



Faculty of Education, Language and Communication

**The Pattern of Tweets by Malaysian Twitter Users during
COVID-19 Vaccination**

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The Pattern of Tweets by Malaysian Twitter Users during COVID-19 Vaccination

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DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Malaysia Sarawak. Except where due acknowledgements have been made, the work is that of the author alone. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

A handwritten signature in black ink, appearing to read 'Eisyah', is written over a horizontal dotted line.

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ABSTRACT

The current study examined the Malaysian Twitter users' sentiment on COVID-19 vaccination utilizing Thematic Analysis, sentiment categories, and Appraisal Theory to observe the i) themes on COVID-19 vaccination that were discussed in tweets; and ii) patterns of sentiments on COVID-19 based on the Appraisal Theory. Twitter messages written by Malaysians from January 1 to December 31, 2021, were collected, which further divided into three different phases. The analysis found three themes and 17 sub-themes with a total of 85 (56.7%) of the tweets focused on the administration of the vaccine, 52 tweets (34.7%) expressed concerns about the impact of vaccines, and 13 tweets (8.7%) discussed vaccination and COVID-19 control. In addition, most of the Malaysian Twitter users have a positive view on COVID-19 vaccination, evidenced by the fact that positive sentiment was the most frequently expressed sentiment category (n=78) of all the three phases, with the highest frequency of positive tweets from Phase 2 (22%), followed with Phase 1 (16.7%), and Phase 3 (13.3%). The usage appraisal aspects of Engagement (n=218) recorded the highest category followed by Attitude (n=128) and Graduation (n=118) indicate the Malaysian Twitter users were paying more attention to the evaluation of events and situations, rather than expressing their own attitudes or opinions or focusing on the level of intensity or focus on their language. In conclusion, this study found the changing pattern of the discussion in relation to the different phases of disease spread and control in Malaysia.

Keywords: Malaysian Twitter users, COVID-19 vaccination, appraisal theory, thematic analysis, sentiment categories

Corak Tweet oleh Pengguna Twitter Malaysia semasa Vaksinasi COVID-19.

ABSTRAK

Kajian ini mengkaji sentimen pengguna Twitter Malaysia tentang vaksin COVID-19 dengan menggunakan Analisis Tematik, kategori sentimen, dan Teori Penilaian untuk mengawasi i) tema-tema tentang vaksin COVID-19 yang dibincangkan dalam tweet; dan ii) corak sentimen tentang COVID-19 berdasarkan Teori Penilaian. Mesej Twitter yang ditulis oleh rakyat Malaysia dari Januari 1 hingga Disember 31, 2021 telah dikumpulkan, yang kemudiannya dibahagikan kepada tiga fasa yang berbeza. Analisis telah menemui tiga tema dan 17 sub-tema dengan jumlah 85 (56.7%) daripada tweet memberi tumpuan pada pentadbiran vaksin, 52 tweet (34.7%) menyatakan kebimbangan tentang impak vaksin, dan 13 tweet (8.7%) membincangkan vaksinasi dan kawalan COVID-19. Selain itu, kebanyakan pengguna Twitter Malaysia mempunyai pandangan yang positif tentang vaksin COVID-19, dibuktikan dengan kategori sentimen positif yang paling kerap digunakan (n=78) dalam ketiga-tiga fasa, dengan kekerapan tweet positif tertinggi dari Fasa 2 (22%), diikuti dengan Fasa 1 (16.7%), dan Fasa 3 (13.3%). Aspek penilaian penggunaan Penglibatan (n=218) mencatatkan kategori tertinggi diikuti oleh Sikap (n=128) dan Gradasi (n=118) menunjukkan pengguna Twitter Malaysia memberi perhatian lebih kepada penilaian kejadian dan situasi, daripada menyatakan sikap atau pendapat mereka atau memberi tumpuan pada tahap intensiti atau fokus dalam bahasa mereka. Kesimpulannya, kajian ini mendapati corak perubahan dalam perbincangan berkaitan dengan fasa-fasa berbeza penyebaran dan kawalan penyakit di Malaysia.

