

## Twitter chirps for Syrian people: Sentiment analysis of tweets related to Syria Chemical Attack

Saimah Bashir<sup>a</sup>, Shohar Bano<sup>b</sup>, Sheikh Shueb<sup>c</sup>, Sumeer Gul<sup>b,\*</sup>, Aasif Ahmad Mir<sup>d</sup>,  
Romisa Ashraf<sup>b</sup>, Shakeela<sup>b</sup>, Neelofar Noor<sup>b</sup>

<sup>a</sup> Department of Political Science, University of Kashmir, Jammu & Kashmir, India

<sup>b</sup> Department of Library and Information Science, University of Kashmir, Jammu & Kashmir, India

<sup>c</sup> Central Library, Islamic University of Science and Technology (IUST), Awantipora, Jammu & Kashmir, India

<sup>d</sup> Department of Library and Information Science, Pondicherry University, Kalapet, Puducherry, India

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### ABSTRACT

**Purpose:** The sentiment analysis of tweets provides information about peoples' attitudes and perceptions towards an event. The current study showcases the role of Twitter in a crisis by analyzing the nature of tweets and the sentiments expressed by the Twitter-sphere during and after the "Khan Shaykhun Syria Chemical Attack."

**Methodology:** A total of 13,156 tweets posted in English on Twitter during the first 27 days of the attack were downloaded and considered for the study. The content analysis of the tweets was done manually, and accordingly, the sentiments of the tweets were highlighted through eight broader categories. Furthermore, to visualize the positive, negative, and neutral sentiments of the tweets, the *Orange Data Mining Software*, a powerful toolkit for machine learning, data mining, and data visualization, was used. *VOSviewer* (a software tool used for creating maps based on network data and for visualizing and exploring the maps) was also used to visualize the word frequency of the tweets.

**Findings:** Twitter is primarily used for situational awareness and acts as an emotional, social support system by sharing sentiments. 35.71% of the tweets are associated with "sharing news and information", with just 2.12% "supporting the government". People mostly retweet the tweets that "criticize the government," with an average retweet count of 15.84, followed by the ones "evincing emotions" (12.21). However, tweets that "raise questions" (3.32) and "provide suggestions" (2.51) fail to gain the attention of too many tweeter users, thus having less impact. People mostly like the tweets that "support government" and "evince emotions," with such tweets on an average receiving 9.89 and 8.37 likes, respectively. Individuals post a large number of tweets (10,137; 77.05%), followed by news channels (1157; 8.79%) and organizations of varied nature (950; 7.22%). However, 912 (6.93%) tweets are posted by users of anonymous nature. Text and text with images form most tweets contributing to 8061 (61.27%) and 3137 (23.84%) of the total tweet count. However, none of the tweets contain video only, and just 3 (0.02%) tweets embed only images. Text-video and text-image formats are highly retweeted and liked. It is evident that 53.70% of the tweets (n = 7065) reflect negative sentiments, while 12.67% (n = 1667) emulate positive sentiments and, 33.63% (n = 4424) showcase a neutral perception about the attack. One can visualize the U.S.A. among the top tweeting countries with the highest percentage of positive sentiments, followed by Canada and Israel. Turkey outscores all the countries in terms of negative tweets, followed by Syria and U.K. However, in terms of neutral tweets, Germany ranks first, followed by Iran and Canada. The tweets pour mainly for the first few days, indicating the concern of users for the victims. Later on, a declining trend of tweets is witnessed. "idlib", "Syria", "Syria chemical attack," and "Assad" are the leading words used more than a thousand times in the tweets.

**Research implications:** The current study adds to the growing body of knowledge to the existing literature on Twitter and its use to narrowcast situational awareness during crisis episodes. One of the implications of the study is that the news agencies highly exploit the sharing side of Twitter during disasters by communicating real-time and unique information, create situational awareness, and connect to the digital audience. Twitter acts as an

\* Corresponding author.

E-mail addresses: [shahsaimah@gmail.com](mailto:shahsaimah@gmail.com) (S. Bashir), [Banozaidd7@gmail.com](mailto:Banozaidd7@gmail.com) (S. Bano), [shkhshb@gmail.com](mailto:shkhshb@gmail.com) (S. Shueb), [sumeersuheel@gmail.com](mailto:sumeersuheel@gmail.com) (S. Gul), [miraasif7298@gmail.com](mailto:miraasif7298@gmail.com) (A.A. Mir), [rumais.ashraf07@gmail.com](mailto:rumais.ashraf07@gmail.com) (R. Ashraf), [shakeelamlis@gmail.com](mailto:shakeelamlis@gmail.com) (Shakeela), [noorneelofar6@gmail.com](mailto:noorneelofar6@gmail.com) (N. Noor).

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emotional outlet that facilitates the mining of condensed varied reactions towards an event to frame disaster response strategies and provides a sociological understanding of social media use during the crisis by the victims and viewers.

*Originality:* The study represents the sentiments of the Twitter-sphere towards the “Syria Chemical Attack.”

## 1. Introduction

Social media is an interactive discourse platform that emerges as a first-hand information source for the masses. It has become an integral part of the routine in modern society by offering powerful public platforms, where people can freely share their emotions, sentiments, and opinions about various topics. Due to the increasing global coverage and high impact of social media, people's views shared via social media on some topics can indicate and mould public opinion [1]. It acts as an online support system at times of catastrophe, whether human-made or natural, since it allows people to share information, seek help, create awareness, and organize campaigns. Tagging social media as the “voice of people” in a real sense holds relevance in the rapid diffusion of information when some significant events of varied characteristics break. Social support platforms also find their use at the time of death of someone to express grief and console the bereaved family by establishing a large online community of mourners [2].

