M = 1.73, SD = .75$). From the general public, the One-Way ANOVA also revealed a significant effect at the $p < .05$ level, $F(1, 415) = 20.059, p < .001, \eta^2 = .046, 95\% \text{ CI } [.015, .091]$. Tweets that were perceived as positive ($M = 2.55, SD = 1.02$) reported higher levels of engagement than tweets perceived as negative ($M = 2.07, SD = 1.16$).

These findings support hypothesis H3 that mental health-related tweets perceived as positive have higher engagement amongst social media users than tweets that are perceived as negative.

4.4.4 Hypothesis H4: There is a significant difference between the level of stigma towards mental health in general and the level of stigma towards mental health on social media, with stigma being higher on social media compared to general mental health stigma.

To test hypothesis H4, data were analyzed using a paired samples t-test to compare the mean scores of the general mental health stigma scale to the social media mental health stigma

scale. From the college student pool, the general mental health stigma scale ($M= 2.94, SD= .764$) reported higher levels of stigmatizing attitudes than the social media mental health stigma scale ($M= 2.111, SD= .733$), $t(56) = -5.905, p < .001, 95\% \text{ CI } [-1.076, -.482]$. From the general public pool, the general mental health stigma scale ($M= 3.28, SD= .889$) reported higher levels of stigmatizing attitudes than the social media mental health stigma scale ($M= 2.30, SD= .892$), $t(207) = -12.074, p < .001, 95\% \text{ CI } [-.994, -.678]$.

While there is a significant difference between these two scales, these findings do not support hypothesis H4 that stigma is higher on social media than in general. These findings indicate that stigma is higher for mental health in general than mental on social media.

4.4.5 Exploratory Analyses for other Variables

In addition to the analyses above, we wondered whether social media users who have used social media to post or discuss anything about their mental health would have lower levels of stigmatizing attitudes towards our two stigma scales (general mental health stigma and social media mental health stigma). To test this, we split the data into two groups: participants who have used social media to post or discuss their mental health and participants who have not used social media to post or discuss their mental health. Similarly to the hypotheses above, the median split was used to determine whether the participant presented stigmatizing or non-stigmatizing attitudes.

To understand whether participants who have used social media to post or discuss their mental health are more likely to display non-stigmatizing attitudes towards the social media stigma scale, a One-Way ANOVA was used to analyze the data, $F, (1,54) = 6.582, p = .013, 95\% \text{ CI } [.005, .272]$. Participants who have used social media to post or discuss mental health ($M= 1.63, SD= .69$) reported lower levels of stigmatizing attitudes than users who have not used social media to discuss or post mental health ($M= 2.23, SD= .69$). These results indicate that

those who have used social media to post or discuss their mental health present less stigmatizing attitudes towards our social media mental health stigma scale than those who have not used social media to post or discuss mental health. The same analysis was run for our general mental health stigma scale, [$F(1, 54) = .166, p = .684, 95\% \text{ CI } [.000, .087]$] however these results were not significant.

From the general public pool, the effect of whether someone has used social media to post or discuss about their mental health was found for whether participants display stigmatizing or non-stigmatizing attitudes towards our social media stigma scale, [$F, (1, 206) = 24.181, p < .001, 95\% \text{ CI } [.039, .188]$]. Participants who have used social media to post or discuss mental health ($M= 1.95, SD= .811$) reported lower levels of stigmatizing attitudes than participants who have not used social media to discuss or post mental health ($M= 2.54, SD= .869$). These results indicate that those who have used social media to post or discuss their mental health present less stigmatizing attitudes towards our social media mental health stigma scale than those who have not used social media to post or discuss mental health. The same analysis was run for our general mental health stigma scale, [$F(1, 206) = .043, p = .837, 95\% \text{ CI } [.000, .018]$], however, these results were not significant.

