Sensing Community Resilience Using Social Media

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This chapter discusses social media use and community resilience development during the COVID-19 pandemic in Singapore. Although around one in four Singapore residents are Twitter users, little is known about their attitudes and sentiments or the roles that social media fulfils in supporting community resilience during a pandemic. The chapter investigates how social media affects citizens' self-resilience capacities during various stages of the COVID-19 pandemic evolution, in particular, in terms of information gathering, information dissemination, information exchange, collaborative problem-solving, coping and promotion of connectedness in order to derive opportunities and challenges for community resilience building. More than a tool for collaborative problem-solving, Twitter is used to coordinate top-down community response and promote connectedness. Geo-tagged data analysis suggests that different regional characteristics do not lead to difference in community resilience efforts across Singapore. Singapore, as a nation, works together as a community in fighting the pandemic.

11.1 Introduction

The COVID-19 pandemic has unleashed unprecedented disruption to economy and society. In its wake, COVID-19 related posts on social media platforms such as Facebook, Twitter, and YouTube have increased. Publicly accessible data posted on social media platforms by users around the world are increasingly used by researchers to quickly identify the main thoughts, attitudes, and feelings surrounding COVID-19 [1]. The scientific community has reported the potential effects of mass isolation on an individual's well-being, and mental health [2, 3]. Yet, there is little or no discussion on the use of social media to sense community resilience during the COVID-19 pandemic.

This study aims to fill this knowledge gap and sense community resilience during the COVID-19 pandemic in Singapore by examining tweets with the *SGUnited* hashtag. This study validates the use of #SGUnited tweets to study how community resilience evolves during the COVID-19 pandemic in Singapore. Additionally, it demonstrates the importance of the Singaporean online community, especially the grassroot communities, to spread community resilience. Results reveal that pandemic increases community resilience, especially in the prelude and the aftermath of a severe lockdown. During a strict lockdown, community resilience is high, but an opposing current of negativities, anxieties, and self-concerns is also high, with potential to undermine group unity if not addressed well. Geographical characteristics of different regions in Singapore are reflected into the content of the tweets. Analysis shows that regional characteristics do not lead to differences in community resilience efforts across Singapore, perhaps because of its small land area (721 sq km) and high population density (7821 persons per sq km).

11.2 Previous Research

11.2.1 Community Resilience During Disasters

Much has been written about the definition of community resilience [4]. Suffice to summarise that community resilience is the ability of a society to cope with and rebound in the face of adverse events or crisis [5, 6]. Understandably, communities with high resilience are usually able to bounce back quickly from adversity and building resilience is often connected with building strong communities [7]. Even though state institutions are important, a community's citizens and public awareness of and responsibility for managing local disaster are critical to sustaining and increasing national resilience in disasters.

In response to the COVID-19 pandemic, the scientific community has increasingly reported on individual well-being, including the potential effects of mass isolation on mental health [2, 3]. Prime, Wade, and Browne [8] discuss the literature on past adversities that have affected populations, such as natural and man-made disasters and recessions, to illustrate numerous aspects in which the well-being of children and families can be at risk during COVID-19.

While resilience exists at the individual and family level, it also occurs at societal level. Vinkers et al. [9] discuss the importance of resilience at both the individual and societal level during the COVID-19 pandemic. Kimhi et al. [10] explore the contribution of community resilience towards decreasing or enhancing anxiety and depression during the pandemic among members of Israel's Jewish and Arab communities.

11.2.2 Community Resilience and Social Media

Social media has become an integral part of many people's everyday lives. It is not surprising that social media is widely used in emergency scenarios. Social networking can influence citizens' self-reliance in the event of a crisis by providing avenues for getting quick and reliable information that reduces uncertainty [11]. Other studies suggest that the public rely on a mix of formal and informal information sources to seek information when using social media during disasters [12, 13]. More specifically, research on the use of Twitter in an emergency context reveals emergency information diffusion of retweets and private messages [14, 15], and information sharing behaviours on Twitter during disasters [16, 17].

Riding on the rapid growth of COVID-19 content on social media, researchers have been using social media to identify the main thoughts, attitudes, and feelings surrounding COVID-19. Li et al. [18] sampled and analysed Weibo posts to explore the impacts of COVID-19 on people's mental health. Su et al. [19] accessed Weibo and Twitter posts to examine and compare the impact of COVID-19 lockdown on individuals' psychological states in China and Italy. Park et al. [20] investigated information transmission networks and news-sharing behaviours regarding COVID-19 on Twitter in Korea. Budhwani and Sun [21] assessed if there was an increase in the prevalence and frequency of the phrases 'Chinese virus' and 'China virus' on Twitter after the 16 March 2020 US presidential reference of this term.