Kata kunci: *Pengguna Twitter Malaysia, vaksin COVID-19, teori penilaian, analisis tematik, kategori sentimen*

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LIST OF ABBREVIATIONS

API	Application Programming Interface
ANN	Artificial Neural Network
ASCII	American Standard Code for Information Interchange
CGS	Centre for Graduate Studies
CDC	Centers for Disease Control and Prevention
COVID-19	Coronavirus Disease 2019
JKVAV	<i>Jawatankuasa Khas Jaminan Akses Bekalan Vaksin COVID-19</i>
LDA	Latent Dirichlet Allocation
LIWC	Linguistic Inquiry and Word Count
LSTM	Long Short-Term Memory
MOH	Ministry of Health Malaysia
MySJ	MySejahtera
NB	Naïve Bayes
NPRA	National Pharmaceutical Regulatory Agency
PICK	National COVID-19 Immunization Program
SOP	Standard Operating Procedures
UNIMAS	University of Malaysia Sarawak
UN	United Nations
UK	United Kingdom
US	United States of America
WHO	World Health Organisation

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter explains the research problem, the purpose of study covering the aim and objectives of the study, the operational definitions of terms used, and the significance of the study.

1.2 Research Problem

The public viewpoint on emerging diseases and the events surrounding a pandemic is bound to shift in the wake of such occurrences, and some of these thoughts and emotions may find an outlet in the virtual realm. In the latter half of the 20th century, people began to use the Internet to disseminate health-related information, mostly through personal websites, online forums, and online communities. The ways of communicating health concerns have evolved in recent years due to the large number of online social networks (Smailhodzic, Hooijsma, Boonstra, & Langley, 2016).

On March 11, 2020, the World Health Organization declared a pandemic of the Coronavirus Disease 2019 (COVID-19) virus. COVID-19 disease is caused by a virus that spreads in the air, and people catch the disease from being around an infected person or through droplet infection from coughing or sneezing (World Health Organization, 2020). The first case of COVID-19 was reported in Wuhan, China and spread around the world by the end of December 2019, affecting 228 countries and territories (Worldometer, 2022). According to World Health Organization (2022), by December 2022, there were 640,395,651 of cumulative positive cases with over 6,618,579 of cumulative deaths around

the world. The World Health Organization, governments, and health authorities have imposed several restrictions due to the uncontrolled spread of the COVID-19 since December 2019. Countries around the world have implemented several strict policies to fight the coronavirus pandemic, including “lockdowns” at home, shutdown of schools and workplaces, cancellation of events and public gatherings, and limitations on public transportation for a certain period of time.

To lower the risks from the transmission of the virus, the vaccination programme was implemented as soon as the testing of the vaccines was conducted. It is essential for the population to acquire herd immunity, which is an indirect protection against an infectious illness, and the immunity is either through vaccination or past infection (World Health Organization, 2022). It is expected that approximately 70% of the population needs to be vaccinated for a country to achieve herd immunity (Aguas et al., 2020). At the present time (March 2023), 50% of the population in Malaysia were fully vaccinated (Statista Research Department, 2023) against COVID-19 (with a total of 72,143,811 administered, 28,103,503 received at least one dose, 27,511,075 received two doses of vaccines and 16,239,413 received the booster dose).

As the COVID-19 pandemic spread globally, the public’s online interest in COVID-19 vaccine-related issues, especially their reactions to the effort on administering vaccination increased (Lyu et al., 2021). The prevalence of COVID-19 concerns the population, and the conversation on this topic has been disseminated via social media or face-to-face interaction. For instance, the rapid development of alternative COVID-19 vaccinations, which is significantly faster than previously established vaccines, as the typical vaccine development timeline takes five to 10 years to assess the vaccine’s safety and efficacy in clinical trials (Johns Hopkins University, 2023), has sparked intense online and offline discussions, as well

as negative responses marked by high levels of worry, uncertainty, and hesitancy. Most of the negative reactions resulted in the spread of incorrect information on vaccinations, which discourages the vaccination of other members of the population. Here, social media might offer a window into thoughts regarding many aspects of COVID-19, such as control measures and news updates on the virus's rapid spread. As individuals often express their opinions and points of view on social media, text mining can be employed to determine the public's rejection and acceptance of vaccination to contain the spread of diseases.