One of the social support platforms used in times of bereavement and reflects public sentiments and perspectives is a microblog. Microblogs allow the users to post a message in the form of brief comments to one's social network and are emerging as a valuable source of user-generated content. Twitter, the most popular microblogging service, has emerged as an essential information source and news alerting medium for social media users. Twitter contains a bulk of data with essential insights that makes it an excellent tool to gauge public opinions and responses towards a particular event of any nature using sentiment analysis. The sentiments expressed over Twitter by the global audience during universal events act as an excellent source of real and unique information. The information shared via this interactive platform is not influenced by filtering and gatekeeping agencies. Because of this, Twitter has become a popular place for researching various perspectives of human sentiments among researchers and scientists [3]. Twitter has also found its use more particularly for the expression of grief during disasters [4] and is recognized as a platform for backchannel activity [5; p. 297].

One of the deadliest chemical attacks in the past, called the “*Khan Shayakhun Chemical Attack*,” which took place on April 4, 2017 in *Khan Shayakhun* in *Idlib* governate of *Syria*, attracted different reactions across the globe on social media, including Twitter. The town was reported to have been struck by an airstrike by government forces, followed by massive civilian chemical poisoning. The release of the toxin gas, which included *Sarin* killed at least 74 people and injured more than 557, according to *Idlib Health Authority* [6]. More than 4.5 million Syrians ran away from their homeland due to danger and violence [7]. The activities related to the event have been extensively discussed on various social media platforms [8].

The current study adds to the growing body of literature on Twitter sentiment analysis by examining the tweet expressions communicated during a heavy heart-wrenching crisis episode, i.e., “*Khan Shayakhun Syria Chemical Attack*.” The study aims to understand the trends of tweets and the social support offered on social media during crises engineered by human activities by performing qualitative and quantitative analyses of tweets.

### 1.1. Review of Literature

Past studies suggest that there are marked differences in the way individuals in the community experience and express emotions. Burnett [9]; Liu and Larose [10] confirm that the online environment serves as an excellent platform for facilitating information and socio-economic

activities. It is observed that online tools can provide emotional and social support [11]. Among such online platforms, Twitter-a micro-blogging service allows users to post real-time messages, “*tweets*.” Twitter has become an integral part of modern society's routine by offering a powerful public platform where people can freely share their emotions, sentiments, and opinions about various topics. Many studies have analyzed Twitter as a potential tool to share information, know public perception, and express emotions. A study conducted by Lee and Goh [12] investigates how microblogs play an essential role in providing emotional and social support by analyzing tweets over the death of Michael Jackson, the king of pop. The results confirm that Twitter is used as a platform to provide informational support. It is also observed that apart from grieving, other categories of sentiments too occupy a high proportion of tweets, such as spreading rumors and expressions of hatred and spam. Ozturk and Ayvaz [1] report the sentiments and opinion of the public on Twitter towards the “*Syrian Refugee Crises*” by examining 2,381,297 relevant tweets posted in Turkish and English languages. The results indicate that Turkish tweets show more positive sentiments towards Syrian refugees than English ones, containing neutral sentiments followed by negative ones. Sentiment analysis of Twitter data also holds the vitality to predict future security attacks by observing a high correlation between the sentiment of Twitter data and actual attacks on the Web [13]. Chen et al. [14] used sentiment analysis to evaluate the polarity of tweets to predict future crimes. Mittal and Goel [15] used Self Organizing Fuzzy Neural Networks (SOFNN) and Dow Jones Industrial Average (DJIA) values on Twitter data to predict stock markets. Other methods have also evolved to perform sentiment analysis such as deep convolution neural network using latent contextual semantic relationships and co-occurrence statistical characteristics of words in tweets [16]; deep learning approach [17]; Hadoop framework and deep learning classifier [18], and Bayesian networks classifiers [19]. Patel and Passi [20] performed sentiment analysis on Twitter data of World Cup Soccer 2014 using a machine learning algorithm. The study demonstrates natural language processing (N.L.P.) techniques for pre-processing linguistic data and machine learning algorithms like naïve Bayes, SVM, Random Forest, and K.N.N. for classifying the tweets as positive, neutral, or negative.

Twitter as a platform for communication is also ascertained by Aharoni [21] to understand how three political leaders-the prime minister of Israel, Benjamin Netanyahu; the prime minister of Britain, David Cameron; and the president of the United States of America, Barack Obama communicate through Twitter. The results show that the president of the U.S.A. uses more Twitter than the other two leaders. However, all three leaders use Twitter for transparency and outreach. Hambrick et al. [22] conducted a study on Twitter's use by professional athletes to communicate with their fans and other players. The tweets were analyzed under six categories: interactivity, diversion, information sharing, content, promotion, and fanship. Results indicate that the athletes converse directly with their followers. A large percentage of tweets fall into the diversion category. In contrast, promotional tweets are less in number, signifying that professional athletes may not be taking advantage of the promotional opportunities of Twitter.

Twitter has also been studied to disseminate information during natural or human-made disasters, crises, and emergencies. It holds perceived legitimacy among the netizens in emergencies. It has been highly used to understand the sentiments of people during and after the disasters such as: “*Typhoon Haiyan in the Philippines*” [23]; “*Japan's 2011 Earthquake*” [24]; “*2015 Chennai Floods in India*” [25]; “*2014 devastating floods of Jammu & Kashmir, India*” [26]; “*2010 Pakistan*