4.4.6 Manipulation Checks

To test whether the tweets used for hypothesis H3 were indeed rated as intended (positive or negative) by the survey participants, a manipulation check was conducted. Tweets one and three were intended to be rated as “positive”, whereas tweets two and four were intended to be “negative” (refer to Figures 2, 3, 4, 5 for tweets used). Data were analyzed using a paired samples t-test to compare the means between the two positive tweets (tweets one and three) and the two negative tweets (tweets two and four). From the college student pool, tweet one ($M= 3.13, SD= 1.07$) and tweet three ($M= 3.69, SD= .90$) reported higher positive tone ratings than

tweet two ($M= 2.03, SD= .90$) and tweet four ($M= 1.33, SD= .57$), $p < .05$. From the general public pool, tweet one ($M= 3.13, SD= 1.04$) and tweet three ($M= 3.75, SD= 1.00$) reported higher positive tone ratings than tweet two ($M= 1.91, SD= .915$) and tweet four ($M= 1.57, SD= .86$), $p < .001$. The means indicate that tweets one and three were rated more positively than tweets two and four, as well as that there was a significant difference between how participants rated the “positive” tweets versus the “negative” tweets.

Discussion

Overall, the results from two studies show that engagement in the mental health conversation has increased over time on Twitter. The sentiment towards the mental health discussion has also increased over time. In 2015, the correlation between sentiment and engagement was negative. However, in 2019 and 2022, the correlation became positive, indicating the stigma and negative attitudes towards the mental health discussion have decreased over time. Our experiment participants were more likely to engage with positive tweets than negative tweets, and these participants were more comfortable being vulnerable on social media about the mental health of those close to them rather than for themselves, as participants were more likely to report posting or discussing mental health topics for those close to them. When asked what topics they discussed on social media sites pertaining to those close to them, participants reported wanting to provide support or encouragement for others and searching for information on specific mental illness(es), but when asked what mental health topics they discuss on social media sites pertaining to themselves, participants reported searching for mental Health memes (comedic relief) and providing support or encouragement for others.

Twitter users have shown a growing interest in the topic of mental health. Over time there has been an increase in both the number of tweets using #mentalhealth and the amount of

engagement those tweets receive, seeing increases in like and reply averages. Upticks in average sentiment scores and the percentage of positive tweets show that along with the growing engagement, the sentiment of these discussions has also seen an increase in positivity. Previous studies show that as Twitter users are using Twitter as an outlet to cope with both mental health issues and issues related to the Covid-19 pandemic, the sentiment towards these discussions has become more positive similar to our results for 2015, 2019, and 2022 (Valdez et al., 2020). The conversations on mental health are constantly evolving and users are becoming more open and supportive to their fellow users.

The zero-inflated regression model found that the correlation between engagement and sentiment was negative in 2015, meaning that posts with a lower sentiment tend to have more engagement. However, in 2019 the correlation becomes positive as we had originally hypothesized and being in line with our survey results. All of the trends in our analysis suggest a decrease in the stigma regarding the mental health conversation on Twitter.

Previous literature shows that there has been an increase in the discussion about mental health, and social media has been a virtual space for individuals to express themselves, find a sense of community, raise awareness, combat stigma, cope, and empower each other (Berry et al., 2017). It is difficult for social media to be a hub for support and information if individuals do not feel safe expressing themselves and seeking help. We looked at non-stigmatizing vs. stigmatizing and found more non-stigmatizing attitudes. The college university sample is 44% stigmatizing and the Cloud research sample is 37% stigmatizing. A chi-square was run and there is no difference between the 44% college sample who have stigmatizing attitudes and the 37% cloud research sample. Individuals, especially students, would benefit from learning about Title I of the Americans with Disabilities Act (ADA) and Section 501 of the Rehabilitation Act of 1973

(Section 501) which safeguards people with disabilities, including mental health disabilities, from discrimination at work (U.S. Equal Opportunity Employment Commission, 2020). It is important that the general public is informed about online mental health resources, such as support groups where individuals can share experiences and personal stories. In addition to support groups, the general public should also be aware of social media platforms that cater to sharing factual mental health information, as well as platforms that have mental health crisis chat capabilities.