Among the various social media platforms, Twitter is one of the key channels (Rufai & Bunce, 2020) utilised to encourage vaccination and decrease the cumulative number of positive COVID-19 cases during the pandemic (Rosli, 2021). According to Google Trend, the terms "COVID-19" and "COVID-19 vaccination" have been trending on online search engines since February 2020 due to the restrictions on movement, travel, and the introduction of work-from-home regulations, which have increased the public's desire for online information. In addition, adapting to the new changes and the lack of information about the new virus have caused difficulties and challenges in starting a new life under the restrictions and uncertainties, as well as the need for social distancing in the physical world, which have contributed to a significant increase in the search for information online, especially in social media applications (Tsao et al., 2021).

During public health outbreaks, social media text analysis can provide first responders with crucial information about public worries and developing issues (Lachlan et al., 2014; Yoon et al., 2013). According to Peretti-Watel et al. (2020), conventional surveys and social media are the platforms where individuals express their opinions on disease outbreaks (Guess et al., 2020; Velasco et al., 2014). According to one of the earlier studies on disease outbreaks, conducted by Lazard et al. (2015) on the Ebola outbreak, fear was the

most prevalent emotion, and the public's main concerns were the symptoms and prognosis of the virus, disease transmission, safe travel, and physical protection. Moreover, Mondragon et al.'s (2016) study also showed fear as the most prominent emotion related to the Ebola outbreak, with government officials and the media being blamed for the incompetent management of the issue. However, based on their analysis of H1N1-related tweets, Chew and Eysenbach (2014) showed that the public experienced a wider range of emotions that include humour, relief, irritation, and intrigue. Similarly, for measles outbreak, Mollema et al. (2015) reported that the main sentiments expressed on social media were irritation, humour, sarcasm, concern, and relief. These studies showed that there were both positive (concern, relief, intrigue) and negative sentiments (fear, irritation, sarcasm) in response to disease outbreaks, and humour could be a way of dealing with a worrying situation.

While several studies have highlighted the diverse implications of COVID-19 on public health prevention effort, few have studied the pandemic's impact on people's perceptions (Cucinotta & Vanelli, 2020). For instance, research has expanded our knowledge of viral transmission, self-protection, and the efficiency of numerous immunisations. Similarly, a significant amount of research focuses on the effectiveness of vaccines, vaccination aversion, and vaccine uptake. Due to the availability of access to vast quantities of online social network data, numerous studies utilise such data to test their proposed strategy, run experiments, and analyse people's sentiments towards a particular topic (Fatemi & Zheleva, 2020; Gao et al., 2020). The World Health Organization identifies vaccination hesitancy as one of the top 10 global health issues (Kuneman et al., 2020). When people are exposed to inaccurate information, it affects their willingness to get vaccinated, but their reluctance and negative tendencies are repressed (Piedrahita-Valdes et al., 2019). As social

media communications are a source of naturally occurring interactions, social media users may feel free to reveal pro- and anti-vaccination attitudes' emotions, feelings, and perspectives.

The past research in Malaysia on COVID-19 is more towards knowledge, attitude, and perception towards COVID-19 prevention and the results are positive (Nor et al., 2020), including a high level of acceptability of COVID-19 vaccines. For example, Elnaem et al. (2021) found that Malaysian adults exhibited positive attitudes by being willing and registered to be vaccinated during the six-month National Immunization Program for COVID-19, and the youth group responded positively by providing positive feedback on the government's "Let's Get Vaccinated Campaign" messages and social media platforms (Hassim et al., 2021). However, another Malaysian study found that the acceptability rate of the vaccine in Malaysia was significantly lower amongst males, people with chronic diseases and those from a lower economic background with poor knowledge about COVID-19 vaccine particularly in those with low education levels and income (Mohamed et al., 2021). According to Naseem et al. (2021), prior research on COVID-19 vaccine reactions has primarily focused on effectiveness, acceptance, attitudes, and opinions.