Aside from country-specific studies, others have interrogated worldwide trends. Lwin et al. [22] examined worldwide trends of four emotions—fear, anger, sadness, and joy—and the narratives underlying those emotions during the COVID-19 pandemic. Abd-Alrazaq et al. [1] identified the main topics posted by Twitter users globally during the COVID-19 pandemic, from 2 February to 15 March 2020. They observed the need for proactive social media monitoring to address the spread of fake news and misinformation on social media.

Social media is not just popular among the community. Rufai and Bunce [23] explored the role of Twitter as used by the Group of Seven (G7) world leaders in response to COVID-19. Chen, Lerman, and Ferrara [24] developed a multilingual COVID-19 Twitter dataset that other researchers can use while Mackey et al. [25] detected and characterized user-generated conversations that could be associated with COVID-19-related symptoms. So far, however, no existing study has used social

media to explore community resilience during the pandemic. In the pages that follow, we will use Twitter data to sense community resilience in Singapore during the COVID-19 pandemic.

11.2.3 Singapore Community Resilience During COVID-19 Pandemic

Singapore won praise from the World Health Organisation for its early response to dealing with COVID-19 pandemic without the need for enforced lockdowns [26]. Even after the migrant worker dormitory cases emerged and circuit breaker (lockdown) enforced, Singapore's COVID-19 pandemic response has been swift and fatality is generally low [27]. Singapore's success is, however, not unique.

Epidemiologists universally acknowledge that communities in Asia including Hong Kong SAR, South Korea, Taiwan, and Vietnam have been more successful than the United States and most European countries in 'flattening the curve' and limiting the spread of the COVID-19 virus among its populations [28]. Some have attributed this to cultural traits such as the collectivist Confucian mindset internalized among Asian societies that prioritise social unity, group goals and greater good of the community over individual desires [28]. Creating social cohesion is important to community resilience [29].

In February 2020, Singapore has launched SGUnited campaign to encourage the population to work together and overcome the challenges arising from the pandemic. The clarion call is to 'stay safe, stay strong and stay united'. In early February 2020, the prime minister and other members of the government advocated using #SGUnited, that soon gained traction in the social media. The timeline of how the COVID-19 outbreak in Singapore had evolved from 1 January to 30 June 2020 is summarised:

- **Imported Phase** (1 January – 3 February 2020). During the imported phase, imported COVID-19 cases increasingly entered Singapore. The first confirmed case was reported on 23 January, a tourist from Wuhan [30]. The first confirmed case involving a Singaporean was confirmed on 31 January, a Singaporean returning from Wuhan [31].
- **Early Local Cluster Phase** (4 February – 23 March 2020). During this phase, local clusters and transmission developed. The first cluster of local transmission was reported on 4 February at Yong Thai Hang, a shop that mainly served Chinese tourists [32].
- **Stronger Measure Phase** (24 March – 6 April 2020). During this phase, the number of cases began to rise exponentially around the world. Singaporean overseas were encouraged to return [33], causing a spike in imported cases. This spike signalled a new phase in Singapore's fight against COVID-19. Various safe distancing measures and travel restrictions were introduced. Singapore registered 1,000 cases on 1 April [34].
- **Circuit Breaker (Lockdown) Initial Phase** (7 April – 20 April 2020). During this phase, the government of Singapore introduced the Circuit Breaker, an elevated set of safe distancing measure to pre-empt the trend of increasing local transmission of COVID-19 [35]. The exponential increase was caused by infection among migrant workers living in dormitories. The first dormitory cluster was identified on 30 March, with four infections at S11 dormitory [36]. Cases quickly ballooned to 4,427 on 16 April, 60% of which were migrant workers [34].
- **Circuit Breaker Tightened Phase** (21 April – 11 May 2020). The exponential increase in cases did not slow down. On 21 April, the prime minister announced tighter measures to the Circuit Breaker period, to further reduce the transmission of COVID-19. He also announced that the Circuit Breaker period would be extended by another four weeks until 1 June 2020 [37].
- **Circuit Breaker Relaxed Phase** (12 May – 1 June 2020). On 2 May, the Multi-Ministry COVID-19 Taskforce announced that it would ease some of the tighter circuit breaker measures in the coming weeks. Particularly from 12 May, a significant number of retail and businesses were allowed to resume operation [38].
- **Safe Reopening Phase NG Phase** (2 June – 30 June 2020). As the daily number of

new community cases had declined significantly and the dormitory situation had stabilized, Singapore exited the Circuit Breaker on 1 June 2020 [39].