Floods" [27]; "2014-UK Floods" [28]; "2011 Tohoku Earthquake" [29]; and "2009 H1N1 Outbreak" [30]. Miyabe et al. [31] also investigated how people use Twitter in response to "Japan's Earthquake 2011". They consider different factors, including where tweets emanate and reveal that people belonging to the disaster area directly communicate using tweets. In contrast, people from other areas spread information through retweets. Gul and Shueb [32] conducted a quantitative and qualitative analysis of tweets tweeted during one of the deadliest attacks, i.e., "Peshawar School Attack" in Pakistan. The study reports that tweets displaying emotions surpass in number, followed by interrogative ones. Moreover, the maximum proportion of tweets is contributed by civilians/individuals with the most significant number of tweets, retweeted, and liked. A study on the "2010 Earthquake in Chile" was conducted by Mendoza et al. [33]; who examined the tweets during the disaster and explored the behavior of Twitter users. The authors confirm that the propagation of tweets that correspond to rumors differs from those that correspond to the news since rumors tend to be more questioned than news by the Twitter community. This confirmation shows that rumors can be easily detected by using an aggregate analysis of tweets. The role of Twitter during election campaigns for party promotions, mobilizing voters, and analyzing the behavior of influential accounts has also been performed. Graham et al. [34] researched 26,282 tweets during the "2010 U.K. General Election" campaign. The results validate that British politicians use Twitter mainly as a unidirectional form of communication with the voters for mobilization. Kalsnes et al. [35] reviewed the political debates during the "Norwegian Elections 2011". They were interested to understand the role of social media in the participation of the audience and the traditional media as gatekeepers and agenda-setters. The authors confirm that the same topics are discussed on Twitter as on T.V., but Twitter reveals critical observation about the agenda than the traditional media. Graham et al. [36] compare how Dutch and British parliamentary candidates use Twitter during "2010 General Elections". The results authenticate that Dutch politicians are more likely to use Twitter than British candidates. Similarly, Gul, et al. [37] studied the "State Assembly Elections 2014" of Jammu and Kashmir, India, to analyze how people use Twitter to express their views during various phases of the election. The results show that users are more active on polling days, and a massive rush of people is seen on the day of voting and results. Other than people, news agencies and social/political groups express their views, personal commentaries, and news updates about the election process. Sharma and Ghose [38] performed a sentiment analysis of Twitter data concerning general elections in India. They observed that the opinion polarity of the folks is in conformity with the actual election results.

Studies also confirm that Twitter is used as a platform to express emotions and happiness. Crannell et al. [39] conducted a study on the tweets of "U.S. Cancer Patients" in order to calculate the average happiness of patients for each cancer diagnosis. The results affirm that different types of cancer are tweeted. Patients express openly on social media about their treatment course, diagnosis, and surgery or biopsy. A study conducted by Yu and Wang [40] uses sentiment analysis to examine the emotional responses in the tweets posted by U.S. Soccer fans during the "2014 FIFA World Cup". The results indicate that anger and fear are the most noticeable negative emotions during the match played by the U.S. team, which increase when the opponent team scores high. However, if the match is played between other teams, U.S. fans show more joy than negative emotions.

## 2. Methodology

The methodology adopted for the completion of the study is quantitative and qualitative and is categorized into five phases. Descriptive statistics, as well as content analysis, form the basis of the study.

### 2.1. Phase I: Hashtag selection for tweet delimitation

The terms or the hashtags used as input terms to download the tweets included "#syriachemicalattack" and "#Idlib." However, only those tweets which were posted in English were considered for the study.

### 2.2. Phase II: Harvesting of tweets

Tweets were harvested against the selected hashtags. The harvested data from the tweets showcasing the "Syria Chemical Attack" covered 27 days, i.e., from April 4, 2017 through April 30, 2017. This period was selected to cover the significant happenings related to the "Syria Chemical Attack," with 4 April marking the beginning of the attack and 30 April witnessing the highest decline in the tweet count. The selected period helped to look for the trending tweets pertinent to the event. A total of 13,156 tweets were retrieved and recorded in Microsoft Excel.

### 2.3. Phase III: Content analysis of tweets and tweet categorization

To understand the sentiments of the tweets and determine the tweet format (i.e., text, image, or video), the study used a naturalistic approach. Initially, 100 tweets were randomly selected and analyzed accordingly in response to their sentiment characteristics. One hundred tweets were selected as a testbed so that the sentiment categories represented through those 100 tweets can be analyzed comprehensively. Each tweet was read and understood expansively so that the sentiment represented through it can be documented. For example, a tweet, "Heart-wrenching. I Buried My Own Children: A Syrian Father's Grief #Idlib #ChildrenUnderAttack" after a thorough understanding was categorized under the "Evinced Emotions" category while as another tweet, "Some #Assad's lies: We never used #barrelbombs We never used chemical weapons in the past Tortures are false #Idlib attack 100% fabrication" was labeled under the "Criticism" category. Accordingly, the tweets were categorized in the light of the subject context they carried. Content analysis of the 100 tweets was done manually, and accordingly, the sentiments of the tweets were categorized under eight broader sentiments (Table 1). This procedure helped to determine the various themes reflecting the event. Major themes and issues presented in the downloaded tweets were thoroughly examined. An inductive approach was used for the evolution of a theme/sentiment. Wherever a tweet did not match a previous category, a new category was devised. Previous studies [4,12, 26,32] also helped to explore additional sentiment categories which were, later, cross-checked and modified, keeping in view the nature of expressions articulated through the tweets reflecting the "Syria Chemical Attack." All the 13,156 tweets were manually analyzed to ascertain the sentiments. After a thorough analysis of the sentiments (visualized from previous studies and the ones constructed by us), the final framework clustered the 13,156 tweets into a total of eight broader categories (Table 1).

However, tweets representing more than one theme of sentiments were sorted under the most dominating sentiment category reflected by

**Table 1**  
Coding framework.

Category	Definition
Sharing news and information	Share news stories, information, and other content related to the Syria chemical attack
Evinced emotions	Express sorrow, grief, sympathy, and emotional distress towards the victims
Raising questions	People asking questions regarding in and around the attack
Providing suggestions	Posts that are suggestive to the government of Syria
Criticizing government	Criticizing the government and its policies and loopholes.
Supporting government	Posts in support of Syria govt. and attack
Raising protests	People raising protests against the attack
Irrelevant	Posts that are not related to the event

them. While collecting the data regarding the location of the Twitter profiles, most of the profiles provided only the names of the cities and some specific area names. The names of the cities were searched individually on the Internet to find their respective countries to maintain the consistency of the location data grouped only under countries.

#### 2.4. Phase IV: Positive, negative, and neutral sentiments of tweets

To visualize the positive, negative and neutral sentiments of the tweets, the dataset was migrated to the *Orange Data Mining Software*, a powerful toolkit for machine learning, data mining, and data visualization. Data pre-processing techniques were applied to the dataset, which included *Transformation*, *Tokenization*, and *Filtering*. Data pre-processing techniques help improve the efficiency of tweet sentiment analysis and remove unnecessary words like noises, stop lists, and abusive words. Using the lexicon-based *Liu and Hu Sentiment Module of Orange Software*, sentiment analysis was performed. Sentiment analysis predicts the sentiment score of each tweet in a corpus. The final sentiment score is the difference between the sum of positive and negative words normalized by the length of the document and multiplied by 100. The final score reflects the percentage of sentiment difference in the tweet.