A review of literature shows that little is understood about the predominant emotions of the population during the COVID-19 pandemic. In the Malaysian state of Sabah, Jafar et al. (2022) identified the leading causes of vaccine hesitancy to participate in the National COVID-19 Immunization Program (PICK), with 62.7% of respondents not registering due to low "confidence" in the vaccine effectiveness, low level of trust towards the "authority" to distribute vaccine, "mainstream media" weakness that spread misinformation, poor "complacency" and understanding of the risks of the virus, bad "social media" influence, and "convenience" issues in terms of availability and accessibility to vaccines and health

services. The respondents also believed that Standard Operating Procedures (SOP) practices were sufficient to prevent the spread of the virus even without vaccination. Perception studies are susceptible to social desirability bias, and as a result, individuals may tend to report higher knowledge and more positive attitudes and perceptions than the actual reality. More accurate insights into the flow of sentiments on COVID-19 vaccination can be obtained by studying naturally occurring communication in social media.

It is preferable to analyse naturally existing data in order to gain a better grasp of attitudes regarding COVID-19 disease and related issues, such as vaccination, in order to achieve a better understanding of these attitudes. Conversations occurring face-to-face and on social media platforms are good sources of authentic data that are not susceptible to social desirability bias or manipulation by the researcher. There are currently no published studies on the analysis of organically occurring social media communication. Little is known about how Malaysians actually discussed COVID-19 vaccines on social media. It is vital to study the topics discussed and attitudes expressed in social media communication during various phases of the disease's development in order to discover the areas of concern, fear, and hope, so that the knowledge can be used by health authorities and the government to create more successful COVID-19 awareness efforts.

1.3 Aim and Objectives of the Study

The study examined how Malaysian Twitter users communicated on Twitter during the different phases of COVID-19 outbreak and control in 2021. There are two objectives addressed in this study, which to:

- (1) Identify the themes on COVID-19 vaccination that were discussed in tweets; and
- (2) Analyze the patterns of sentiments on COVID-19 vaccination based on the Appraisal Theory.

To address the objectives, the study seeks the answer to the following research questions:

- (1) What were the dominant themes surrounding COVID-19 vaccination discussed by Malaysian Twitter users in 2021?
- (2) How did the themes related to COVID-19 vaccination evolve over the different phases of the outbreak and control in Malaysia in 2021?
- (3) What were the most dominant sentiment categories (positive, neutral or negative) that Malaysian Twitter users used when discussing on COVID-19 vaccination?
- (4) What patterns of sentiments (such as evaluation, affect, and appreciation) were observed in Malaysian Twitter discussions about COVID-19, as per the Appraisal Theory framework?

1.4 Operational Definition of Terms

1.4.1 Malaysian Twitter Users

Twitter is a micro-blogging site that allows people to post and read short messages (called “tweets”) from and about other users. The term “Malaysian Twitter Users” used in this study refers to the individuals or Twitter users who posted tweets in Malaysia on COVID-19 vaccination, whether they have been vaccinated or not.

1.4.2 COVID-19 Vaccines

Vaccine, as defined by Winchester Hospital (2022), is a biological substance used to prevent bacterial and virus infections in humans. It is also called as “immunizations” as it imitates the body’s immunological response to disease. In Malaysia, there are eight types of vaccines that has been approved to use by the Government including the Moderna, Pfizer/BioNTech, CanSino, Janssen (Johnson&Johnson), Oxford/AstraZeneca, Covaxin, Sinopharm, and Sinovac (COVID19 Vaccine Tracker, 2022). However, because Twitter users in Malaysia may employed other terms while discussing this issue, the search terms include related keywords such as Coronavirus, COVID19, C19, Sputnik V, vaccine (s), vaccination (s), vaccinate (d), vaccination drive (s), booster (s), and immunisation (s).

