

Social Network Analysis of Twitter Data from Pakistan During COVID-19

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Abstract

Purpose

The use of social media has increased during the COVID-19 pandemic. Social media platforms provide opportunities to share news, ideas, and personal stories. Twitter is used by citizens in Pakistan to respond and comment on emerging news stories and events . However, it is not known whether Twitter played a positive or negative role in spreading updates and preventive messages during COVID-19. The aim of this study was to analyse content from Twitter during the pandemic.

Methodology

NodeXL was utilised to retrieve data using the keyword *وائرس کورونا* (written in Urdu and which translates to Coronavirus). The first dataset (Case Study 1) was based on 10,284 Twitter users from the end of March. The second dataset (Case Study 2) was based on 10,644 Twitter users from the start of April. The theoretical lens of effective message framing was utilised to classify the most retweeted content on Twitter.

Findings

Twitter was utilised for personal and professional projections and included certain tweets included political motives even during the unfolding health crisis. There appeared to be very few successful attempts to utilise Twitter as a tool for health awareness and risk communication. The empirical findings indicate that the most retweeted messages were gain framed and can be classified as personal, informative, and political in nature.

Originality

The present study provides insights likely to be of interest to researchers, health organizations, citizens, government, and politicians that are interested in making more effective use of social media for the purposes of health promotion. We also provide novel insights into the key topics of discussions, websites, and hashtags used by Pakistani Twitter users during the COVID-19 Pandemic.

Introduction

Social networking sites (SNS) are a source of information and awareness in the domain of public health. Clinicians and public health institutions may run awareness campaigns through SNS to disseminate public health messages. A recent major public health concern is the COVID-19 pandemic which has rapidly spread across the world.

A major public health challenge has been to stop the spread of COVID-19. Since the beginning of the pandemic, the World Health Organisation (WHO) has declared COVID-19 to be a worldwide threat. A number of information channels such as broadcast and print media played a positive role by including information on prevention messages, updates, and guidelines. Gao et al., (2020) reported that a number of global cross sectional surveys investigated the exposure of citizens to social media platforms and found large increases in users accessing various platforms. However, increased use of social media also led to the transmission of misinformation (Ahmed et al., 2020). The forced isolation policies and lockdown led to an increase in people's online interactions. Specifically, in Pakistan, social media usage increased during the pandemic and a total of 78 million broadband subscribers were using social media, Web-conferencing services and other interactive applications to work from home and for social connectivity (Murtaza, 2020).

Recent work (Mittal et al., 2021) has examined content shared on social media platforms in English predominantly covering the United States of America (USA) and the United Kingdom (UK). There is a lack of research in developing Asian countries in regard to analysing social media content and particularly social media content from Pakistan. Health authorities confirmed the first case of COVID-19 in Pakistan in the city of Karachi on February 26, 2020. Almost within a month, the number of confirmed cases reached to 2289 on April 1, 2020. The

official statistics confirmed that the most affected patients were male and aged between 60-69 years. At the time of writing, the total number of citizens infected stood at 139,229 with 2,632 confirmed deaths causing not only health but also a social and economic crisis (Government of Pakistan, 2020).

Previous studies have found effective use of Twitter in Pakistan during political campaigns such as for charity purposes and other natural crisis events (Kagan et al., 2015; Murthy & Longwell, 2013; Khan, Zaher & Gao, 2018). However, there is a lack of empirical research on how Pakistani citizens and organisations were utilising Twitter during the COVID-19 Pandemic. Keeping in mind the alarming situation, the present study aims to analyze the health awareness campaigns and control strategies of Pakistani Twitter users. Tweets were collected in two phases in the months of March and April 2020. More specifically, the present study aims to address the following research questions:

- What was the network shape of the discussions taking place related to COVID-19 in Pakistan?
- What were the network metrics of the data such as influential users, popular web sources, and commonly used words?
- What key themes emerged during the discussion and how can message framing theory be used to interpret popular (most retweeted) tweets?

The present study aims to investigate Twitter health messages framing and effects. Our findings are likely to be of interest to governments and public health authorities in Pakistan as well as around the world. Our work will add to the existing body of literature around the use of social media for public health and serve as a contribution to the message framing theory. Furthermore, the potential audience of tweets being sent and read in Pakistan during the pandemic has a potential reach in the millions. Our two datasets contain conversations from over 20 thousand Twitter users whom all have their own followers. The Twitter account of Imran Khan (the

current prime minister of Pakistan), who is one user within our data, has over 14.5 million followers alone. Moreover, tweets are also indexed across the Web and included in media reports giving them widespread visibility. From a public health perspective, it is vital to gain an understanding of the types of information being shared and content being consumed.

Literature Review

Theoretical Lens

Theoretically, the present study will apply the effective message framing approach to analyze Twitter data. In digital marketing, message framing is a technique to shape and form opinions which posits that a consumer's response always depends on how the message is composed and encoded (Cheng, Woon & Lynes, 2011). Message framing may affect an individual's behaviour decision making.

The connection between message framing and behavioural actions is rooted in prospect theory (de Bruijn, 2019). According to prospect theory, an individual's decision making preferences may alter the way information arrives to them (Hennig-Thurau et al., 2015). For example, a gain framed message (eat healthy food to retain quality life) may make people avoid risk. On the other hand, a loss framed message (if you do not eat healthy food, you will lose quality of life) may make people take risks considering the potential loss (Updegraff & Rothman, 2013).

Prospect theory was originally proposed to explain the choices among lotteries involving monetary outcomes (Tversky & Kahneman, 1979). The theory proposed that people don't take risks when they confronted with the advantages of decisions, however, they do take risks when confronted with the price of a decision (Adonis, Basu, and Luiz, 2015).