#### 2.5. Phase V: Word frequency

*VOSviewer* (a software tool used for creating maps based on network data and visualizing and exploring the maps) was used to visualize the word frequency from the dataset. The tweet dataset was exported to the *VOSviewer*, which extracted a total of 19,173 keywords. Eight hundred fifty-four keywords were selected by using a minimum threshold of 10 occurrences by keyword. A visualization network of the keywords was generated accordingly.

### 3. Data analysis

#### 3.1. Tweet expression

Twitter is used to express various sentiments during and after the event (Table 2). A large proportion of tweets (4698; 35.71%) represent “news and information,” indicating that Twitter is mainly used to share real-time information. These tweets provide the current information pertinent to the chemical attack from the recognized news sources such as *B.B.C.*, *Aljazeera*, *The Guardian*, *CNN*, etc.

e.g. (Assad forces carried out Sarin attack, says French intelligence the guardian.com/world/2017/April).

(271#Syria/govt. employees sanctioned by the U.S. in the wake of Khan Sheikhoun Chemical Weapons attack).

(France: @ Assad regime was behind Syria chemical attack CNN).

Tweets sponsoring emotions like sadness, sympathy, sorrow, anger, and grief are listed at the second rank (2993; 22.75%). The tweets cover messages from simple condolence (e.g., *Trump condemns chemical attack in Syria*); to sorrow (*Mohammad fled besieged east Ghouta in Syria chemical attack—I lost 30 relatives in the chemical attack*). Some tweets express heart-rending posts (*no child this deserves pain #Syrian children, a picture*

**Table 2**

Tweet expressions.

Tweet category	Tweet count	% age
Sharing news and information	4698	35.71
Raising questions	879	6.68
Evincing emotions	2993	22.75
Providing suggestions	2466	18.74
Criticizing government	975	7.41
Government support	279	2.12
Raising protests	815	6.19
Irrelevant	51	0.39

*of child Syria last breath after beating them with chemotherapy #anewmassacreinsyria*).

The suggestive tweets cover 2466 (18.74%) tweets, which mainly advocate countries to investigate the chemical attack and use science to uncover lies. 975 (7.41%) of the tweets pertain to the category that criticize government.

Tweets raising questions comprise 879 (6.68%) tweets. Questions are asked by individuals or news organizations and are diverse. These include asking reasons for chemical attack (e.g., *Are they terrorists? What is their fault?*), reasons for killing the children (e.g., *save our children; what are our leaders doing about these humanitarian crises?*), etc.

A small score (815; 6.19%) of tweets raise protests, followed by the ones that support the government (279; 2.12%). However, a meager tweet count (51; 0.39%) is *irrelevant*.

#### 3.2. Impact of tweets

Retweets and likes are some of the essential features of Twitter. Tweets marked as favorite indicates the user's liking for a particular tweet. Re-tweet denotes re-posting of someone else's tweet in order to share it with his/her followers. On a positive note, both features suggest a sort of reward or acknowledgment of the work (tweet). As such, retweets and likes are used to measure the impact of tweets.

People mostly retweet the tweets that “criticize the government,” with an average retweet count of 15.84, followed by the ones “evincing emotions” (12.21). However, tweets that “raise questions” (3.32) and “provide suggestions” (2.51) fail to gain the attention of too many tweeter users, thus having less impact. The tweets, along with the number of retweets indicating their popularity and impact, are demonstrated in Table 3.

Table 4 depicts how many times tweets are liked indicating people's favorites. People mostly like the tweets that “support government” and “evince emotions,” with such tweets on an average receiving 9.89 and 8.37 likes, respectively. Furthermore, the tweets “raising protest” and “criticizing government” on average are more liked than the tweets “sharing news and information,” “providing suggestions,” and “raising questions.”

#### 3.3. Most popular tweets

Of the 13,156 tweets, a large number of tweets are posted by individuals (10,137; 77.05%), followed by news channels (1157; 8.79%) and organizations of varied nature (950; 7.22%). However, 912 (6.93%) tweets are posted by users of anonymous nature.

Table 5 displays the top 10 tweets that were highly retweeted. The highly retweeted tweet is posted by an individual who criticizes the attack and claims it is a hoax. However, the list is dominated by prominent figures in politics, journalism, anti-terrorism, and human rights. It also includes the young girl from Syria, who sent messages through Twitter mentioning the city's siege and prominent organizations like DOAM and WHO.

**Table 3**

Tweet expressions and retweets.

Tweet category	Tweet count	Retweet count	Avg. Retweet count
Sharing news and information	4698	36,782	7.83
Raising questions	879	2918	3.32
Evincing emotions	2993	36,530	12.21
Providing suggestions	2466	6201	2.51
Criticizing government	975	15,446	15.84
Government support	279	2465	8.84
Raising protests	815	7000	8.59
Irrelevant	51	14	0.27



**Table 4**

Tweet expression and favorite tweets.

Tweet category	Tweet count	Likes count	Avg. Like count
Sharing news and information	4698	21,033	4.48
Raising questions	879	2278	2.59
Evinces emotions	2993	25,064	8.37
Providing suggestions	2466	7479	3.03
Criticizing government	975	4809	4.93
Government support	279	2758	9.89
Raising protests	815	5250	6.44
Irrelevant	51	23	0.45

### 3.4. Tweet format and impact

The tweeter sphere uses different formats of information to express their sentiments. Some use only text, while some prefer uploading images and videos along with the text. Text and text with images form most tweets contributing to 8061 (61.27%) and 3137 (23.84%) of the total tweet count. However, none of the tweets contain only video, and just 3 (0.02%) tweets embed only images (Table 6).