1.4.3 Thematic Analysis

Thematic Analysis is a qualitative research method used to identify, analyze, and report patterns or themes within textual data (Braun & Clarke, 2006) which involves a systematic process of coding and categorizing text data to uncover meaningful themes that provide insight into the perspectives, opinions, and attitudes of participants. In the context of this study, an inductive Thematic Analysis was applied to gain a deeper understanding of the underlying themes and patterns in the content shared by Malaysian Twitter users during different phases of the COVID-19 outbreak and control in 2021. This method enables the researchers to extract valuable insights from the textual data, contributing to a comprehensive understanding of the discourse surrounding COVID-19 vaccination on Twitter in Malaysia. Some of the themes identified through inductive Thematic Analysis in

this study were Vaccine Administration, Vaccination and COVID-19 Control and Impact of Vaccine.

1.4.4 Sentiment Analysis and Categories

Sentiment analysis is a method employed to assess the emotional tone or attitude conveyed within text data. In the context of this study, sentiment analysis is used to discern whether tweets express a positive, negative, or neutral sentiment towards COVID-19 vaccinations. This analysis is based on the categorization criteria outlined in the codebook developed by Nuzhath et al. (2021). Sentiment is defined as a positive or negative judgement communicated through words (Taboada, 2016). According to the Nuzhath et al.'s (2021), codebook, tweets were categorised as positive, negative, or neutral based on their attitudes toward vaccinations. The tweets were classed as positive if they referenced scientific discoveries connected to the COVID-19 vaccine trial, if they requested information on how to participate in the clinical study, or if they indicated a good attitude about the COVID-19 vaccination. Next, tweets were deemed negative if they referred to vaccinations as unnecessary, provided misinformation or conspiracy theories, or raised safety and efficacy concerns about the coronavirus vaccine. Neutral categories where the overall sentiment of the tweet was neutral, and when tweets did not contain emotive language or reference a COVID-19 vaccination clinical study in general.

1.4.5 Phases of COVID-19 Spread and Control

People's opinion on any issue could change over time, while a phase is a different aspect or state within a cycle of changes. This study divides the study period into three phases

based on iconic events, ranging from the unavailability of vaccines in Malaysia to the implementation of the third dose of COVID-19 vaccination after 80% of the adult population has been fully vaccinated, to observe a clear picture of how Malaysian Twitter users reacted on events related to COVID-19 vaccination. The COVID-19 vaccination tweets were collected from January 1 to December 31, 2021, encompassing three phases of disease spread and control: (1) before the availability of vaccination (January 1 to February 23, 2021), (2) arrival of the first vaccine in Malaysia (February 24 to September 24, 2021), and (3) implementation of a booster dose (September 25 until December 31, 2021).

1.5 Significance of the Study

The study made significant contributions to knowledge through an in-depth Thematic Analysis of selected case studies. It generated novel insights into the types of content shared by Malaysian Twitter users surrounding COVID-19 vaccination during the phases of disease spread and control. This shed light on the predominant concerns of Malaysian Twitter users regarding the virus outbreak, from its onset to its containment. In addition, it is possible to study the changes in the opinion of Malaysians during different phases of vaccination. By examining the discussion on COVID-19 vaccination difficulties among Malaysian Twitter users, it will be possible to determine how Malaysian Twitter users reacted during the vaccination phases. This work contributes to the body of knowledge by evaluating the viability of Twitter data for getting in-depth understanding of infectious disease epidemics. As previously indicated, social media research is a rapidly evolving and emerging discipline, and a substantial portion of studies that have used Twitter for health objectives have employed quantitative methods. Therefore, one of the objectives of this study was to determine whether Twitter could provide in-depth insights on health-related topics. A

fundamental virtue of Twitter data is that it captures real-time information rapidly (Ahmed, 2018). The results of this study were used to obtain a better understanding of the types of discussions that occur throughout an infectious disease outbreak's spread and containment.

