

Qualitative and Artificial Intelligence-Based Sentiment Analysis of Turkish Tweets Related to Schizophrenia



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ABSTRACT

Objective: The aim of this study was to qualitatively examine Turkish tweets about schizophrenia in respect of stigmatization and discrimination within a one-month period and to conduct sentiment analysis using artificial intelligence applications.

Method: Using the keyword ‘schizophrenia,’ Turkish tweets were gathered from the Python Tweepy application between December 19, 2020 and January 18, 2021. Features were extracted using the Bidirectional Encoder Representations from Transformers (BERT) method and artificial neural networks and tweets were classified as positive, neutral, or negative. Approximately 5% of the tweets were qualitatively analyzed, constituting those most frequently liked and retweeted.

Results: The study found that, of the total of 3406 schizophrenia-related tweets shared in Turkey over a period of one-month, 2996 were original, and were then retweeted a total of 1823 times, and liked by 25,413 people. It was determined that 63.4% of the tweets shared about schizophrenia contained negative emotions, 28.7% were neutral, and 7.71% expressed positive emotions. Within the scope of the qualitative analysis, 145 tweets were examined and classified under four main themes and two sub-themes; namely, news about violent patients, insult (insulting people in interpersonal relationships, insulting people in the news), mockery, and information.

Conclusion: The results of this study showed that the Turkish tweets about schizophrenia, which were analyzed using artificial intelligence-based sentiment analysis were found often to contain negative emotions. It was also seen that Twitter users used the term schizophrenia, not in a medical sense but to insult and make fun of individuals, frequently shared the news that patients were victims or perpetrators of violence, and the messages shared by professional branch organizations or mental health professionals were primarily for conveying information to the public.

Keywords: Natural language processing, machine learning, schizophrenia, social stigma, social media

INTRODUCTION

According to World Health Organisation (WHO) data, 264 million people worldwide have been diagnosed with depressive disorder, 45 million with bipolar disorder and 20 million have been diagnosed with schizophrenia and other psychotic disorders, which are a leading cause of disability (Pavlova et al. 2020). In addition to their destructive effects, individuals with mental disorders throughout the world are exposed to stigmatisation, discrimination and marginalisation, preventing them from applying for mental healthcare services

and maintaining treatment (Pavlova et al. 2020, Budenz et al. 2019), including other psychosocial problems (Makita et al. 2020).

According to Goffman (1963), stigmatisation confers negative characteristics on the individual and aims to diminish the value of the individual in society. Stigmatization is composed of 3 structural parts, i.e. stereotypes, negative emotional responses, and behaviours (Corrigan and Watson, 2002). Although stigmatisation and discrimination are valid for many conditions, those with mental disorders have always

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been the most affected by stigmatisation and discrimination in all societies throughout history (Corker et al. 2015). Negative attitudes have been directed at these conditions since ancient times as mental health disorders have been perceived as untreatable disorders which are a punishment from God or a curse (Chan et al. 2019). Even today, individuals with a mental health disorder are exposed to stigmatisation and discrimination in all walks of life, experiencing, therefore, difficulties in finding employment, accommodation, and accessing health and education services (Dikeç et al. 2019). It has been reported that among mental health disorders, schizophrenia is often associated with dangerous and violent behaviour, towards which the society behaves with a negative and stigmatising attitude (Morgan et al. 2018). Based on data from 27 countries, it was determined that approximately half of patients diagnosed with schizophrenia have been outcast by friends or family members, 29% have experienced discrimination when seeking employment, and 39% have been exposed to disrespectful behaviour from healthcare personnel (Thorncroft et al. 2009).

The media has become an environment from which individuals obtain information about health and diseases. At the same time, information in the media has an effect on attitudes and behaviours towards mental disorders. News in newspaper headlines have been evaluated in studies in national and international literature, and with psychopathology usually at the forefront instead of well-being (Kenez et al. 2015). Negative factors have been attributed to individuals diagnosed with a mental health disorders, especially those diagnosed with schizophrenia, and it has been determined that the news published often aroused fear and anger towards these patients (Aci et al. 2020).