Conclusion

6.1 Limitations

The Twitter data collection only included twelve weeks of data from Twitter. Because we only had time to collect twelve weeks, other important topics or changes in trends surrounding the mental health discussion may have not been captured and included in the analysis. In addition, we only collected data using the hashtag #mentalhealth. By using other mental health-related hashtags, such as #endthestigma or #mentalhealthawareness, other topics and trends could have been identified.

In terms of the experimental survey, the survey for the college university participant sample was only published for a week. If the survey was published for longer, we could have collected more relevant data. In addition to the short time frame that the survey was published, the survey was also published during the students' finals week. Many students did not have time to fill out the survey and their responses may have also been skewed since finals week is a very stressful time for college students.

6.2 Further Research

Twitter holds access to an enormous amount of data, and we only analyzed twelve weeks of data. This caused us to potentially miss important topics and changes in trends that could have given us a clearer picture of what is actually happening on Twitter regarding mental health. Collecting social media data can provide more accurate and appropriate descriptions of how trends have changed over time. Further research should be conducted to include longer periods of time or different months of the year to see if our results can be replicated.

Additionally, we feel that further research can be done on whether the type of social media platform can affect the stigma toward mental health discussion and awareness. The study ran by (Naslund et al., 2019) measured both their frequency of social general social media usage and how often that usage is for mental health purposes, as well as if the participant had any interest in targeted programs that promote and address mental health discussion through social media. Their results allowed them to conclude that a wide demographic range of individuals would support such programs which can be perceived as presenting non-stigmatizing attitudes towards viewing mental health on social media.

Other research can be done to see if there were various reasons why people would present stigmatizing attitudes towards mental health topics both via social media and in general. The scale we used (Day, 2017) was divided up into categories based on stigma or perceived limitations that participants view individuals struggling with mental illness may have. For example, they have a category called “relationship disruption” which refers to one’s ability to uphold and a healthy relationship with someone with a mental illness and view that relationship positively. Further research could be done to see if these categories replicate into stigma found through social media and ways to combat those attitudes. It would also be helpful to research

how perceived success, education, and how loved and supported an individual feels can affect their comfort with expressing their mental health or discussing mental health topics on social media sites.

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Appendix A: Social Media Usage Questions

Do you currently use, or have you used any form of social media in the last 6 months?

- Yes
- No

Which social media site have you used in the last 6 months? (select all that apply) (Hong, H., & Kim, T. (2021, October 5). *Understanding University Students' experiences, perceptions, and attitudes toward peers displaying mental health-related problems on social networking sites: Online survey and interview study*. JMIR Mental Health. Retrieved November 15, 2022, from <https://mental.jmir.org/2021/10/e23465/>)

- Twitter
- Facebook
- Instagram
- Snapchat
- TikTok
- Reddit
- other _____

How frequently do you use social media? (check what you feel best describes your usage)

- Never
- Once a week
- 2-3 times a week
- 4-6 times a week
- Daily

Have you ever used social media to seek emotional support?

- Yes, I have used social media to seek emotional support
- No, I have not used social media to seek emotional support

Have you ever used social media to seek mental health resources?

- Yes, I have used social media to seek mental health resources
- No, I have not used social media to seek mental health resources

Have you ever used social media to post or discuss anything about mental health topics that affect those close to you?

- Yes, I have posted on my mental health on social media
- No, I have not posted on my mental health on social media

If yes, what topic(s) did you discuss? (select any that apply)

- Information on specific mental illnesses
- Resources for assistance regarding mental health
- Mental health memes (comedic relief)
- Providing support or encouragement for others
- Seeking support or engagement from others
- Other _____

Have you ever used social media to post or discuss anything about mental health topics that affect those close to you?

- Yes, I have used social media to post/discuss mental health topics for those close to me
- No, I have not used social media to post/discuss mental health topics for those close to me

If yes, what mental health topic(s) have you discussed? (select any that apply)

- Information on specific mental illnesses
- Resources for assistance regarding mental health
- Mental health memes (comedic relief)
- Providing support or encouragement for others
- Seeking support or engagement from others
- Other _____

How often do you use social media to search for information about mental health?