The opinions of Malaysian social media users on a variety of themes (their concerns, anxieties, and hopes) reveal what promotes vaccine uptake and what causes reluctance. Social influencers and government bodies can utilize the information to urge the public to be vaccinated. To lessen vaccine reluctance, it is crucial for public health officials to comprehend the primary public interests and concerns (Lyu et al., 2021). The results of this project can be of potential interest to organizations such as the WHO, the United Nations (UN), and the Ministry of Health (MOH) in Malaysia on how the discussion related to disease outbreak, control strategies and vaccination campaign has been discussed by the public which expressed through the social media platform for planning more effective vaccination campaign in the future.

1.6 Chapter Summary

This chapter covered the topics of this study which examined the Malaysian Twitter users' sentiment on COVID-19 vaccination from January 1 to December 31, 2021. In Section 1.2, the problems of the study and what is currently known about this topic based on past studies were explained. In addition, Section 1.3 provided the purpose and objectives of this study. Considering there are specific terms used in this study, operational definition was explained in Section 1.4 on important keywords such as "Malaysian Twitter users", "COVID-19 vaccines", "themes related to COVID-19 vaccination", "sentiment categories", and "phases of disease spread and control" used in this study. Lastly, Section 1.5 explained the significance of this study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the infectious disease on social media, COVID-19 vaccines on Twitter, Thematic Analysis and Topic Modelling, sentiment analysis and categories and the Appraisal Theory by Martin and White (2005). Where relevant, in the review of related literature, results on the public sentiments and attitudes reported in papers on social media are included.

2.2 Infectious Disease and Social Media

The internet has emerged as a resource for getting medical information in the late 20th and early 21st centuries (Diaz et al., 2002; Morahan-Martin, 2004). With the advanced internet and online communication services, the usage of social networks has taken place in 2000 with a great boost of many social networking sites springing up such as Friendster (in 2001), Myspace, LinkedIn (in 2003), Yahoo!360, Youtube (in 2005), and Twitter (in 2006) (Edosomwan et al., 2011). The advancement of social networking services helps users to find more information in an easy and quick way, and one type of the information searched is related to health information.

In addition, people with a need for health-related information on the Internet can obtain it at any time of day in full anonymity (Morahan-Martin, 2004). However, there were still concerns related to the accessible health information shared on the internet. For example, research indicates people tend to believe the online information to be reliable and correct (Fogel et al., 2002). Early studies on health information on the Internet revealed that it can

affect public decision making. Moreover, health information on the Internet revealed that as many as 70% of Internet users claimed that the content on the Web influenced their medical decisions (Fox & Rainie, 2000).

Social media provides an efficient platform for general users, patients, and their relatives to access information from other users, ask help and advice from other users, make contributions to others, receive assistance from the forum and share their experiences in the community. With the access to information on social media platforms, people find useful information more effectively and personally than traditional information retrieval through search engines. Between 2011 and 2016, there were 21 studies have been published concerning health information and social media, which range from the discussion on specific disease to public concerns (Zhao & Zhang, 2017). Twitter is one of the social media platforms that grew in popularity as an important resource for public health research and has been used in many studies to track trends and behaviours related to illnesses and conditions (Nelson & Staggers, 2013).

The role of social media in providing accessible health information and the heightened risk of infectious disease outbreaks in our interconnected world have converged, highlighting the need to explore how these dynamics intersect. As documented by the World Health Organization and the World Bank, infectious disease outbreaks account for 29 of the 96 leading causes of human mortality, accounting for a high number of deaths in a short period of time (Murray & Lopez, 1996; Taylor et al., 2001). Due to increasing globalization in the 21st century as a result of international trade and travel, the probability of a fatal infectious disease outbreak spreading from one country to another has grown (Smith, 2006). There have been numerous infectious disease outbreaks affecting the public in recent years, including the swine flu pandemic (in 2009), the Ebola epidemic (in 2014), and the Zika

outbreak (in 2016). One of the most recent global outbreaks of infectious disease was Coronavirus disease in 2019 (COVID-19).