11.3 Methods

11.3.1 Data Collection

#SGUnited was used as a proxy for resilience tweets. Tweets with the #SGUnited were collected using the Twitter Standard Search API from the start of the project, in mid-April to 30 June 2020. Twitter users' information were extracted from the tweets collected. Overall, there were 5,784 users. Their tweets since 1 January 2020 were then scraped using the Twitter Timeline API. The Twitter Timeline API was less restrictive than the Twitter Standard Search API. Finally, all the tweets with #SGUnited were filtered. We collected 17,367 tweets from 1 January 2020 to 30 June 2020, of which 1,011 were geolocated tweets.

11.3.2 Data Pre-Processing

Punctuation marks and stop words such as 'an' and 'the' were removed from the tweets. Furthermore, various forms of the same word (e.g. travels, traveling, and travel's) were lemmatized by converting them to the main word (e.g. travel) using the *WordNetLemmatizer* module of the Natural Language Toolkit Python library. Following the terms and conditions, terms of use, and privacy policies of Twitter, all data were anonymized and were not reported verbatim to any third party.

11.3.3 Data Analysis

Five types of analysis were performed on the tweets to understand different aspects of resilience: (a) frequency count and analysis of popular information sources, (b) topic extraction, (c) sentiment analysis, (d) pronoun analysis, and (e) geospatial analysis.

The frequency of #SGUnited tweets and retweets was analysed according to the earlier mentioned COVID-19 evolution timeline. Then, popular users and influencers were extracted from two popularity measures. The first popularity measure was based on the number of tweets a user posted that were retweeted by others. The second popularity measure was based on the number of retweets that a user received for his/her tweets.

Sentiment and pronoun analyses were performed to discover how and when tweets were used to create a venue for collaborative problem solving and promotion of connectedness. Pronouns were calculated by listing them and finding them in the tweets. First person singular pronouns included 'I', 'me', 'my', and 'mine'. First person plural pronouns included 'we', 'us', 'our', 'ours'. Second person pronouns included 'you', 'your', and 'yours'. Third person singular pronouns were 'he', 'him', 'his', 'she', 'her', 'hers', 'it', 'its'. Lastly, third person plural pronouns were 'they', 'them', 'theirs'. Sentiment scores (ascription of positive or negative emotional valence) were given to tweets using *Vader* library in Python.

Topic modelling technique, specifically the *TwitterLDA* [40], was used to extract topics from tweets. Topic distribution in a day would identify popular topics from the tweets. The topics were visualized using R library *LDAViz* [41]. Tableau was used for visualization of other graphs.

There were 1,011 geolocated tweets. Eliminating the ones that were in other countries, and that were too generic (i.e. only mention Singapore), 840 tweets remained for analysis. Of these, 442 tweets had geocoordinate points, whereas the rest only had polygon coordinates that showed in which of the five Singapore regions they belonged to: North, East, West, North East, or Central. Topics of the tweets of each region were extracted to discover the topics discussed at each region.

11.4 Results

The examination of how social media affects citizens’ self-resilience capacities during various stages of the COVID-19 pandemic evolution involved three areas: (1) how social media affected self-resilience in terms of information gathering, dissemination, and exchange; (2) how social media affected self-resilience in terms of collaborative problem solving, coping, and promotion of connectedness; and (3) whether social media showed any regional-specific community resilience.

11.4.1 Information Gathering, Dissemination, and Exchange During the COVID-19 Pandemic

According to Bruns and Liang [42], Twitter is particularly suitable for crisis communication. With its flat and flexible communicative structures, any visitor can access public tweets. Such communicative structure facilitates fast, and large-scale collection of information [43]. Particularly during major events, the follower-followee relationships can lead to emergent social properties at a macro-scale, which are driven by a bottom-up self-organization of information [44], thus providing unique access to information deemed important by the community. Additionally, Twitter is a persistent source of data about individual responses to a disaster within a community, establishing Twitter as a valuable tool for measuring disaster resilience across communities [45]. The exploration into how Twitter, as a medium of information gathering, dissemination, and exchange, affects the capacities of community resilience in Singapore during the COVID-19 pandemic involves reviewing the intensity of information gathering and dissemination at various stages of the pandemic, the topic of information exchanged, and popular information sources.

11.4.1.1 Tweets Intensity at Various Stages of the Pandemic

Social media provides clear opportunities for two-way crisis communication between authorities, media and citizens [46]. This two-way communication helps to build community resilience by providing emergency information and facilitating community response and recovery [47]. Intensity of tweets during various stages of pandemic is analysed to discover at which stages are the crisis communication information exchanges among Singaporeans most prevalent.