Health behaviours are much affected by the framing of information messages (gain/loss frame). Several researches (Rothman et al., 1993; Rivers et al., 2005; Sherman et al., 2006; Gallagher et al., 2012) have investigated the impact of framing health messages on behaviours. The message theory was first put forth by Erving Goffman in 1974. He wrote an essay on the organization of experience under the title of Frame Analysis. He put forth that people interpret what is going on around their world through their primary framework. The theory suggests that message effectiveness is influenced by the type of behaviour promoted and the framing of the health message (Rothman et al., 2006). Gain frame messages emphasize the benefits of behaviour change ('quitting smoking lowers your risk of lung cancer'), and loss-frame messages emphasize the costs of failure to act ('by not quitting smoking, you increase your risk of lung cancer') (Latimer et al., 2008). Positively framed messages describe the positive consequences of having examination or adopting prevention behaviour. Contrary to this, negative framing emphasizes on loss or failures of not having those preventions or examinations (Rothman et al., 1993). The scope of the present study is to identify the positive and negative framing of Twitter messages and their popularity (network shape, retweet count) during recent outbreak of COVID-19.

Negatively and positively framed information influences the choices, attitudes and behaviours of citizens significantly. It has been argued that negatively framed messages are more effective in persuading people than positively framed messages. However, research has also established that message framing does not always produce consistent results, the personality and behaviour of the decision maker is also significant in this regard (Rothman et al., 1993). The framing angle of Prospect theory determines that people respond differently to loss or gain framed messages such as when exposed to gains they avoid risk (they are risk-averse), on the other hand they may prefer risk when considering losses. In addition, this perspective involves two

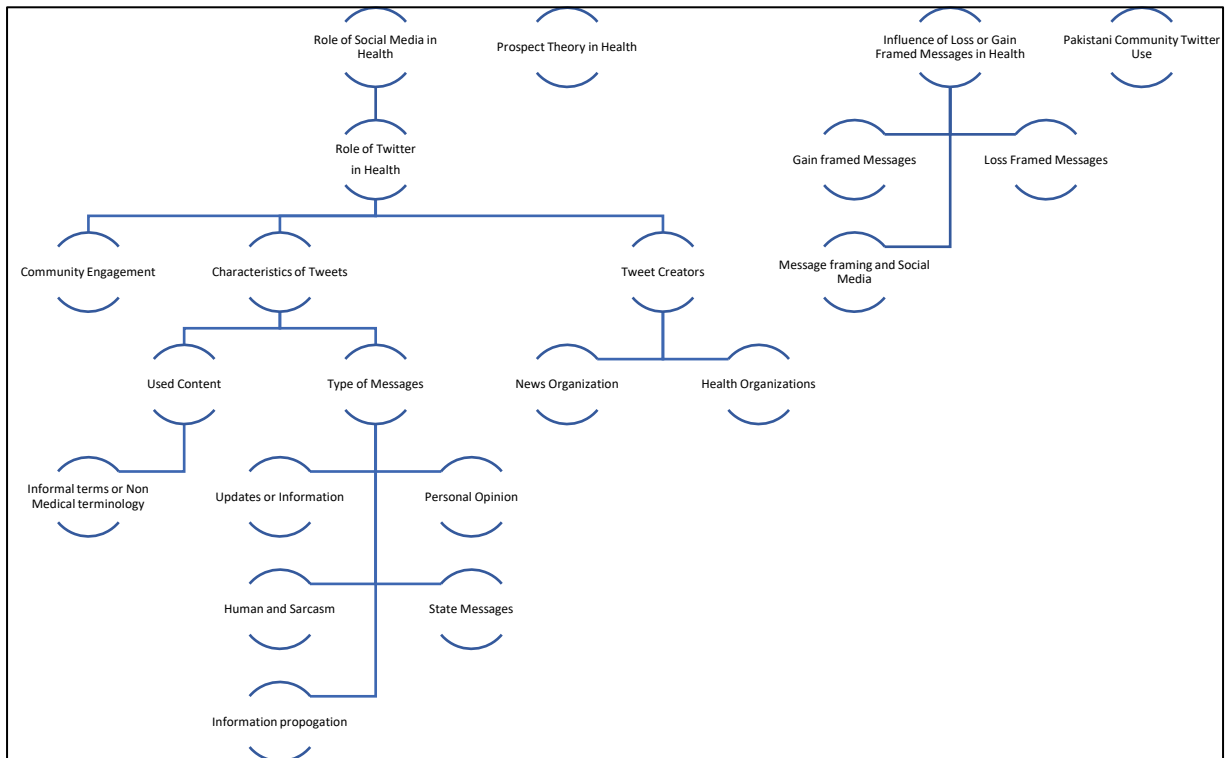
phenomena, framing and reflection effects. A negative frame may state the negative consequences of an option and a negative reflection may describe the outcome of losing someone's belonging (Rothman et al., 1993). The present study will look into the framing effects of Twitter health messages.

A number of studies have measured the impact of health message framing through empirical research (Detweiler et al., 1999; Gallagher et al., 2012; Rivers et al., 2005). Studies related to message framing have examined human behaviours, our study aims to identify Twitter messages frames (positive, negative) during COVID-19 pandemic and behaviour will be measured through the shape of networks and retweet counts. The prospect theory of message framing has not been widely explored in terms of social media health campaigns and global health crisis events. This study will draw upon this theoretical lens when analysing tweets related to the COVID-19 pandemic.