Text-video format is highly re-tweeted with an average retweet count of 22.68, followed by text-image and text-image- video with an average of 12.97 and 8.52 retweet count, respectively. Text-image format is highly liked with an average like count of 7.75, followed by text-video (7.55) and text-image-video (5.11) formats respectively. However, the average retweet and average like count for text-only format amount to 3.44 and 3.79. The image-only format witnesses the least average retweet count (0.33) and average like count (0.67), correspondingly.

### 3.5. Geographical distribution and positive, negative, and neutral sentiments of tweets

The geographical distribution of many tweets (3113; 23.66%) was not mentioned by the Twitter users, limiting the geographical mapping to 10,043 tweets. The tweets were poured in from 122 countries across the globe, with a significant contribution from the U.S.A. (3352; 33.38%), followed by U.K. (1188; 11.83%) and Turkey (530; 5.28%). The chemical-stricken land, Syria, contributes 453 (4.51%) tweets, thus, and is at par with Israel (459; 4.57%) and India (409; 4.07%). Canada, Iran, Pakistan and Germany are also among the top ten countries with the highest percentage of tweets.

The sentiment-level analysis further enriched the findings by classifying tweets into positive, negative, and neutral ones. Table 7 helps to visualize the public perceptions, opinions, and emotions (positive, negative, and neutral) through tweets across the top 10 tweeting countries. One can visualize the U.S.A. among the top tweeting countries with the highest percentage of positive sentiments, followed by Canada and Israel. Turkey outscores all the countries in terms of negative tweets, followed by Syria and U.K. However, in terms of neutral tweets, Germany ranks first, followed by Iran and Canada. It is evident that 53.70% of the tweets (n=7065) reflect negative sentiments, while 12.67% (n=1667) emulate positive sentiments and, 33.63 (n=4424) showcase a neutral perception about the attack. This signifies that the majority of Twitter users have a negative outlook toward the "Syria Chemical Attack."

### 3.6. Sentiment trends

On analyzing the various categories of tweets, the tweet activity has increased on the second day of the attack (5 April). Then a gradual fall is witnessed from 8 April to 30 April (Fig. 1). Almost for the first week of the attack, Twitter witnesses heavy traffic of tweets, most of which pertain to the "news updates" and "emotions." However, the tweet count declines as the days pass by, but "sharing news and information" tweets continue to pour in good numbers. Tweets that "raise questions" almost show a steady trend for the last few days of the attack. Unlike other tweet categories, the "irrelevant" tweets pour in a large number only on the first

**Table 5**

Top 10 popular tweets.

User name	Profile	Tweet	Retweets
The Lemniscat	Individual	#SyriaHoax Watch actor who's not willing to lie down in the mud object when his head scarf is removed #Idlib #Syria <a href="https://youtube.com/watch?v=4b7byi5ZhbQ">https://youtube.com/watch?v=4b7byi5ZhbQ</a>	10,200
Al Jazeera English	News Channel	This is the aftermath of a suspected chemical weapons attack in Syria's rebel-held province #Idlib where at least 72 people were killed.	6900
Mario Rubio	Individual (American politician)	"Be sure of this: The wicked will not go unpunished" Proverbs 11:21 #SyriaChemicalAttack	2800
Sophie McNeill	Individual (Australian journalist, and human rights activist)	I'm receiving horrific photos purportedly of a chemical attack in the #Idlib town of #KhanSheikhan we told children among dead #Syria	1900
Bana Alabed	Individual (Syrian girl from Aleppo, Syria)	More than 100 people were just killed in #Idlib. Get up, come out, demand justice for the people of Syria wherever you are. Justice. justice.	1800
Charles Lister	Individual (Director of the Syria and Countering Terrorism and Extremism Programs at the Middle East Institute)	GRAPHIC. My God - it's happened again. 60+ killed (possibly 100+) in a chemical gas attack on opposition-held Khan Sheikhoun in #Idlib.	1600
DOAM	Organization (Documenting Oppression Against Muslims: DOAM)	#Syria - Father says last goodbye to his two children killed in yesterday's Assad's chemical attack on Khan Sheikhoun, #Idlib. #Ummah	1200
World Health Organization (WHO)	Health Organization	"WHO is alarmed by serious reports of the use of highly toxic chemicals in an attack in #Idlib, #Syria <a href="https://goo.gl/wAQy4q">https://goo.gl/wAQy4q</a>	1100
Thomas van Linge	Individual (Activist for freedom, democracy and Human rights)	#Syria: horrible photos are coming out of Khan Shaykhun (#Idlib) where the regime has committed a major chemical attack on civilians	898
Max Fanni Canelles	Individual (Professor at Bologna University)	"#Children killed by gassing in #Syria: the testimony of Auxilia #Assad #Putin #Trump #syria #idlib <a href="http://soci alnews.it/editoriali/chil dren-killed-by-gassing-in-sy ria-the-testimony-of-auxilia/by">http://soci alnews.it/editoriali/chil dren-killed-by-gassing-in-sy ria-the-testimony-of-auxilia/by</a>	829

day of the attack and then start diminishing.

### 3.7. Word frequency of frequently appearing keywords in tweets

Table 8 shows the 50 most frequently occurring words people have used to share their thoughts regarding the attack. "idlib", "Syria", "Syria chemical attack," and "Assad" are the leading words used more than a thousand times in the tweets. However, the words "chemical attack", "child", "Russia", "attack", "trump", "person," and "world" have been

**Table 6**  
Tweet format and impact.

Tweet format <sup>a</sup>	Tweet count	Retweet count	Avg. Retweet count	Likes count	Avg. Like count
T	8061	27,709	3.44	30,554	3.79
I	3	1	0.33	2	0.67
TI	3137	40,682	12.97	24,298	7.75
TIV	379	3228	8.52	1938	5.11
TV	1576	35,736	22.68	11,902	7.55

<sup>a</sup> T = text; I = image; V = video.

used more than 500 times. The rest of the words have been used less than 500 times. A visual representation of words appearing in tweets is displayed in Fig. 2. The node size represents the number of occurrences of a term with links depicting a co-occurrence relationship (only 1000 links are shown). The keywords make up different clusters, indicated by the color of the nodes, with items in a cluster showing a close relationship between them.