COVID-19 is an infection caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2; formerly known as 2019-nCoV), which was first identified in Wuhan City, Hubei Province, China, during an outbreak of respiratory disease cases (CDC, 2019). The World Health Organization (2020) reported that it was first detected on December 31, 2019. Then, on January 30, 2020, the World Health Organization declared the COVID-19 outbreak a worldwide health emergency. On March 11, 2020, the World Health Organization declared COVID-19 a global pandemic. A majority of infected individuals experience mild to moderate respiratory symptoms and recover without medical intervention. Others, though, become dangerously ill and require medical care. The global pandemic and COVID-19 itself have impacted a variety of sectors.

The public expressed a range of reactions and attitudes to the COVID-19 pandemic. One of the earliest studies on COVID-19 was by Kruspe et al. (2020) who analyzed sentiments expressed in tweets collected from December 2019 until April 2020. The researchers studied the development of these sentiments over time, segmented the results by country, and correlated them with events that took place in each country during those five months. As for the data collection, the Twitter Application Programming Interface (API) was used to collect the tweets using few keywords for filtering the tweets such as “corona”, “covid”, “wuhan”, “koroona”, and “korona”. The Twitter users were from Italy, Spain, France, Germany, and United Kingdom (UK). The researcher sub-sampled the data collection, approximately 4,683,226 geo-referenced tweets in 60 languages located in Europe, then downloaded a shapefile of the earth in order to create the European sample before been filtered using Python. The data analysis in this research is mainly based on

training neural networks on the Sentiment140 dataset (Go et al., 2009) which consists of 1.5 million tweets.

The analysis of sentiments of tweets from countries in Europe by Kruspe et al. (2020) shows a decline in the sentiment curve over time. A decline in the sentiment curve means that the sentiment of tweets became more negative over time, hence, this study shows that the public's moods became more negative as time passed. Out of 40,000 Italian tweets, 12,000 contained the search keywords. Before the end of January (when the first cases in Italy recorded), the sentiment curve was low, but it climbed during March and coincided with the announcement of the Italian lockdown. In Spain, 780,000 tweets were collected of which 14,000 were keyword tweets. The sentiment curve increased when a lockdown was announced in March. As for France, there were 309,000 tweets with 4,600 approximately keyword tweets. Interestingly, the sentiment curve in France started to dip when the lockdown started on 16 March 2020. Germany recorded 415,000 tweets and 5,900 keyword tweets, and the sentiment curve was quite flatter than the other countries. As for the UK, around 1,380,000 tweets containing 22,000 keyword tweets were collected. The sentiment curve in the UK peaked during early March due to the lockdown and dipped until mid-March when the other European countries implemented lockdown. Overall, Kruspe et al. (2020) analyzed 4.6 million tweets. In the UK and European countries, the sentiments were negative at the beginning of the COVID-19 pandemic but after March the public began to think about the risks and handling of the situation in a more relaxed way.

Accurate and reliable information is the only source can be relied on by the public during this period, however, there were numbers of false information spread keep increasing, it is important to identify the trustworthiness of the information spread during this period. Prabhakar Kaila and Prasad (2020) focused on the information flow on Twitter related to

“#coronavirus” outbreak by downloaded 18,000 tweets using the package “rtweet” in R since it is the maximum number of tweets can be downloaded using the package and Twitter API. After converted the tweets into a corpus of text, sentiment analysis was conducted using package “syuzhet” in R, NRC sentiment dictionary also used in this study in order to calculate the presence of eight different emotions (anger, anticipation, disgust, fear, joy, sadness, surprise, and trust) together with its polarity (positive and negative). Topic Modelling in this study applied LDA to create a mixture of topic for document related to fixed set.