Role of Social Media and Twitter Health Research

A wide range of studies have been published on the role of social media in the health domain. The focus of the present study was on the influential role of Twitter in health information behaviour. The literature map in Figure 1 illustrates that four major aspects (the role of social media in health, prospect theory in health, message framing in health and how Pakistani citizens use Twitter) were synthesised during the literature review procedure.

Figure 1. Reviewed literature map & scope of the study



A number of studies have highlighted the role of Twitter in health promotion and prevention. Among these studies, some have also identified and analysed tweet creators. McLaughlin, et al. (2016) collected a total of 1,435 tweets and analyzed the content of 774 English tweets to investigate the propagation of various issues about daily oral pre-exposure prophylaxis (PrEP). The researchers also examined the social representations of PrEP and the features of the sources of those tweets through this study. They found that influential tweet creators belonged to news media, NGOs, academic institutions, and commercial companies.

Similarly, another study revealed that stories of news organizations had a higher impact on spreading health-related information in comparison to tweets of health organizations. (Radzikowski, et al., 2016). In addition, Chew & Eysenbach (2010) found that resource-related messages were most frequently shared in tweets and the most popular sources were news websites. They established this after analysing the content of more than two million Twitter messages containing the terms like swineflu, swine flu, and/or H1N1. However, they noted that

the messages related to government agencies and health organization were least popular in tweets.

A growing body of literature has also investigated the characteristics of shared health related tweets by diverse communities. Such as Gough, et al. (2017) whom conducted a quasi-experimental feasibility study in Northern Ireland using social media (Twitter) to spread different message frames with regard to care in the sun and cancer prevention. The researchers analyzed 417,678 tweets and categorized the messages into five categories, i.e., humour, shock, informative, personal stories, and opportunistic messages. This study concluded that shocking and humorous messages generated the greatest impressions and engagement, but information-based messages were likely to be shared most.

Similarly, Ahmed et al., (2019) found in their study that the most frequently shared tweets were based on Ebola news, updates, or information, and on personal opinion and interests related to Ebola. They discovered this after an evidence-based research, which investigated the information shared through Twitter on 30 Sep. 2014, when the first patient was diagnosed the Ebola virus infected outside of West Africa. It was also revealed that some users were expressing humour and sarcasm towards the Ebola outbreak, however, on investigation, those tweets were found to be spam based. Likewise, McLaughlin, et al. (2016) investigated how information propagation was affected by Twitter messages with relevance to PrEP. The study revealed that PrEP-related information on Twitter implied many issues, and individual users created a number of accounts to propagate messages. In addition, health related tweets created a number of community engagements and networks (Radzikowski, et al., 2016).

Influence of Loss or Gain Framed Messages in Health

A considerable amount of published literature has measured the impact of gain or loss framed messages on health information behaviours. Researchers have suggested to frame persuasive health messages to respond people positively (Detweiler et al., 1999). Rothman, et al. (2006) reviewed the state of research in this area and the theory on message framing and how it could inform efforts to enhance health practices throughout the cancer care continuum. The researchers found that gain framed appeals were more influential when aiming at behaviours which prevented the onset of disease. On the other hand, loss framed appeals were more effective when aiming at behaviours which detected the presence of an illness. Here, prospect theory highlighted how health messages should be framed around potential gains (advantages) or potential losses (disadvantages) (Detweiler et al., 1999).

Both type of framed messages were found to be equally persuasive for the respondents. However, interestingly, gain framed messages were more motivating in the adoption of preventive behaviour. Furthermore, negatively framed information persuaded risk taking behaviour. Rivers, et al. (2005) conducted a study on 441 females who watched either a loss or gain framed video highlighting the prevention or detection roles of the Pap test. The result of the study found that loss framed messages emphasized the costs of not identifying cervical cancer early, which was a risky behaviour, and gain framed messages emphasized the benefits of preventing cervical cancer, which was less risky behaviour, and this was most persuasive in motivating females to obtain a Pap test.

There is a consensus among researchers (Park, Kim, & Kim, 2020; Nan & Madden 2014; Updegraff, Brick, Emanuel, Mintzer, & Sherman; 2015; Sherman, Mann, & Updegraff ,2006) that message framing has a significant impact on the health behaviour of individuals. In

contrast, an experimental study in the context of sunscreen use identified no significant difference between the behaviours of individuals due to gain or loss framed messages (Detweiler et al., 1999). Similarly, Nan & Madden's (2014) cross cultural study examined the influence of worldviews and message framing on public opinions toward the human papillomavirus (HPV) vaccination mandate. Researchers' found people with different worldviews reacted differently to loss and gain framed messages. Such as people with a hierarchical worldview, a loss framed (vs. gain framed) message resulted in greater support for the mandate and more positive thoughts, whereas the reverse was found for those with an egalitarian worldview.

Social Media and Health Sector in Pakistan

A number of studies have reported that YouTube and Facebook are popular social media mediums among Pakistani students (Naqvi, Jiang & Miao, 2020; Ahmad, Alvi & Ittefaq, 2019). Javed and Bhatti (2014) suggested that social media is a timely and efficient tool to discuss health and patient care issues. Unlike other disciplines, medical students use social media for academic purposes including interactive and collaborative learning (Khan, 2020). Efforts have been made to digitize the health sector in Pakistan, a case study of a Facebook group analysed and reported that the group had played a significant role in solving women and children's health issues (Ittefaq & Iqbal, 2018). In spite of these efforts, social media misinformation crisis further complicates the health situation in the country. A study (Ittefaq, Hussain & Fatima, 2020) highlighted that during COVID-19, Pakistani politicians, religious leaders, and the general public became health experts on social media. Their advice and suggestions created health chaos among the general public. The researchers suggested to improve the health literacy of the general public through awareness programs and training (Ittefaq, Hussain & Fatima, 2020).