The number of tweets, and retweets appears to follow closely the COVID-19 phases in Singapore (Table 11.1). Intensity of tweets gained momentum during the implementation of stronger measure when the global and national infected cases increased (Figure 11.1). The intensity reached its peak during the Circuit Breaker tightened measure period following the emergence of dormitory clusters in Singapore that created an upsurge of national infected cases. As the number of cases stabilized, the government relaxed the lockdown measures and the number of tweets also seemed to decline.

TABLE 11.1
The number of tweets and retweets across different phases of COVID-19

Phase	Date	No. of Tweets	No. of Retweets	Sum SG Daily Infected
Imported	1 Jan – 3 Feb	6	0	18
Early local clusters	4 Feb – 12 Mar	563	683	492
Stronger measure	13 Mar – 6 Apr	4,241	1,226	866
Circuit Breaker initial	7 Apr – 20 Apr	2,575	1,069	6,649
Circuit Breaker tightened	21 Apr – 11 May	6,102	3,670	15,808
Circuit Breaker relaxed	12 May – 1 Jun	2,930	1,457	11,505
Safe reopening	2 Jun – 30 Jun	2,516	1,236	8,884

The results follow previous studies of Twitter showing that during natural hazards, there is a gradual increase in tweet intensity with hazard proximity [46]. The suggestion is that Twitter

presents a disaster communication platform that provides essential information during crucial times throughout the COVID-19 pandemic in Singapore. But unlike natural disaster, where there is an objective definition of hazard, there is no objective definition of hazard during a pandemic. In our results, hazard is equated with strict lockdown, and the highest number of infected cases. But the current pandemic is protracted with no cure insight yet, the “strict lockdown” definition may not be the same for all countries, and no one can really predict whether the number of infected cases has reached a tipping point. Future studies can investigate whether hazard during a pandemic has a universally accepted objective measure.

FIGURE 11.1
Community resilience tweets by phase and number of national infected cases, 1 January to 30 June 2020

11.4.1.2 Popular Topics and Tweets

Disasters are inherent with a high degree of uncertainty and the perception of severe threat [48]. The central characteristics, functions, and applications of social media in disaster relate to social convergence to provide support and information sharing to reduce uncertainty [11]. On Twitter, people spread information that they feel or know to be newsworthy through retweeting notwithstanding the possibility of fake news [44].

In Table 11.2, the top two topics in #SGUnited tweets are listed; topic definition can be found on Table 11.3. Here’s how the table should be read. For example, during the imported phase, topic 24 (lifestyle and leisure) becomes the most discussed topic for three days, and topic 10 (COVID transmission and test) is the most discussed topic for a day. In total, during the imported phase, there are four days where tweets with #SGUnited are found. During the period, topic 11 (estate economy) is the second most discussed topic for two days, while topic 24 (lifestyle and leisure), and topic 0 (youth, global, and national unity) are the second most discussed topic for a day.

For Singapore, during the COVID-19 pandemic, the community seemed to focus on accessing Twitter to get and exchange information relating to lifestyle and leisure (Table 11.2). For most of the days throughout the six-month period, topic 24 (lifestyle and leisure) was the first or second most discussed topic. Topic 24 communicated information exchange about lifestyle changes that were crucial to curb the pandemic spread, e.g. promotional message of online products that were advertised to help fight viruses, different new safeguarding efforts on travel in public transport, guidelines for the wearing of masks, and introduction to the ‘soaper 5’. Singapore introduced the concept of soaper 5 (Wipe Up Wilson, Super Soaper Soffy, Virus Screener Varun, Hands Down Hana, and Mask Up Mei Mei) to help little children build a new lifestyle habit in the midst of the pandemic.

Besides being a tool to promote new lifestyle changes, Twitter was also a popular platform to promote positivity, and connectedness. For example, during the Stronger Measure phase, the ClapforSGUnited event on 30 March 2020 [49] was accompanied with an increase in topic 2

(appreciation for frontliners) and topic 18 (appreciation for healthcare workers) including retweets (Figure 11.2). These topics became the second most discussed topic for a few days during the Stronger Measure phase. Similarly, during the Circuit Breaker tightened phase, SingforSG event saw an increase in topic 0 (youth, national, and global unity), and topic 2 (appreciation for frontliners) discussion on Twitter. SingforSg event was created by MediaCorp (a media and entertainment group), inviting Singaporeans to take part in a nationwide singalong to promote unity during COVID-19. The results highlighted the importance of large-scale fun events at the national level to promote a sense of community unity on Twitter. Not only did these events create an increase in retweets during the event days, but also a few days following the event.