- Never
- Once each month
- 2-3 times a week
- 4-6 times a week
- Daily

Of the listed reasons, what is the top reason you would use social media to address your mental health concerns?

- Connect with others who also need mental health support
- Learn about mental health from others
- Share personal experiences about living with mental health issues
- Learn about strategies for coping with mental health issues
- Other _____

Appendix B: Engagement Matrix Table

How likely would you perform the following actions?

	1 (not at all)	2	3	4	5 (very likely)
Retweet this tweet					
Like this tweet					
Reply to this tweet					

Appendix C: Stigma Conclusion Questions

Day, E. N., Edgren, K., & Eshleman, A. J. (2007). Measuring stigma toward mental illness: Development and application of the mental illness stigma scale. *Journal of Applied Social Psychology*, 37(10), 2191–2219. <https://doi.org/10.1111/j.1559-1816.2007.00255.x>

1) I don't think that it is possible to have a normal relationship with someone who posts about their mental health.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

2) I would find it difficult to trust someone who posts about their mental health on social media.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

3) It would be difficult to have a close meaningful relationship with someone who posts about their mental health on social media.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

4) I feel anxious and uncomfortable when I'm reading a post someone made on social media about their mental health.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

5) A close relationship with someone who posts about their mental health on social media would be like living on an emotional roller coaster.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

6) I think that a personal relationship with someone who posts about their mental health on social media would be too demanding.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

7) Posting about your mental health on social media prevents people from having normal relationships with you.

1	2	3	4	5
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Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
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8) When talking with someone who posts about their mental health, I worry that I might say something that will upset them.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

9) I don't think that I can really relax and be myself when I'm around someone who posts about their mental health on social media.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

10) When I am around someone who posts about their mental health on social media, I worry that they might harm me physically.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

11) I would feel unsure about what to say or do if I were around someone who posts about their mental health on social media.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

12) I feel nervous and uneasy when I'm near someone who posts about their mental health on social media.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

13) It is inappropriate to discuss personal matters such as your mental health on social media.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

14) People who post about their mental health are looking for attention.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

15) I am not comfortable expressing my thoughts about mental health online.

1	2	3	4	5
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Appendix D: General Stigma Questions

Gierk, B., Bernd Löwe, Murray, A. M., & Kohlmann, S. (2018). Assessment of perceived mental health-related stigma: The stigma-9 questionnaire (STIG-9). *Psychiatry Research*, 270, 822–830. <https://doi.org/10.1016/j.psychres.2018.10.026>

1) I think that most people take the opinion of someone battling with mental health issues less seriously.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

2) I think that most people consider someone battling with mental health issues to be dangerous.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

3) I think that most people hesitate to do business with someone battling with mental health issues.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

4) I think that most people think badly of someone battling with mental health issues.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

5) I think that most people consider mental health issues to be a sign of personal weaknesses.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

6) I think that most people hesitate to entrust their child with someone who is battling with mental health issues.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

7) I think that most people do not even take a look at an application from someone who is battling with mental health issues.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

8) I think that most people do not enter a relationship with someone who is battling with mental health issues.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

9) I think that most people feel uneasy when someone who is battling with mental health issues moves into the neighborhood.

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

Appendix E: Demographic Questions

Please specify your age:

- Under 18
- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65 or older

What gender do you identify with?

- Female
- Male
- Non-binary
- Other _____
- Prefer not to say

What is your Ethnicity/Race? (select all that apply)

- American Indian or Alaska Native
- Asian
- Black or African American
- Hispanic or Latino
- Native Hawaiian or Other Pacific Islander
- White (Middle Eastern, North African origin)
- White (European)
- Other _____
- Prefer not to say

Are you currently enrolled in and attending a college or university?

- Yes
- No

If enrolled in University, what year are you expecting to graduate?

- 2023
- 2024
- 2025
- 2026
- Graduate student
- Other

What hypothesis do you think we were testing? Did thinking this influence your responses in any way? (open entry)

Did anything strike you as odd or unusual in this study?