Literature Gap

The above reviewed literature validates the role of social media in changing health behaviours. Moreover, the prospect theory of message framing has a significant impact on behaviours. However, cultural, and contextual factors may be the key factors in this regard. A number of international studies measured framing of information in the light of such theories. However, there is a literature gap in the local Pakistani context as well as very few international studies that have examined this perspective in relation to social media platforms. Therefore, the present study aims to utilise the message framing theory when analysing Twitter data.

Methods

Research Design

This project utilized NodeXL Ahmed and Lugovic (2019) to retrieve Twitter data using the keyword وائرس كورونا (the Urdu word for coronavirus – which was used because our research revealed that this was the most popular term used on Twitter by users from Pakistan) and this included users who replied to or mentioned other users. English tweets were not included because these tweets are more likely to have been sent by users outside of Pakistan. NodeXL has recently been used to analyze COVID-19 misinformation on Twitter (Ahmed et al., 2020). The study was pragmatic and applied quantitative analysis of Twitter data as well as qualitative interpretation of tweets. More information on data retrieval will be provided in the Data Retrieval and Analysis section.

Data Collection

This study collected two datasets. The first dataset (Case Study 1) was based on 10,284 Twitter users from 20-hour, 1-minute period from Sunday, 29 March 2020 at 14:21 UTC to Monday, 30 March 2020. The second dataset (Case Study 2) was based on 10,644 Twitter users from

the 1-day, 13-hour, 36-minute period from Friday, 03 April 2020 at 22:58 UTC to Sunday, 05 April 2020 at 12:34 UTC. Retrieving and analysing two datasets rather than examining a single dataset will prevent time-specific events over-representing the results of our content and social network analysis. It may also help uncover potential commonalities across time and help improve the reliability of results.

Data Retrieval and Analysis

NodeXL was utilized to retrieve data which is widely used in social media research. NodeXL draws upon the Twitter Application Programming Interface (API) which provides access to a subsample of tweets. NodeXL was selected because it has access to a number of algorithms and features suitable for our research such as the ability to group by cluster and its Natural Language Processing (NLP) text-analysis functionality. For each dataset a social network graph was created. The graph's vertices were grouped by cluster using the Clauset-Newman-Moore cluster algorithm. The graph was laid out using the Harel-Koren Fast Multiscale layout algorithm. NodeXL was then utilized to identify Twitter users who were influential by the betweenness centrality algorithm (users can appear influential within the network if they tweet and/or if they were tweeted at). Users that are influential by betweenness centrality are likely to have significant social capital within a network and are important users for information propagation. Our study also identified influential websites, co-occurring keywords, and hashtags.

Findings

Case Study 1 – Twitter Data from Monday, March 30th, 2020

Figure 2 has clustered Twitter users into a number of different groups. Previous seminal research (Smith, Rainie, Shneiderman, & Himelboim, 2014) has identified 6-types of network

and producer who is very active and participates in awareness campaigns to fight against COVID-19.

The second group mostly talked about a tweet related to the role of government in the spread of COVID-19 in the country. The retweeted link was of an online newspaper which stated, *“high court considered government guilty in the spread of this virus as people from border and airports easily crossed border without screening”*. This group of users mostly mentioned a parliamentarian and politician @babaksardar, who has a good number of followers (26.2 thousand).

Among the members of third group, a video of a senator and politician who tested COVID-19 positive became viral. He tweeted that although he has no symptoms of COVID-19 and felt well, he had been self-isolating at home and urged others to stay at home. Within this group the most popular mentioned account belonged to a political party chairman.

Another political tweet was retweeted within the community of group four. The political personality and deputy secretary to Chief Minister Punjab (one of Pakistan’s provinces) highlighted the efforts of the Chief Minister with regard to the state-of-the-art medical arrangements in the Province. Additionally, he purposely mentioned the account of Chief Minister @usmanakbuzdar to please him by marketing his efforts.

The fifth network of Twitter community retweeted the news shared by a common citizen about the announcement of award “Nisha-e-Kashmir” by the Prime Minister of Azad Kashmir for a doctor who caused to death while treating COVID-19 patients. This tweet seems to be popular as it showed solidarity with the front liners (medical staff). The most mentioned user account

(@Senator_Baloch) was of a politician and member of the provincial assembly who had a good number of followers.

The overall findings show that only one tweet is informative in nature and the user sending the tweet was a television actor. Other influential Twitter users were political accounts which means that they were either tweeted by politicians or the most mentioned users were politicians.

Table I *Most Retweeted and Mentioned Users in the Top 5 Groups for Case Study 1*

NodeXL Group	Most retweeted tweet (n)	Most Mentioned User (n)
1	Although this has not been proven, we cannot completely rule out the possibility that the coronavirus may not have formed in a laboratory, but may be a biological weapon. Dr. Atta-ur-Rehman #DrAtta #Coronavirus https://t.co/pXenDhTZTZ (293)	iamhumayunsaeed (261)
2	The government was very negligent on the issue of coronavirus: Lahore High Court The full bench remarked that the government has no data on how many people passed without screening. The government was very negligent about the coronavirus. Let the COVID-positive come into the society. https://t.co/HgcqfgJ3VV (547)	babaksardar (13)
3	The other day I had a test for coronavirus which was reported to be positive. So far, I have not been able to feel any of the symptoms of this virus and I am feeling very healthy and my responsibilities at home in isolation. Citizens also stay at home! https://t.co/2vzS7qt0SY (4886)	bbhuttozardari (97)
4	On the special instructions of the Chief Minister of Punjab, Sardar @UsmanAKBuzdar, a 19,000-bed ICU has been set up to deal with the coronavirus challenge. The whole world is appreciating the Punjab Government's readiness and response against disease But I pray to Allah that this sore disease will end, Ameen https://t.co/L0VBJL4vH (1576)	usmanakbuzdar (20)