In recent years, social media applications in addition to mass communication tools, have emerged as both sources of societal information about mental disorders and the place where mental disorders are most stigmatised and discriminated (Budenz et al. 2019, Pavlova et al. 2020). In an online survey of 2265 Facebook users, Imhoff (2016) determined intense feelings of anxiety, anger and insecurity towards schizophrenia. On social media, especially on Twitter, individuals can express their thoughts and feelings in 280 characters anonymously or under a pseudonym, without censorship. To obtain more likes, individuals post extreme statements, and these can often be found in hurtful shared messages about mental disorders. Twitter differs from other social media platforms in that shared content is spread rapidly, like a viral infection (Budenz et al. 2020, Pavlova et al. 2020). The shared information, videos and photographs about mental disorders can manipulate and affect the knowledge, attitudes, and behaviours of social media users towards mental disorders. Moreover, young people with a mental disorder may spend more time on social media as they socialise less in daily life or because of changes in daily routine during the COVID-19 pandemic. Exposure to the negative

communications about mental health disorders can increase the internalized stigmatisation of these individuals using social media (Budenz et al. 2020). Accordingly, it can be said that social media can increase both societal stigmatisation and internalised stigmatisation. Despite an increase in recent years in the number of studies examining Twitter posts related to stigmatisation and discrimination in social media, numbers are still limited.

In parallel with the development and spread of artificial intelligence techniques, sentiment analysis, which has often been used in the analysis of online applications data in recent years, is an analysis method which allows the determination of emotions that are expressed in these texts and their positive or negative nature. Sentiment analysis, which is one of the Natural Language Processing (NLP) techniques, is the most frequently used method and is enabled by two approaches. These are the lexicon-based and the machine learning approaches (Pozzi et al. 2016). Although big data can be analyzed with the machine learning method, its use in social media studies related to mental disorders is extremely limited, and usually small data sets have been analyzed (Budenz et al. 2019).

Despite the limited number of studies that have examined communications concerning mental health disorders and schizophrenia, there has been a noticeable increase in recent years. No study could be found on this subject in the Turkish literature, which could be due to difficulties encountered in Turkish tweets analysis of the communications. Therefore, the aim of this study was to examine Turkish tweets in respect of stigmatisation using the term 'schizophrenia,' which is exposed to stigmatisation the most within the collective term of mental disorders. With the combined use of artificial intelligence applications, sentiment analysis, and qualitative analysis by the researchers, this study could contribute to literature.

METHOD

Study Aim and Design

The aim of the study was to examine tweets in Turkish language about schizophrenia in respect of stigmatisation and discrimination, which were shared during a one-month period on Twitter, which is one of the most frequently used social media platforms worldwide. In the study, Turkish tweets were examined quantitatively with sentiment analysis, which is based on artificial intelligence applications, and qualitatively using content analysis (Ersoy, 2017). The quantitative reporting of the data was made with reference to The Strengthening of the Reporting of Observational Studies in Epidemiology (STROBE) (Vandenbrouche et al. 2007) and the qualitative reporting with the Consolidated Criteria for Reporting Qualitative Studies (COREQ) guidelines (Tong et al. 2007).

Study Sampling

In stage-one of the study, the sample was formed of all the Turkish tweets shared in the 4-week period between 19 December 2020 - 18 January 2021. The keyword 'schizophrenia' was used to scan respective tweets. In the sentiment analysis phase of the study, tweets including the word 'schizophrenia' were used with the number of users sharing these tweets, the number of likes, and the number of retweets. A total of 3406 tweets were identified in the defined period, and the sample of 2996 tweets was formed, which included the keyword, contained positive, neutral, or negative statements, and were not retweets or duplications (Table 1).