TABLE 11.2
Top two most discussed topics during COVID-19

Phase	Date	Topic	No. of Days the Topic was the 1 st /2 nd Most Discussed Topic
<i>The first most discussed topic</i>			
Imported	1 Jan – 3 Feb	24, 10	3, 1
Early local clusters	4 Feb – 12 Mar	24, 0, 10, 4, 7, 14, 15, 2, 3, 8, 20, 21	19, 2, 2, 2, 2, 2, 2, 1, 1, 1, 1, 1
Stronger measure	13 Mar – 6 Apr	24, 19, 22, 5, 2, 15, 11, 18, 17	15, 2, 2, 1, 1, 1, 1, 1, 1
Circuit Breaker initial	7 Apr – 20 Apr	24, 9, 8, 19	10, 2, 1, 1
Circuit Breaker tightened	21 Apr – 11 May	24, 5, 21, 0, 7, 10, 15, 4, 2	10, 2, 2, 2, 1, 1, 1, 1, 1
Circuit Breaker relaxed	12 May – 1 Jun	24, 3, 16, 1, 13, 11	13, 3, 2, 1 1, 1
Safe reopening	2 Jun – 30 Jun	24, 1, 5, 10, 13, 0, 6, 17, 21, 22	15, 2, 2, 2, 2, 1, 1, 1, 1, 1
<i>The second most discussed topic</i>			
Imported	1 Jan – 3 Feb	11, 24, 0	2, 1, 1
Early local clusters	4 Feb – 12 Mar	24, 21, 7, 5, 10, 2, 0, 15, 3, 8, 11, 1, 18, 19	12, 5, 4, 3, 2, 2, 1, 1, 1, 1, 1, 1, 1, 1
Stronger measure	13 Mar – 6 Apr	24, 18, 5, 7, 2, 17, 19, 11, 0, 4	6, 5, 3, 3, 2, 2, 1, 1 1, 1
Circuit Breaker initial	7 Apr – 20 Apr	24, 21, 9, 19, 8, 5, 17, 15	4, 4, 1, 1, 1, 1, 1, 1
Circuit Breaker tightened	21 Apr – 11 May	24, 21, 12, 23, 5, 7, 3, 9	7, 6, 2, 2, 1, 1, 1, 1
Circuit Breaker relaxed	12 May – 1 Jun	21, 19, 24, 14, 16, 1, 5, 15, 4, 22, 17	5, 4, 3, 2, 1, 1, 1, 1, 1, 1, 1
Safe reopening	2 Jun – 30 Jun	24, 6, 22, 5, 21, 17, 19, 7, 10, 14, 12, 20	7, 4, 3, 2, 2, 2, 2, 2, 1, 1, 1, 1

Note: Refer to Table 11.3 for topic definition.

TABLE 11.3
LDA generated topics

Topic 0	youth, national, and global unity	Topic 12	COVID-19 cases
Topic 1	tourism, and daily entertainment	Topic 13	safe reopening
Topic 2	frontliners appreciation for	Topic 14	food delivery and cooking
Topic 3	stay-home	Topic 15	webinar, and digital tech
Topic 4	stay-home and cooking	Topic 16	religious celebration and Brompton bike
Topic 5	live updates and livestream	Topic 17	dengue, and Malay words
Topic 6	jobs, companies, and industries	Topic 18	appreciation for healthcare workers
Topic 7	fitness and health	Topic 19	video and radio broadcast
Topic 8	education and job training	Topic 20	stay positive
Topic 9	domestic life and foreign worker	Topic 21	public holiday nature, and relaxing
Topic 10	circuit breaker and lockdown	Topic 22	art, innovation, and nation rebuilding
Topic 11	COVID-19 transmission and test	Topic 23	Ramadhan
	estate economy	Topic 24	lifestyle, and leisure

FIGURE 11.2
Number of retweets

Similar to the discovery by Vicari et al. [43] for disaster, our data showed that Twitter was primarily used as a means to disseminate warnings and behaviour guidelines during the pandemic. On Table 11.2, topic 9 (Circuit Breaker) became the most discussed topic on Twitter for a few days during the Circuit Breaker initial phase. This topic contributed to a high number of retweets (See Figure 11.2). Two weeks into the Circuit Breaker, on 21 April, the prime minister announced the extension of the Circuit Breaker. This announcement circulated widely on Twitter (Figure 11.2). The circuit breaker extension caused topic 9 (Circuit Breaker) to appear as the second highest ranked topic for a day during the Circuit Breaker Tightened phase (Table 11.2). During important milestones of the pandemic, Twitter provided an additional channel (besides traditional media like newspaper, radio and television) to announce important measures, specifically the Circuit Breaker.