5	<p>The Prime Minister of Azad Kashmir, Raja Farooq Haider, has announced the state's highest official award, the 'Kashmir Mark', for Dr Osama Riaz of Gilgit-Baltistan, who died of corona while treating patients with coronavirus. #SaluteToFrontLineSoldiers https://t.co/39Q1xBWz1F (11)</p>	senator_bal (1)
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It was evident from the data (Table II) that the most shared tweets of news sources or websites belonged to different Pakistani news channels, such as Geo TV and these were mostly from the Urdu version of the British Broadcasting Corporation (BBC) News. In regard to the most popular Web-source, Table I highlights that the Pakistani Twitter community's most shared article was titled '*Canadian PM's wife recovered from coronavirus*' (n=180) on the Urdu Geo TV news website.

The second most shared Web-source related to COVID-19 cases and death updates in Pakistan titled '*Corona cases increased in Pakistan: Total 18 deaths*' (n=23). Other links were varied and were related to the issues caused by the lockdown or working from home (online education) and other Web-sources were based on monitoring the COVID-19 situation in other countries. It was also found that Pakistanis were interested in COVID-19 updates (tests, drug, etc.) and the prevention measures and transmission routes of COVID-19 (sneezing, coughing and social distancing).

Table II *Top URLs shared Case Study 1*

Top URLs	Description	Content	Occurrence
https://urdu.geo.tv/latest/217350-	Urdu Geo TV news website	Canadian PM's wife recovered from coronavirus	180
https://bit.ly/2WU5Uru	Urdu Ary TV news website	Corona cases increased in Pakistan: Total 18 deaths	23
https://trib.al/MYIZyra	BBC News Urdu website	Coronavirus: online education continue, students face issues	19
https://trib.al/qapYZpd	BBC news Urdu website	Is coronavirus spread among Syrian refugee camps?	19
https://trib.al/tdhyqfo	BBC news Urdu website	Coronavirus: can a small number of tests be harmful for Pakistan?	17
https://nakarkhana.com/3110/	Commercial news website	Traumatized by the coronavirus, the German finance minister committed suicide	17
https://walizone.blogspot.com/	Individual blog website about health tips	Coronavirus can travel to 27 ft. from sneezing or coughing	17
https://trib.al/gIOs2mu	BBC news Urdu website	Coronavirus: what is happening in the world	15
https://www.dawnnews.tv/news/1124224/	Dawn news website	Is this experimental drug effective for treating COVID-19?	14
https://trib.al/HsCzYOa	BBC news Urdu website	Coronavirus: what is happening in the world	13

One of the objectives of the study was to identify the top hashtags and top words. As can be seen from the Table 3, the top hashtag used was *#جو محدود وہ محفوظ* (English translation: ‘*the one who is limited is safe*’) (n=1,223), the other popular hashtags include “#salutetofrontlinesoldiers” (n=566) (this hashtag was used by the nation to pay tribute to all front liners who are fighting against the pandemic including doctors, paramedical staff, police officers). Other hashtags were related directly to COVID-19 such as “#covid-19”, “#coronavirus”, “#coronainpakistan”, “#coronaupdate” and “#covid19”.

Table III *Top Hashtags and Occurrences*

Top Hashtags	Occurrences
جو محدود وہ محفوظ	1,223
salutetofrontlinesoldiers	566
covid_19	457
Coronavirus	227
coronainpakistan	184
tributetodoctorsandforces	177
Coronaupdate	155
covid19	133
coronavirusupdates	122
Arynewsurdu	112

The top words used on Twitter from Pakistan were ‘corona’ and ‘coronavirus’ such as “from corona, of virus, from virus” and the other word-phrases included “walk through gates” and “sanitizers”. It was apparent from the data that during of the transmission of COVID-19 in Pakistan, the Twitter communication was focused on COVID-19 news, updates, reasons, the situation in the world related to virus and acknowledging the efforts of those who are on the front line and during the pandemic.

Table IV *Top Words Used and Occurrences*

Top words	Occurrences
کورونا, وائرس	18,826
وائرس, سے	5,109
وائرس, کی	4,293
وائرس, کے	3,776
میں, کورونا	3,473

The next section provides the results from our second case study in which data was retrieved on the 5th of April 2020.

Case Study 2 – Twitter Data From Sunday, 5th April 2020

Figure 3 presents results from our second case study which analyzed data from Sunday the 5th of April. In this network visualization we can also see that the graph mostly represents a community cluster. There are many small and medium clusters of Twitter users who have little overlap. The similar network shape and structure was observed for the data from the 30th of March This suggests that the discussion around COVID-19 tended to be based on a smaller number of communities, discussing different topics, throughout the pandemic.