#### 4. Discussion and conclusion

Twitter, one of the most popular microblogging services, allows users to create and share ideas and information instantly without barriers. It changes public opinion and produces social change; therefore, it assumes importance due to the privilege of changing the narrative and the way some audience views the crisis [42]. Twitter is increasingly being used for sentiment analysis, which provides a way to know public emotions about the events, products, brands, or other related phenomena.

In this study, the effort has been made to investigate the use of Twitter during and after the “Syria Chemical Attack” by examining the tweets related to the attack. The study reveals that the majority of the tweets belong to the category of “news and information,” followed by “emotional,” “suggestive,” and “other” categories. Moreover, tweets that display emotions surpass the number of interrogative ones, which is also reported by Gul and Shueb [32]. The highest number of tweets sharing news updates is attributed to the fact that individuals, news agencies, and other groups stay active in providing the news and information across the globe so that possible actions can be taken to remedy the situation. It may also be partially due to the urge of news outlets/media consumers to feed the “I want it now” desire as the crisis increases the demand for information. Moreover, journalists use Twitter for their traditional role of information dissemination [23]. Thus, Twitter plays an essential role in breaking news and acts as a social network and as a news source, thereby creating awareness about the situation [43]. Twitter is used to connect with masses during disasters but sometimes can also create confusion due to the posting of incorrect information

[42]. Therefore, caution needs to be taken because news agencies sometimes prefer speed over the accuracy of the information, more particularly during crises and disasters. At the same time, according to Hermida [44]; Twitter provides a platform for collaborative verification by supporting distributed over centralized expertise and collective over individual intelligence with a large number of observations rather than a single source of information. Nevertheless, Twitter has entered the current news and information distribution landscape, particularly during crises and disasters, and is used for situational awareness and saving lives. This attribute of Twitter can be used by the authorities to instantly establish their communication with the public during the crisis, ameliorating situational awareness and safety concerns. The study further unravels that Twitter is used as a tool to express deep emotions of sadness over the loss of innocent lives, sending out grief and comforting messages, and is beneficial for providing practical support to the people who suffer during the human-made crisis. Lee and Goh [12] also highlight the use of Twitter as a powerful platform for emotional, social, and informational support during human loss, thus affirming the findings of our study that Twitter acts as a free platform for news sharing, providing situational awareness and virtual social-support. In this context, Mendoza et al. [33] refer to Twitter as a utility during the crisis that perpetuates far-reaching effects.

The study also indicates the type of tweets that are highly diffused among Twitter users and create an impact employing likes and retweets. The higher the score of the “re-tweets” and “likes,” the greater is the impact [32]. Re-tweeting reflects which message gets agreement and wide distribution on Twitter [45]. The highest proportion of “retweets” and “likes” in the study belongs to the tweet categories that “criticize” and “support” government, thus showing the high impact or the influence over the rest of the categories. It is also observed that the tweets that criticize government get more interest in the public and spread virally than the tweets that support the government. So, Twitter acts as a tool to reflect the perceptions of the masses about the government in times of crisis episodes.

With the increased brevity of 140 characters to 280, Twitter allows users to post messages that may include photos, videos, and links [46]. However, the results reveal that majority of tweets during a crisis are mainly textual. The image and video formats are less used than textual tweets for the possible reason that textual tweets are easy to post in comparison to the images and videos, as affirmed by Gul et al. [37]. The textual tweets that embed images and videos are re-tweeted and liked more, thus having a high impact compared to tweets only in text format, partially due to interest created by visual content.

Moreover, Twitter brings diverse groups of people across geographical regions to show the emotional reactions towards an event. The tweets from 122 countries with large pour in from the U.S.A., U.K., and Turkey show the virtual support system that Twitter builds up

**Table 7**  
Geographical distribution and positive, negative, and neutral sentiments of tweets.<sup>a</sup>

Rank	Country	Tweet count	%age	Sentiments					
				Positive	%age	Negative	%age	Neutral	%age
1	USA	3352	33.38	583	17.39	1561	46.57	1208	36.04
2	UK	1188	11.83	122	10.27	694	58.42	372	31.31
3	Turkey	530	5.28	37	6.98	342	64.53	151	28.49
4	Israel	459	4.57	69	15.03	241	52.51	149	32.46
5	Syria	453	4.51	27	5.96	279	61.59	147	32.45
6	India	409	4.07	59	14.43	211	51.59	139	33.99
7	Canada	373	3.71	57	15.28	168	45.04	148	39.68
8	Iran	301	3.00	24	7.97	157	52.16	120	39.87
9	Pakistan	239	2.38	24	10.04	124	51.88	91	38.08
10	Germany	190	1.89	19	10.00	92	48.42	79	41.58
	Other countries	2549	25.38	286	11.22	1485	58.26	778	30.52
	Anonymous	3113	23.66	360	11.56	1711	54.96	1042	33.47
	Total	13,156		1667	12.67	7065	53.70	4424	33.63

<sup>a</sup> The percentage for the tweets with known geographical location is calculated on 10043 tweets, while as for tweets with geographical anonymity, the percentage is calculated on 13156 tweets. Percentage for total tweet counts across different sentiment categories is also calculated on 13156 tweets.