Table 1. The Quantitative Features of Schizophrenia-related Turkish Tweets

Tweets	N	
Total Number of Tweets	3406	
Number of Unique Tweets	2996	
Total Number of Retweets	1823	
Total Number of Likes	25.413	
Total Number of Users	2632	
Tweet Frequency	Mean	Standard Deviation
Number of Tweets per Day	96.64	26.28
Number of Unique Tweets Shared by Daily Users	1.13	0.00
Number of Likes for Daily Tweets	8.48	0.02
Number of Retweets per Day	0.60	0.00
Users		
Number of Users Who Liked Tweets	9.65	0.02
Number of Retweeters	0.69	0.00
Tweets About Schizophrenia	N	%
Positive	231	7.71
Neutral	865	28.9
Negative	1900	63.4
Characteristics of Daily Negative Tweets	Mean	Standard Deviation
Number of Negative Tweets per Day	61.29	15.67
Number of Users Sharing Negative Tweets Daily	0.72	0.00
Number of Users Liking Negative Tweets Daily	5.45	0.02
Number of Users Retweeting Negative Tweets per Day	0.40	0.00

In stage-two of the study, 145 tweets (approximately 5% of the total sample which had the most likes, were re-tweeted and reached the highest number of people) were evaluated using qualitative data analysis. Measurement sampling methods were used in the qualitative data analysis. As there is no defined rule as regards the sample size for qualitative research, and the sample size can be determined according to the study question and aim, and the study design was structured flexibly, data collection was terminated when data started to be repeated, in other words, when data saturation began (Polit and Beck, 2006).

Data Analysis

Data for the study was gathered over a period of one month on Twitter with the help of the artificial intelligence program Tweepy Packet (Roesslein, 2009). Data collection was completed on 18 January 2021. In the sentiment analysis of the data, the NLP method, Bidirectional Encoder Representations from Transformers (BERT), was used to reveal the characteristics of the tweets (Google AI, 2019). BERT is the most up-to-date technological method, which has been used by Google in 70 languages since October 2019, and is the technique used in almost all search engines in English (Search Engine Land, 2020). In this study, the pre-trained BERTurk was used as the technique for feature extraction (Schweter, 2020). The Multilayer Perceptron (MLP), which is often used in psychiatry and behavioural sciences was used as an advanced feed Artificial Neural Networks (ANN) classifier (Wu et al. 2020). The feature extraction and classification techniques are summarised in Figure 1.

The qualitative data analysis in the study was performed by two researchers. The most liked and retweets were analyzed using the Colaizzi phenomenological interpretation method (Colaizzi, 1978). The steps of the Colaizzi phenomenological data analysis were applied by two researchers as follows: 1. The tweets were read and re-read to understand the sentiment in the communication, 2. Significant schizophrenia-related expressions in these tweets were selected, 3. Meanings were formulated by examining these significant expressions, 4. The formulated meanings were grouped as themes and sub-themes, 5. The results obtained were combined richly and comprehensively, 6. The basic conceptual structure of the tweets was defined.

In addition, the tweets were read with Tweet Text to determine the most frequently used words. A word cloud was created with frequently used words in large script and less frequently used words in smaller script (Figure 3).

Ethical Aspects of the Study

The study was approved by the Hamidiye Scientific Research Ethics Committee of University of Health (decision no: E.36398, dated: 19/10/2020). As the study was conducted on publicly-accessible social media, institutional permission

was not required individual informed consent was not required for data was anonymous. The data was obtained from Twitter in compliance with the Personal Data Protection Law (2016) and the Ethical Guidelines for Internet Research (Franzke et al. 2021) and personal information of the individuals was not obtained. The names

of institutions and organisations, tagged subjects (hashtag, #), people (mention, @), and website links (URL addresses) were removed from the tweets. Tweets to be examined in the qualitative analysis were selected by another researcher not involved in the qualitative analysis. The tweets with the most likes and retweets were ranked in order. The column