Figure 3. Twitter data from Sunday, 05 April 2020

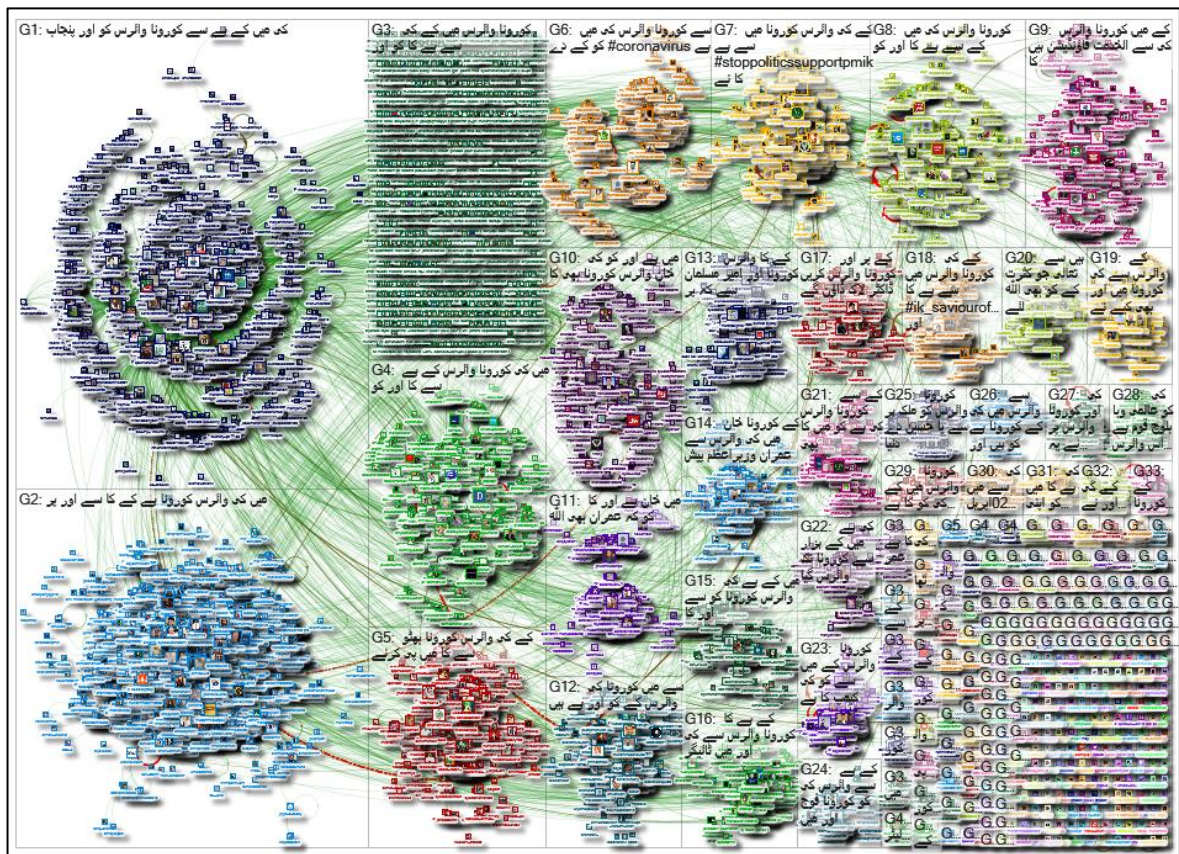


Table V reveals that the most retweeted content and mentioned users related to Case Study 2. The first and the fourth group retweeted a tweet from the Chief Minister, Punjab Province which provided an update of COVID-19 confirmed cases and the facilities and treatment provided to citizens affected. The most mentioned users here are the accounts of Prime Minister of Pakistan and one journalist @xadeejournalist. Another tweet which is widely retweeted

within group two, was related to a journalists' reaction on government. This was a viral video which highlighted how the government was trolling journalists on social media after asking disliked questions during a media briefing. The most mentioned noticeable user account belonged to columnist, anchor, and analyst @saleemkhansafi.

The group retweeted a political video showing that the Prime Minister didn't take precautions while meeting with his ministers, however, the minister in question was conscious and maintained social distancing. It aimed to show the causal behaviour of the Prime Minister during the days of pandemic.

The last and the fifth group conversed about a tweet posted by the Chief Minister Sindh Province, who was requesting funds for the COVID-19 emergency. The most popular user within the communication was @bbhuttozardari, the Chief Minister's political party leader. Unlike Case Study 1, the most communicated content in Case Study 2 was related to tweets of political personalities regarding updates and funding requests. However, some retweeted content highlighted the actions and reactions of the Prime Minister, also targeting media on asking unwanted questions about the prevailing situation in the country.

Table V *Most Retweeted and Mentioned Users in the Top 5 Groups for Case Study 2*

NodeXL Group	Most retweeted tweet (n)	Most Mentioned User (n)
1	The number of coronavirus cases in Punjab is 1133. 10,623 Tablighi Jamaat preachers have been quarantined in 33 districts and so far 296 cases have tested positive, which are being properly cared for. 312 cases are from different centers. The remaining 525 people are in different districts (1157)	imrankhanpti (223)
2	Instead of trolling of journalists on social media, the government and the PTI should focus on fighting the coronavirus. Statement of Bilawal Bhutto Zardari See the background of trolling journalists https://t.co/whhEjfBiLZ (568)	saleemkhansafi (45)
3	Prime Minister Imran Khan may think that the coronavirus is not so dangerous but Sheikh Rashid does not agree with his opinion at all. Watch the video #CoronaVirusPakistan https://t.co/cpvo3BQI2j (37)	pak_ngr (1)
4	The number of coronavirus cases in Punjab is 1133 10,623 Tablighi Jamaat preachers have been quarantined in 33 districts and so far 296 cases have tested positive, which are being properly cared for. 312 cases are from different centers. The remaining 525 people are in different districts (1157)	xadeejournalist (23)
5	Sindh Chief Minister Syed Murad Ali Shah has appealed to the people of Pakistan and Pakistanis around the world to donate to the Coronavirus Emergency Fund. https://t.co/lwxIZmCJS9 (253)	bbhuttozardari (255)