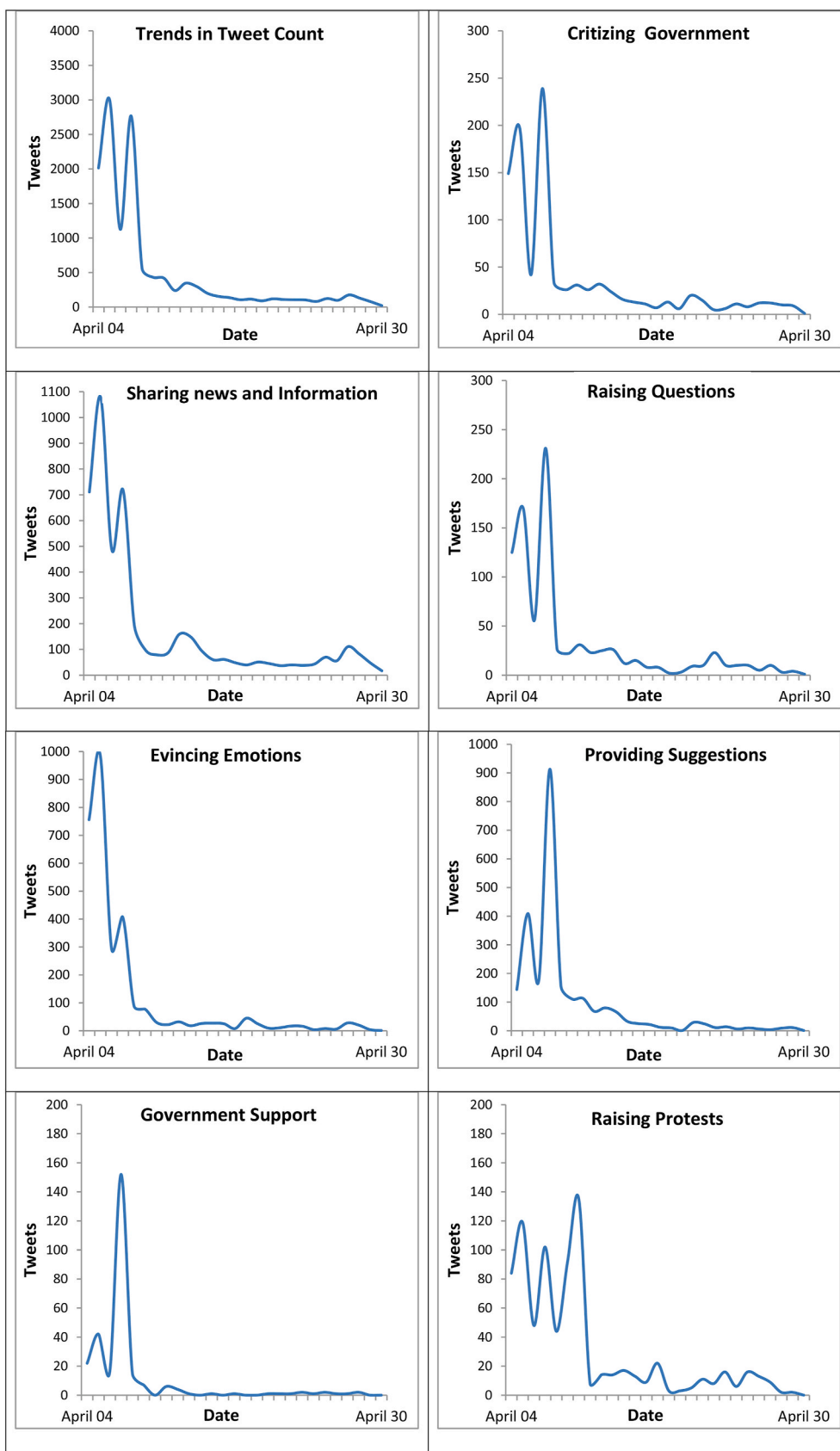


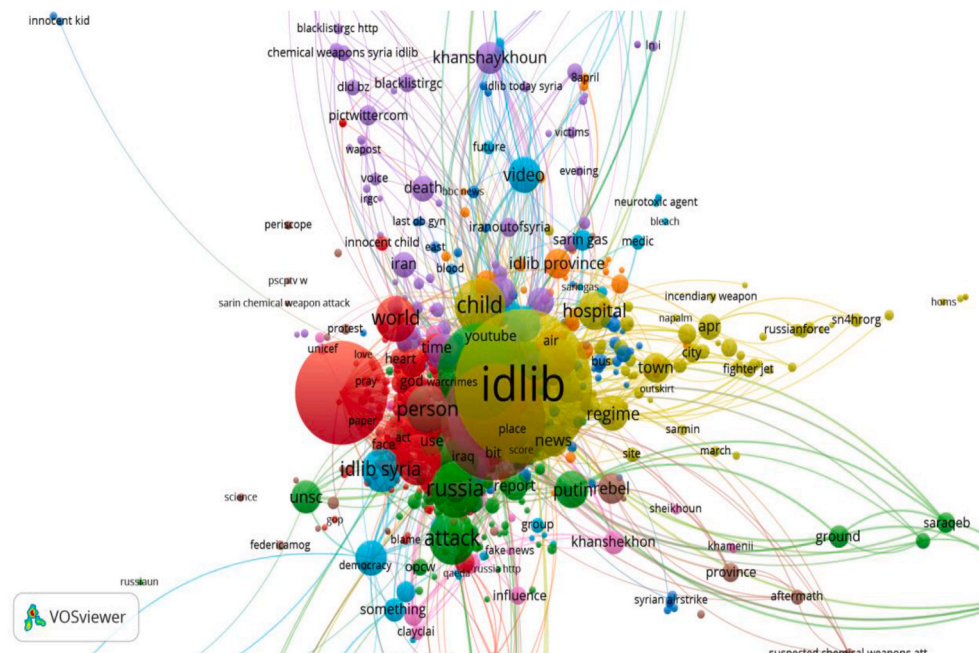
Fig. 1. Tweet trends along with sentiment representation.

**Table 8**

Top 50 frequently appearing keywords in tweets.