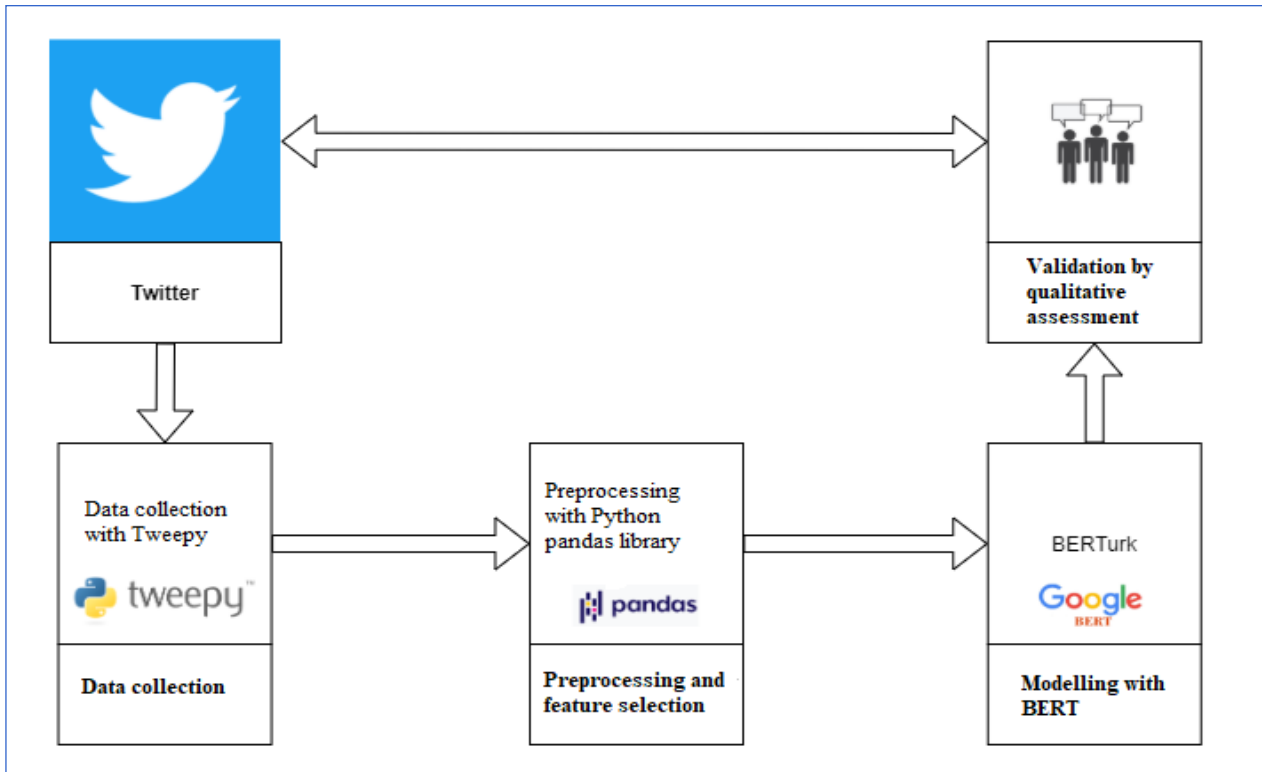


Figure 1. Quantitative Data Analysis of Turkish Tweets related to Schizophrenia

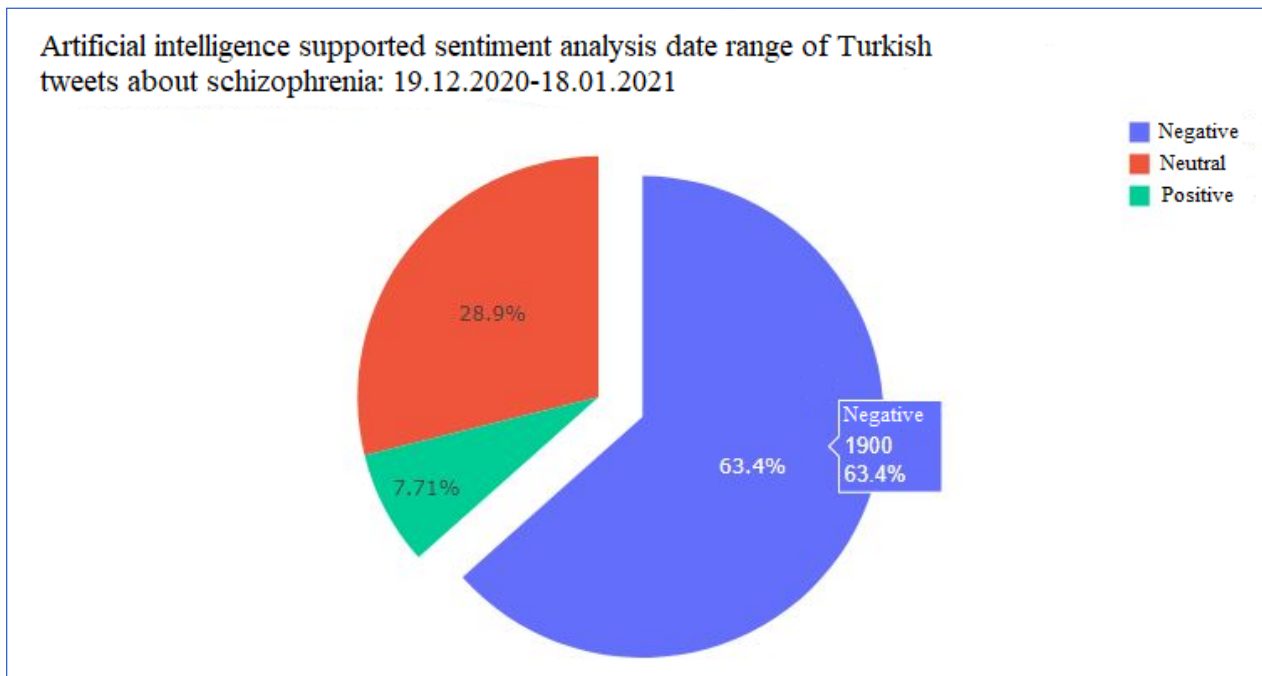


Figure 2. Sentiment Analysis of Schizophrenia-related Turkish Tweets

person with whom they had experienced problems in an interpersonal relationship or another Twitter user did not have the ability to evaluate reality.

“Schizophrenia onset – stay away from me!”

“Are you schizophrenic or something, pal? Or am I a retard magnet?”

“Schizophrenia – what a pity!”

Personal Insults on the News

It was determined that schizophrenia-related tweets were directed at people on the news, targeted politicians, certain events, and characters in TV series and soap opera stars. The term, schizophrenia, was determined to have often been used to criticise political parties and characters in soap operas, dealing with mental health disorders and therapies recently in Turkey.

“Adding a schizo in the script? Everything was great with our production now it’s Now its doubly divine. A schizo... is that the best you could think of?”

“So, who’s A? Does s/he even exist or s/he is just schizophrenic ”

“@.... X has gone schizo.”

“Now they are whining everywhere that the party is going to be banned and they are victims aonce again. Yeah, once a victim always a victim right. It seems schizophreniz is settling in..”

“...and I think it’s a schizophrenic situation to attack on headscarves, portraying yourself as the victim and profiting off of it at the same time”

Mockery

In the tweets examined, the word ‘schizophrenia’ was often used with aggressive feelings with the intent to reduce, make fun of or mock another person. It was also seen that individuals would make fun of themselves saying “am I schizophrenic or what?”

“Hey, I’d love to say I’m in love with your uncle, but it’s too soon to go schizo!”

“I’ve become really schizophrenic”

“As a patient in Psychiatry ward was leaving, s/he promised us to visit us and bring hazelnuts this time. It was so nice and I was happy for a moment then it occurred to me that he was a schizophrenic, so I just carried on with the ward round...”

“When the eye can’t see, the heart becomes a telltale schizophrenic and sets the scene.”

“Shame on you, uncle! I have schizophrenia.”

“As a schizophrenic family, we celebrated my brother’s fake birthday”

Information

Then there are tweets especially from professional branch organisations defending patient rights, providing information about self-help group activities and the study results of mental healthcare workers and the tweets of some groups were shared to inform group members about schizophrenia and other psychotic disorders, to inform the society or to merely combat stigmatisation.