Table VI provides the information regarding top URLs (i.e., most frequently shared) shared in Case Study 2 on April 5, 2020. It was evident that almost all shared links were of news websites in similar to Case Study 1. Only one shared link belonged to a blog on health tips. The majority of the links were about the country situation due to the recent COVID-19 pandemic. It is interesting to note here that the Twitter community shared news links related to the situation in neighbouring countries and other political news about developed countries and their activities. Some of the shared links informed individual stories of patients who either recovered from virus or caused to death while fighting against it. It is also evident from the data that people are interested to know about the COVID-19 vaccine, its preparation and availability on market.

Table VI Top URLs Shared Case Study 2

Top URLs	Description	Content	Occurrence
http://urdu.dunyanews.tv/index.php/ur/Pakistan/539670/	Urdu Dunya TV news website	Provincial health minister stated that 90% infected people in her province have very limited symptoms	92
https://trib.al/MRY7D4g	BBC news Urdu website	Coronavirus will destroy the Indian economy and the government support package is not enough	73
http://urdu.dunyanews.tv/index.php/ur/Pakistan/539715/	Urdu Dunya TV news website	Tragedy over Coronavirus in Sindh, people on daily wages need food, forced to starve	52
https://m.facebook.com/story.php?story_fbid=2842033469220370&id=100002412351802	Video shared from an anchor/news analyst Facebook account	Prime Minister encountering journalists on the issue of COVID-19 in the country	41
http://urdu.dunyanews.tv/index.php/ur/World/539566/	Urdu Dunya TV news website	Microsoft owner Bill Gates announces spending billions of dollars on coronavirus vaccine	40
https://trib.al/A3Ckjk1	BBC news Urdu website	Coronavirus: The story of the Kashmiri patient recovering in under the administration of Pakistan	29
https://trib.al/fedlITk	BBC news Urdu website	Corona: Germany accuses US of "stealing" masks	28
https://walizone.blogspot.com/	Blog on Health tips	Coronavirus update: How long can vaccines against coronavirus be available on the market?	24
https://trib.al/DOWoHK	BBC news Urdu website	Coronavirus : Nurse Arima Nasreen also lost her life to code-19	22
https://trib.al/wNFSvuj	BBC news Urdu website	Victims of Delhi riots: 'First riots and then coronavirus displaced'	21

Table VII provides an overview of the top hashtags used on Twitter during this time. It was found that top hashtag *#stoppoliticssupportpmik* was used by Twitter users to support the present government during the crisis and asking opposition parties to stop politicising the issue.

The party supporters and citizens used this hashtag to appreciate the efforts of government. The second most popular hashtag was “coronavirus” which is not surprising given the topic under study. The third hashtag #ik_saviourofnation was also shared multiple times. The supporters of the Prime Minister used this hashtag in the support of him as ‘ik’ in this context stands for Imran Khan. The other used hashtags were “covid2019”, “coronaviruspandemic” and “covid19”. During the crisis, Twitter users also highlighted the sufferings of Kashmiris (the disputed region between Pakistan and India) and used the hashtags #feelsufferingsofkashmiris and #kashmirisrjectindianlaws to show support. The other hashtags used included #pakistanfightscorona and #pakistan to show affinity with the country and the efforts of the government and army.

Table VII *Top Hashtags and Occurrences Case Study 2*

Top Hashtags	Occurrences
Stoppoliticssupportpmik	671
Coronavirus	642
ik_saviourofnation	237
covid2019	209
coronaviruspandemic	199
covid19	191
feelsufferingsofkashmiris	128
pakistanfightscorona	109
Pakistan	108
kashmirisrjectindianlaws	105

As shown in Table VIII, the top used words used in this network included “corona” and “virus”, this finding developed an understanding that Twitter had been used as a strong communication tool during pandemic.

Table VIII *Top Words Used and Occurrences Case Study 2*

Top words	Occurrences
میں	23320
کی	23241
کے	21912
کورونا	20667
وائرس	20412

Discussion

The results of this study indicate that Twitter is a powerful and active channel of communication among politicians, journalists, actors and the wider public. Prior researches also noted the successful use of this medium by politicians and dedicated public users (Aharony, 2012; Graham et al., 2014; Grant et al., 2010). The present study has demonstrated that Twitter as a quick channel was used during COVID-19 pandemic for spreading news, updates and for political scoring between government and opposition. These results corroborate the findings of previous work which claimed that social media can be an effective tool of fast communication during health related crisis events (Eriksson & Olsson, 2016; Khalid, et al., 2016; Kostkova et al., 2014). In addition, the classification of tweets mirrors the categories identified in previous studies such as shock, informative, personal stories, and opportunistic (Gough, et al., 2017). It is evident from the data that during the recent health crisis Pakistani Twitter users mostly shared informative, political news related to the government on COVID-19 and personal stories. Pakistani Twitter users were tweeting about the stories of politicians and famous personalities with regard to COVID-19.

It was also found that during the health crisis citizens shared resource related links such as newspaper websites, and the findings of this study are consistent with previous research such as Chew & Eysenbach (2010) who found that news websites were commonly shared during emergencies. The results related to tweet creators are in contrast with previous work

McLaughlin, et al. (2016) which reported how influential Tweet creators belonged to non-governmental organization (NGOs), academic institutions, and commercial companies. For the present study the most popular tweet creators were politicians.