By posting circuit breaker announcements on Twitter, #SGUnited tweets and retweets offered a glimpse into how social media could provide emergency intelligence through crowdsourcing, and boost the coordination of community response and recovery, lending evidence to how social media could be used to help build community resilience [47].

Festivals and national holidays also contributed to an increase in information dissemination on Twitter, i.e. retweets, during the pandemic. During the Circuit Breaker tightened period, Muslims in Singapore started their month of fasting. The event created an increase in retweets on 25 April (Figure 11.2) and topic 23 (Ramadhan, the fasting month and related activities) also became the second most discussed topic for a few days during the Circuit Breaker tightened period (Table 11.2). On 1 May, tweets about Labour Day (a public holiday) celebration spread widely on Twitter, inducing an increase in retweets (Figure 11.2). In consequence, topic 21 (public holiday, and relaxing activities) became the most discussed topics for a few days during the Circuit Breaker tightened period (Table 11.2). Besides expressing happiness during public holidays, messages during those days were also accompanied with resilience messages, such as encouraging words, a call for fundraising, and volunteerism. Festivals nurture community resilience through the sharing of values, interests, and traditions central to the host community [50]. The finding suggests that national holidays and festivals could be utilized to spread positive messages on social media as community cohesion increases during those days.

Our topic results seemed to be quite different from previous research. Abd-Alrazaq et al. [1] in their study of COVID-19-related tweets between 2 February and 15 March 2020 discovered that the five most discussed topics were deaths, fear, travel bans, economic losses, and panic buying. Generally, these tweets were largely negative. Currently, there was no previous research that specifically addressed the most discussed topics about COVID-19 in Singapore. Our analysis on tweets with #SGUnited revealed that the COVID-19 and related tweets were mostly positive and concentrated on introducing measures and lifestyle changes. This could be due to the content of postings introduced on #SGUnited. For example, during the stronger measure phase of the COVID-19, travel ban and advisory were introduced by the Singapore government but, the tweets with #SGUnited that were most widely disseminated during that phase were not about travel ban, but about encouragement, the Clap for SG activity.

Previous research on the use of Twitter for nurturing community resilience is usually focused on natural disaster. In these studies, Twitter mostly works as an early warning system [11, 43–45]. Requests for help and information on disaster recovery are also posted on Twitter, improving the lines of communication, thus enhancing self-resilience of citizens [11]. The community resilience fingerprints during natural disasters are largely related to ecological and infrastructure categories [45]. But, COVID-19 pandemic appears to have a different pathway from natural disaster.

Unlike natural disaster, the COVID-19 pandemic is protracted. Local communities need to be ready for the next waves, as long as there is no cure yet for the pandemic and the incidence and deaths related to COVID-19 continue to rise within the global community. In Singapore, through #SGUnited, Twitter is being used as an early warning system for the pandemic as well as for introducing and encouraging lifestyle changes in the community, which are important to sustaining the care and safety of the community. In consequence, lifestyle topic takes the majority of conversations on Twitter.

11.4.1.3 Popular Information Sources

Influential actors including heroes, and role models are important stakeholders during a disaster [43]. They can play an active role in nurturing community resilience through social media. Table 11.4 lists the top 20 popular users who were retweeted. They include government representatives, citizens, influencers, and private entities.

The most widely retweeted users appeared to be citizens while other entities (e.g. mainstream journalism) appeared to be the most likely retweeted users (Table 11.4). Postings from government entities are likely to be retweeted, and they are widely retweeted as well. Since citizens are more widely retweeted, the importance of building community resilience at the grassroots level should not be underestimated. That is, bottom-up activism is as equally important as a top-down directive in responding to the pandemic. Additionally, other non-governmental entities, especially online news portals, as the most likely retweeted users offer great options to encourage the implementation of

top-down directives as their messages are highly likely to gain traction. In sum, official information dissemination by the government agencies though important, may not be sufficient on its own during a pandemic; the process could be complemented by both citizens and other entities like mainstream journalism to further support information exchange and promote connectedness.