Rank	Term	Occurrences	Relevance Score <sup>a</sup>	Rank	Term	Occurrences	Relevance Score <sup>a</sup>
1	Idlib	5690	0.0342	26	Khansheikhoun	267	0.0951
2	Syria	3274	0.0428	27	Unsc	267	0.4378
3	Syriachemicalattack	2596	0.2341	28	Khanshaykhoun	261	0.8142
4	Assad	1656	0.1088	29	News	251	0.3359
5	Chemical Attack	799	0.0624	30	Idlib Attack	249	0.8093
6	Child	793	0.1211	31	Idlib Http	247	0.8078
7	Russia	771	0.24	32	Rebel	243	0.375
8	Attack	659	0.1336	33	Gas Attack	230	0.1631
9	Trump	653	0.2151	34	Sarin	230	0.1557
10	Person	574	0.1545	35	Fbme	228	0.1303
11	World	516	0.1974	36	Idlib Province	225	0.8193
12	Idlib Syria	463	0.3872	37	Potus	225	0.3954
13	Chemical Weapon	460	0.1112	38	Syria Syriachemicalattack	219	0.4292
14	Civilian	433	0.1774	39	Town	215	0.6083
15	Hospital	368	0.2485	40	Turkey	214	0.4297
16	Putin	351	0.5409	41	Time	213	0.1884
17	Video	317	0.7937	42	Idlibgasattack	201	0.2902
18	Chemicalattack	316	0.3012	43	Humanity	200	0.2871
19	Victim	316	0.1747	44	Report	199	0.1363
20	Khanshaykhun	310	0.7402	45	Airstrike	190	0.278
21	Regime	310	0.9488	46	Use	186	0.1899
22	Today	301	0.0963	47	Action	173	0.2244
23	Realdonaldtrump	298	0.4262	48	Status	173	0.1074
24	War	289	0.2172	49	Response	170	0.206
25	Syriagasattack Syriachemicalattack	285	0.2402	50	idlib chemical attack	166	0.6537

<sup>a</sup> “Terms with a high relevance score tend to represent specific topics covered by the text data, while terms with a low relevance score tend to be of a general nature and tend not to be representative of any specific topic” [41].

**Fig. 2.** Visualization network of keywords.

beyond the geographical boundaries of a disaster-stricken country. The study also showcases which regions reflect positive, negative, and neutral sentiments towards the event. It is observed that the people mostly show negative sentiments, thus showing a propensity towards an event that was a devastating one. Leveraging the tweet sentiments can help the governments handle and look towards an event like “*Syria Chemical Attack*” in a more managed way. Sentiments of the tweets can aid in developing more strategic disaster management methods, especially the ones that are man-made.

The study also confirms that the tweet trend regarding the event declines with time, which indicates that even the important and

impactful events lose their significance with the passing time. This observation indicates that even the intensity of micro-coordination via social media platforms like Twitter also shows a decline in coordinating and synchronizing crisis communication. However, in the initial phase of the event, an active status of the users is witnessed, which visualizes concern of people for other people, as is evident from the posts pertinent to the devastating and heart-wrenching event.

“*idlib*”, “*Syria*”, “*Syria chemical attack*,” and “*Assad*” are the widespread words in the tweets. Some other words which include “*chemical attack*”, “*child*”, “*Russia*”, “*attack*”, “*trump*”, “*person*”, “*world*” etc. have been used to indicate the various expressions by Twitter users.



Thus, it is evident that Twitter provides a public platform to share information, express views and emotions, show public support or criticism towards individual/government, or event, and can be used to call for help in real-time. The study indicates that Twitter as a powerful and influential instrument can be used for news updates and analyze the public concern and response during natural disasters and human-made catastrophes so that appropriate intervention strategies and efforts would be taken to confront such situations and minimize the collateral damage.

#### 4.1. Limitations and future research

The study is one of its types to show how the Twitter-sphere reacts during human-made disasters. It would be interesting to perform sentiment analysis on a large scale by including other social networking sites that might produce different results. As the study covers only tweets in the English language, it cannot reflect the differences and sentiments of the non-English tweeter sphere. Moreover, the study uses a limited set of existing categories, although modified, the exploration of additional categories can also be considered along with the framing of theoretical models. Future studies may look into how Twitter changes news coverage and reporting, including sharing of photographic/video evidence during disasters and examine the genuineness and authenticity of news shared on it; so that decision-makers such as police and disaster response teams can keep the people peaceful, united, and safe. Furthermore, the role of key communicators on social media during the crisis also needs to be highlighted, given the importance of law enforcement agencies.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Saimah Bashir is a Faculty in the Department of Political Science, University of Kashmir, India. e-mail: [shahsaimah@gmail.com](mailto:shahsaimah@gmail.com)

Shohar Bano is pursuing her Ph.D. from the Department of Library and Information Science, University of Kashmir, India. e-mail: [Banozaidi7@gmail.com](mailto:Banozaidi7@gmail.com)

Sheikh Shueb works as an Assistant Librarian at Islamic University of Science and Technology, Awantipora, Jammu & Kashmir, India, and is also pursuing his Ph.D. in the Department of Library and Information Science, University of Kashmir, India. His field of specialization is *Funded Research and Citation Behaviour, with special reference to Altmetrics*. He has several national and international articles to his credit. Besides, he has also participated in many international and national conferences. e-mail: [shkhshb@gmail.com](mailto:shkhshb@gmail.com)

Dr. Sumeer Gul works as an Associate Professor in the Department of Library and Information Science, University of Kashmir, India. He is associated as an author with reputed journals like *Scientometrics*, *Online Information Review*, *Aslib Journal of Information Management (earlier Aslib Proceedings)*, *Journal of Librarianship and Information Science*, *The Electronic Library*, *Data Technologies and Applications (earlier Program)*, *European Journal of Integrative Medicine*, *VINE*, *Global Knowledge*, *Memory and Communication (earlier Library Review)*, *Serials Librarian*, etc. Dr. Sumeer Gul is the corresponding author and can be contacted at: [sumeersuheel@gmail.com](mailto:sumeersuheel@gmail.com)

Aasif Ahmad Mir is a research scholar in the Department of Library and Information Science, Pondicherry University, Kalapet, Puducherry, India. His research interests include *Open Access*, *Bibliometrics*, *Data Mining*, and *Machine Learning*. He has published two research articles in Scopus indexed journal and has presented papers/posters in national/international conferences. e-mail: [miraasif7298@gmail.com](mailto:miraasif7298@gmail.com)

Romisa Ashraf is a Master's in Library and Information Science from the University of Kashmir, India. e-mail: [rumais.ashraf07@gmail.com](mailto:rumais.ashraf07@gmail.com)

Shakeela is a Master's in Library and Information Science from the University of Kashmir, India. e-mail: [shakeelamlis@gmail.com](mailto:shakeelamlis@gmail.com)

Neelofar Noor is a Master's in Library and Information Science from the University of Kashmir, India. e-mail: [noorneelofar6@gmail.com](mailto:noorneelofar6@gmail.com).