“This week we’ll talk about schizophrenia. We are presenting a section from the TV series Z to give a context to the disease. Read with pleasure...”

“Non-adherence with treatment is often seen in schizophrenia cases. In this research published in journal X, long-lasting injection treatment is seen to have an extremely positive impact on the course of the disease in the early stages. The benefits of an early-start to this treatment are evident.”

“The Mass COVID-19 Vaccination Strategy must take Chronic and Severe Mental Health Diseases into consideration.”

“Schizophrenia is not a measurement of personality or intellect. It is a mental health disorder. Therefore, the use of the word ‘schizophrenia’, in a degrading way in society is hurtful to patients and their relatives. We must avoid all kinds of discriminatory language.”

DISCUSSION

In this study based on artificial intelligence applications, schizophrenia-related tweets in Turkish language were examined using sentiment and qualitative analyses with a focus on stigmatisation and discrimination over a one-month period. As the first study on this subject in Turkey to have applied sentiment analysis in the field of mental health, we believe that the results of this study will contribute to the literature. The vast majority of the tweets examined in this study were found to express negative sentiments about schizophrenia. Every day, at least a-tweet is posted about schizophrenia, and a mean number of 96 tweets per day were posted on this subject, of which 61 expressed negative feelings and were liked by approximately 6 people and retweeted 0.40 times, hence the public spread. Similar to the findings of other sentiment analyses (Joseph et al. 2015, Budenz et al. 2020, Makita et al. 2020, Pavlova et al. 2020), the findings of the current study that examined schizophrenia-related tweets and those in relation with mental health disorders also show that there was ‘thick’ stigmatisation in the use in Turkish of the Word ‘schizophrenia’ irrespective of culture.

In the tweets examined qualitatively in the current study, it was determined that news of violence related to patients diagnosed

with schizophrenia from newspapers or news agencies were often shared from social media accounts, and these tweets were retweeted and liked by users. In a retrospective study of Turkish newspaper items by Aci et al. (2020), there was seen to be negative news about mental health disorders on two-thirds of the pages of the newspapers examined, three-quarters of the news items mentioned murders committed by patients, serious crimes and forensic events, in two-thirds of the news items the patient was the perpetrator of the crime, and in one-third the patient was stated to be the victim. In half of the news pieces examined, there were photographs of the patients and personal information was not protected. Similarly, the current study showed that photographs of patients were posted and information was not protected in these tweets posted using content from web sites of news agencies. Twitter was seen to not have protected privacy and to have permitted the sharing of names and images in these posts sharing news pieces from newspaper or news agency webpages.

With the transfer of written media to a digital environment, newspapers, journals and television channels created social media accounts which are currently actively used. Through these accounts, news can be transmitted immediately and to more people. In the Regulation on the Procedures and Principles of Broadcasting Services published by the Radio and Television Supreme Council (RTUK) in 2011, the broadcast service principles include 'respecting the dignity of individuals, respecting privacy, not allowing the sharing of information and documents regarding private life without the consent of individuals, and not discriminating against or humiliating individuals because of disability' (RTUK, 2011). Taking into consideration the role of mental health professionals to defend patient rights, it is very important that RTUK is notified of these posts and news pieces from newspapers or news agency websites that use personal information and are stigmatising, and that possible inspections and sanctions should be in place so as to prevent the sharing of news on social media in this way.