TABLE 11.4
Top 20 popular users by popularity measure and user category

User Category	Popularity Measure Based on how widely they are retweeted	Based on how likely they get retweeted
Government (government departments and individuals like prime minister and ministers)	6	6
Other Entities (e.g. mainstream journalism business and private sector)	5	9
Citizens	8	4
Influencer (e.g. individuals with social media following)	1	1
	20	20

11.4.2 Promotion of Connectedness and Collaborative Problem Solving

Singaporeans generally appeared positive during the pandemic. There were more positive tweets than negative tweets (Figure 11.3). Nevertheless, a handful of negative tweets still existed. Their frequency generally did not fluctuate and remained low, and flat throughout. One exception was seen during the Circuit Breaker tightening phase where there was a surge of negative tweets alongside the positive tweets. Negative tweets could erode the promotion of connectedness during the pandemic. Most of the negative tweets were complaints about government institutes and government-imposed measures. Some of the tweets expressed dissatisfaction with how the government handled the COVID-19 situation. Some of the tweets complained about having to wear mask on the mass rapid transit system. There were also tweets that complained about racism.

FIGURE 11.3
Positive and negative tweets from 1 January to 30 June 2020

The results of the pronouns analysis agreed with the results of the sentiment analysis. As

shown on Table 11.5 and Figure 11.4, during the Circuit Breaker tightened phase, although there was a prevalence of the first-person plural pronoun (‘we’), first-person singular pronouns (‘I’) also increased a lot as compared to other periods. The first-person singular pronoun suggested selfishness and attention to the self [51]. Yet, during the circuit breaker initial phase, and safe reopening phase, the number of first-person plural pronoun (‘we’) were significantly higher than first-person singular pronoun (‘I’). The results seemed to indicate that during the prelude and the aftermath of a hazard (lockdown), community unity was higher than individual concern. However, during the lockdown, community unity was accompanied by negative emotions and individual concerns. The implication is that the city and community need to be very vigilant during the lockdown (a hazard) because individual anger, exasperation, and selfishness could easily build up and spread. Top-down directives and bottom-up activism could be employed to boost positivity, hope, and bonding during such times.

TABLE 11.5
Total number of different pronouns

Pronoun	Total
First Person Singular	3,592
First Person Plural	12,581
Second Person	5,182
Third Person Singular	3,348
Third Person Plural	2,188

FIGURE 11.4
Number of tweets and different pronouns throughout different phases of the pandemic

As first-person plural pronoun (‘we’) in a sentence indicates unity [51], 119 tweets with the highest number of first-person plural pronoun (‘we’) were further analysed to discover the types of collaborative problem solving and promotion of connectedness done through Twitter. The top three messages with the highest community unity markers (the word ‘we’), were about the promotion of connectedness (64%), namely, expressing appreciation for healthcare workers, urging fellow citizens to follow COVID-19 preventive measures, and sharing positivity and words of encouragement (Table 11.6). Our results agree with previous research that social media is useful to offer help, ask for help, and aid in recovery services [11]. During the pandemic when job losses, wage cuts and economic contraction are being experienced by many citizens, Twitter users used the platform to request for donation, sharing new job and volunteer opportunities. For example, crowd wisdom provided solutions for unemployed persons and small businesses by posting job opportunities and rallying people to help and support small businesses.

The ability of social media to connect people through time and space enhances collaborative

problem-solving and citizens’ ability to cope and make sense of the situation, particularly in a highly ambiguous social context [11, 52]. However, collaborative problem-solving occupies less than 50% of the communication on Twitter. Mostly, the bulk of the communication revolves around the promotion of connectedness including spreading positivity and urging fellow citizens to follow rules.

TABLE 11.6
Tweets with high number of first-person plural pronouns

Category	Total	Percentage
Appreciation for frontline, and healthcare workers	32	27%
Urging fellow citizens to strictly follow measures	27	23%
Sharing positivity	17	14%
Sharing information	16	13%
Selling product/service	10	8%
Requesting donation or other support	8	7%
New COVID-related job opportunities	4	3%
Encouraging citizens to support small businesses	3	3%
Volunteer opportunities	1	1%
Complains about government measures	1	1%

11.4.3 Regional-Specific Community Resilience

Community resilience concepts apply best to place-based communities, i.e. a community that is bound together by a place [53]. Singapore, as a nation, has given place-based planning a particular emphasis in the country’s long-term development plan with much focus on place identity [54]. Place and urban spatial structure exert a powerful influence on people’s everyday activities [55]. This section explores whether regional characteristics lead to regional-specific community resilience. The number of tweets and the top five topics across the five regions of Singapore are tabulated in Table 11.7.