Furthermore, message framing theory, which emphasizes the effectiveness of information construction or framing of messages to change human behaviours, was applied when analysing Twitter data. According to theory (Rothman et al., 2006), gain frame messages emphasize the gains of behaviour change, and loss-frame messages emphasize the losses caused due to failure in action. The most retweeted tweets presented in Table I (Case Study 1) and V (Case Study 2) have been analyzed with this lens, interestingly, in comparison to previous research, all messages (tweets) were political in nature, highlighting the gains of politicians, opposition leaders and journalists. The tweets highlighting change in behaviour, personal and government projection (Table IX, column 1) have been classified as gain frame messages. In contrast, tweets criticizing government actions on COVID-19 have been treated as loss frame messages (Table IX, column 3). In Table IX the numbers in brackets for each Twitter message relate to the number of retweets that they received. Theoretically, the present study identified gaps in the application of gain or loss frame message theory. Moreover, our study proposes to extend the gain frame thread and apply it to social media platforms which is a novel application and contribution to the message framing theory.

It was also found that most of the popular tweets were gain framed, although Twitter users utilised recent pandemic content to further political, personal, and professional aims. Pakistani Twitter users engaged with the platform as a communication tool for popularity, highlighting efforts of politicians during health emergency and opposing government and the actions of the Prime Minister. Loss framed messages were few in number and contained fewer retweets than

gain framed messages. Loss framed messages were also political in nature and highlighted the negligence of government on the issue of coronavirus. Only one tweet from case study 1 related to conspiracy theory on the issue of COVID-19.

Overall, our results show that social media communication or more specifically, Twitter has not been used organically in an attempt to drive changes in behaviours and that there is potential to do this. Therefore, not many of these messages can be structured according to the effective message framing approach. Social media communication is diverse in nature as the present study identified different forms of gain frame messages as well as a number of other categories.

Previous empirical research has identified the role of social media as awareness and risk communication tool during health crisis (Jamison-Powell et al., 2012; Kostkova et al., 2014), however, Twitter users in Pakistan utilised the platform for personal projections, political aims and for sharing information.

Table IX An Analysis of Gain/Loss Frame Twitter Messages

Case Study 1			
Political Gain Framing <i>(Translated into English language)</i>	Gain framing for Appeals or Fund Raising	Loss Framed Messages <i>(Translated into English language)</i>	Messages plotting conspiracies <i>(Translated into English language)</i>
The other day I had a test for coronavirus which was reported to be positive...I am feeling very healthy and performing my responsibilities at home in isolation. I am asking Citizens, also stay at home (4886)		The government was very negligent on the issue of coronavirus: Lahore High Court The full bench remarked that the government has no data on how many people passed without screening. (547)	Although this has not been proven, we cannot completely rule out the possibility that the coronavirus may not have formed in a laboratory, but may be a biological weapon (293)
On the special instructions of the Chief Minister of Punjab,19,000-bed ICU has been set up ... The whole world is appreciating the Punjab Government's readiness and response ... (1576)			
Azad Kashmir Prime Minister ...has announced the state's highest official award 'Kashmir Mark' for Gilgit-Baltistan's Dr, who died of Corona while undergoing treatment for Coronavirus patients (11)			
Case Study 2			
Political Gain Framing <i>(Translated into English language)</i>	Gain framing for Appeals or Fund Raising <i>(Translated into English language)</i>	Loss Framed Messages <i>(Translated into English language)</i>	Others <i>(Translated into English language)</i>
The number of cases of coronavirus in Punjab is 1133. 10,623 Tablighi Jamaat preachers have been quarantined in 33 districts and so far 296 cases have tested positive, which are being properly cared for...(1157)	Sindh Chief Minister Syed Murad Ali Shah has appealed to the people of Pakistan and Pakistanis around the world to donate to the Coronavirus Emergency Fund. (253)	Focus on fighting the coronavirus instead of trolling social media for critics of the government and the PTI. Statement of Bilawal Bhutto Zardari (568)	Prime Minister Imran Khan may think that the coronavirus is not so dangerous but Sheikh Rashid does not agree with his opinion at all. (37)

In regard to limitations, this study made use of the Twitter Search API which provides a random sample of tweets meaning that certain tweets may have been missing from our dataset. Moreover, our study examined single time-periods which is a limitation in terms of generalisability to other time periods, and future research could seek to examine other dates. Furthermore, more general limitations of social media data also apply to our data such as information quality and reliability. Social media communication is diverse in nature and future research could use existing research to further develop a contextualized framework for classification and/or develop a typology of content.

Conclusion

The findings of the present study help us to understand how certain Twitter users in Pakistan were using the platform for personal and professional projections as well as politically even during the unfolding COVID-19 health crisis. Furthermore, according to our results, it did not appear that Twitter accounts in Pakistan were making use of Twitter to disseminate awareness of COVID-19 such as risk communication. This is a low-cost strategy with potential of high reach. The results of this study have further practical and theoretical implications. This is because this research enhances our understanding of the use of Twitter during the COVID-19 pandemic crisis, namely, that the Pakistani health authorities, governments as well as citizens may benefit by developing further knowledge on how to make effective use of communication tools such as Twitter. There is a need to plan information literacy training, such as workshops and seminars in order to make people more responsible citizens in the use of social media. The Ministry of Health and/or other health departments may also wish to make use of Twitter for disseminating factual and timely information. Educators and researchers may wish to include such components of training into curricula at different grade levels or for specific subject

domains. Our novel application of game framing to social media posts opens up further avenues for future research and development in this area.

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