The results of this study showed that the term 'schizophrenia' was often used between individuals, not in a medical sense, but to insult, mock, humiliate, or degrade politicians, people in the news, or characters in TV series and soap operas. A word cloud was created of the words used most frequently in these tweets, and it was seen that the words *schizophrenia*, *schizophrenic*, *and*, *one*, *a*, *the*, *this* were used, often in the expression 'this is a schizophrenic.' Joseph et al. (2015) examined posts about schizophrenia and screened communications including the words 'schizophrenic, diabetes, and diabetic' over a period of four days. The posts related to schizophrenia were found to be significantly more negative and expressed with more limited medical terminology, and posts that included the expression 'schizophrenic' were more stigmatising (Joseph et al. 2015). It was also emphasized in that study that the

term 'schizophrenia' was extremely misused on Twitter. In a study by Alvarez-Mon et al. (2019), schizophrenia-related Twitter posts were examined in addition to five other medical conditions such as Alzheimer's, breast cancer, diabetes, and AIDS. It was reported that schizophrenia was more often misused in tweets compared to other conditions, and regarding the latter, more scientific information was shared about the disease, including prevention and protection. The results of the said study showed that individuals using the word 'schizophrenia', were divorced from reality or had abnormal thoughts and displayed similar behaviour, or used it as a sign of anger when trying to diminish values through insult. This suggested that the terms used in the past to label individuals with mental health disorders, such as 'mad, crazy, maniac, mental patient, etc.' (Üçok, 2003, Özmen et al. 2004) have been replaced today by 'schizophrenia, schizo, and schizophrenic.' Therefore, it is of great importance to give social messages more often that explain that stigmatisation starts with language. Similarly, in a 10-year study analysing social media posts, (Pavlova et al. 2020) collected these posts under the seven themes, namely, awareness, accessibility and funding, classification, emotions and problemisation, stigmatisation, services, and youth. Although posts related with mental health disorders, which were used by individuals to express their own concerns about mental disorders usually aimed to increase general awareness, it was emphasized that the quality of information in these messages was low, that these were usually related to common mental disorders, and often used stigmatising expressions blended together with fear, madness, and violence.

The current study found that the tweets of professional associations and mental health professionals provided and included scientific information with neutral expressions with the aim of public information. It was seen that during the Mental Health Awareness Week that such tweets were posted to raise awareness, and it can be recommended that such tweets should continue. In a study of posts during the world during Mental Health Awareness Week, the data were qualitatively analyzed and three themes were determined at the end of the study. These were stigmatisation, awareness, and personal experience with defence of rights (Makita et al. 2020). The study concerned reported that posts on social media could be stigmatising, even in Mental Health Awareness Week. Therefore, it can be recommended that mental health professionals and professional associations actively use social media accounts to share informative posts, including videos and photographs. Similarly, short videos created by professional branch associations showing difficulties that patients diagnosed with schizophrenia and their families experience and the effects of stigmatisation and discrimination on their daily lives can be shared on social media, which require these associations to update

their social media accounts frequently and assign a budget to cover production costs of content on this subject, so that such processes can be most effectively carried out. Through projects and collaboration, associations should prepare social media campaigns against stigmatisation and should also share informative posts on social media accounts to correct misinformation about schizophrenia and other mental disorders. The long-term effects of these campaigns should be evaluated with sentiment analysis of large data and comparisons should be made according to the share and like rates of stigmatising statements on social media. The effects of these campaigns could also be measured with on-line self-reported questionnaires or scales. These campaigns could enable patients with good functionality who are adherent with treatment to become social media activists, and this should reduce social prejudices to schizophrenia patients. It is also very important that there is collaboration between professional branch organisations and Non-Governmental Organisations and Federations of patients and their relatives.

CONCLUSION

In this study which examined schizophrenia-related Turkish tweets with an artificial intelligence-based analysis technique, the content was found usually negative. It was seen that Twitter users used the term 'schizophrenia' not in a medical sense, but to insult or mock people; news were often shared portraying patients as perpetrators and victims of violence, and the tweets from professional branch associations and mental health professionals were posted with the aim of public information. As individuals can share thoughts and feelings on almost every subject on social media without censorship, there is a need for further studies using sentiment analysis with large data sets in this era of artificial intelligence, not only in respect of schizophrenia but also for other mental disorders and substance abuse, which is also severely stigmatized, and these studies should be repeated in the long term. There is also a need to increase the number of campaigns to combat on-line stigmatisation and the effects of these should be measured. In addition, the active use of social media by patients diagnosed with mental health disorders to share their experiences will serve as a significant step-up against stigmatisation.

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