TABLE 11.7
Distribution of topics and tweets across Singapore’s five regions

Region	Number of Tweets	Top 3 Topics	Topic ¹ %1
Central Region	479 (0.57)	21, 24, 0	42%, 30%, 4%
North Region	74 (0.09)	24, 21, 0	43%, 20%, 4%
North East Region	78 (0.09)	24, 21, 0	32%, 14%, 9%
West Region	166 (0.20)	24, 5, 21	47%, 33%, 4%
East Region	43 (0.05)	21, 24, 0	35%, 26%, 7%
Total	840		

Note: ¹ shows percentage of topic in Top 3 Topics in sequence.

The most popular topics for all regions are topic 24 (lifestyle and leisure), topic 21 (public holiday, nature, and relaxing), and topic 0 (youth, national, and global unity). Nevertheless, there is an aberration in the West Region where there is a relatively high number of topic 5 (jobs, companies, and industries). One may quickly conjecture that the West Region, as the industrial region of Singapore, becomes the main source of jobs topic. However, looking deeper into the tweets, all tweets from the West region that talks about topic 5, come only from one user, MukundanAP, a data scientist and motivational speaker who shares business leadership quotes daily.

The analysis seems to suggest that regional differences in Singapore are not big enough to warrant a difference in community resilience across regions during the COVID-19 pandemic. This could be due to the small land size, high population density, compact urban development and coherent policy response in Singapore. Unlike in the United States where people of different states can take different responses to wearing a mask to reduce COVID-19 transmission, the COVID-19 policy responses are implemented uniformly nationwide in Singapore.

Furthermore, people-place relationship in community resilience is often based on the assumption that different communities within geographically defined space have different levels of vulnerability and resilience, the result of different sense of community and ideals as well as attachment to place [56, 57]. In Singapore, where land is small, transportation is convenient, and government directives are strictly imposed, regional difference does not create different vulnerabilities. For example, during the water shortages in 1961 and 1963, regions near the reservoirs do not have advantages because water is rationed evenly across the nation [58]. Ethnic integration policy in Singapore's housing programme that mixes different races in public housing estates where 80% of resident population live, has strengthened social cohesion [59]. As a result, from what is shown by the tweets, different region in Singapore does not show different community resilience effort.

Berkes and Ross [56] identified two different strands of community resilience studies. The first strand treats community resilience as a social-ecological system strongly affected by geographical locations. The second strand treats community resilience as a social entity affected by personal development, social connections, and mental health. Perhaps, for the case of Singapore, the resilience of a community as a social entity is more relevant than the resilience of a community as a geographical unit.

Singapore has two different COVID-19 clusters, that are geographically unseparated, but socially separated, i.e. the dormitory cluster, and the community cluster. A stark difference in the living condition of the two clusters produces different infection rate. Dormitory cluster infection rate has been very high, even when community cluster infection rate remains moderate. The difference in social classes in Singapore has created different vulnerabilities to the pandemic.

11.5 Conclusion

In this study, #SGUnited tweets were analysed to sense community resilience in Singapore during the COVID-19 pandemic. Various analyses were performed on the tweets to understand different aspects of resilience tweets: (a) frequency count, and popular users analysis, (b) topic extraction, (c) sentiment analysis, (d) pronoun analysis, and (e) geospatial analysis. Frequency count shows that resilience tweets follow different phases of government measures in curbing the pandemic. During the time when strict lockdown is imposed, resilience tweets are high, and during relaxed measures, resilience tweets are low. Popular user analysis reveals the importance of citizens in popularizing tweets while topic extraction indicates that although the 'lifestyle and leisure' topic takes the bulk of the conversation on Twitter, it rarely gains traction. Other topics, such as Circuit Breaker, and appreciation for healthcare front-liners, are more likely to get popular during a health pandemic.

Sentiment and pronoun analysis show that #SGUnited tweets are generally positive and contain a lot of first personal plural pronouns ('we'), indicating group unity. Tweets with the highest number of group unit markers ('we'), are mostly about the promotion of connectedness, and community response coordination than about collaborative problem solving. It would appear that Twitter is mostly used in Singapore as a tool to promote connectedness and coordinate top-down government directives during the pandemic. Perhaps because of this effort towards connectedness, the geospatial analysis does not show much regional differences. Instead, the indication is that Singapore works as one community to fight the pandemic even though there might be differences in infection rate among population groups. Overall, our study illustrates the use of social media as a population-level sensor for community resilience during the pandemic; it provides a promising data source for understanding user attitudes, thoughts and feelings towards the unprecedented health epidemic. Central to strengthening community resilience is partnership and a coordinated approach that informs and engages all stakeholders including the people themselves, to mobilise collective efforts and practise social responsibility.

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