Prabhakar Kaila and Prasad (2020) found that negative sentiment was slightly higher than positive sentiment. As for the emotion analysis, fear recorded the highest percentage followed by trust, anticipation, sadness, anger, joy, disgust and surprise. The frequent words in tweets also mostly relevant to the corona virus outbreak such as people (1800), cases (1400), virus (1100), china (900), health (820), outbreak (650), world (620), confirmed (610), spread (610), positive (500), quarantine (400), oil (390), panic (390), tested (390), cruise (390), countries (380), infected (370), deaths (370), markets (310) and pandemic (310). Correctional analysis on two most critical words which are “covid” and “quarantine” showed the highest correlation for “covid” was “coronavirusoutbreak” with 0.25, and the lowest was “U.S.A” with 0.10, while the highest correlation for the word “quarantine” was “implementation” with 0.14, and the lowest was “restrictionscritical” with 0.10. Topic Modelling analysis found 10 different topics with different top term words. Topic 1 was about panic caused by the coronavirus, Topic 2 was related to self-testing suggestion by the government, Topic 3 was mainly about confirmed cases in China, Topic 4 discussed about coronavirus outbreak in other countries, Topic 5 was about the spread of infection, Topic 6 was more about news posted about COVID-19, Topic 7 was mainly about USA President

speech about coronavirus, Topic 8 was about the outbreak on the cruise ships in Japan and USA, Topic 9 discussed the advice by health authorities, and Topic 10 referred to government suggestions to take care against the virus. In conclusion, the information flow on Twitter related to coronavirus outbreak was relevant and mostly accurate.

Another study on topics and sentiments on COVID-19 in Twitter was carried out by Naseem et al. (2021) on worldwide data collected using Tweepy, an official Python Twitter API library from February to March 2020. There are 12 keywords that the researchers used to collect the data, which were “Coronavirus”, “Corona”, “Covid”, “COVID-19”, “Pandemic”, “Corona Outbreak”, “Coronavirus Outbreak”, “Stay Home”, “Coronavirus Pandemic”, “Lockdown”, “Social Distance”, and “Quarantine”. There are roughly about 2.1 million tweets found during those two months period, the researchers then choose the tweets according to few criteria which resulting with 90,000 tweets from 70,000 users collected. Text Blob was used to decide the polarities of the sentiments, whether positive, negative, and neutral. The study found that worldwide users on Twitter expressed negative sentiments more often compared to positive sentiments in relation to COVID-19. However, the intensity and count of negative sentiment decreased over time. Additionally, the study conducted exploratory analysis and identified the most frequently mentioned keywords, such as coronavirus cases, social distancing, and staying at home.

By May 2020, the sentiments on COVID-19 pandemic were positive in Nepal. Pokharel (2020) collected the data from Nepalese Twitter users from May 21, 2020, until May 31, 2020. The data were collected using the Tweepy python library with the Twitter API provided by the Twitter Developer with the usage of hashtags (i.e., #coronavirus and #COVID-19), resulting in 615 tweets collected. During the process, the no-English keywords, stop words, @, hashtags, retweets (RT), and emojis were tokenized to facilitate

analysis of the data. Next, TextBlob library, which takes advantage of Naïve Bayes (NB) model, was used to find the polarity of the text, whether it is positive, neutral, or negative text. The sentiment polarity result found that out of 615 tweets, 58% of it were positive, 27% neutral, and 15% negative for both keywords. The highest number of positive sentiments out of the 11 days period is on May 29, 2020, while negative sentiments is on May 23, 2020. The perspective of tweeters (subjective or objective viewpoints) showed that the large portion of the records were objective with the average of 62.27%, meanwhile the average of subjective was 32.37%, which express feelings and opinions. Average sentiment analysis showed eight different categories (worry and boredom, relief, pessimism and impatience, optimism, neutral and relaxed, hope, confidence, and calm and content). The highest percentage is neutral and relaxed sentiments (56%), and there were only three tweets with the “confidence” keyword. In conclusion, Pokharel (2020) concluded that a substantial number of mentions regarding the corona virus outbreak were mostly positive.

In the United States, Hung et al. (2020) analysed social sentiments against COVID-19 in Twitter using Machine Learning (ML) methods that usually used in the artificial intelligence field. This study reveals that discussions on Twitter reflect an overall supportive attitude from Americans regarding infection prevention efforts taken by authorities in response to COVID-19 pandemic. The tweets were collected from the US Twitter users within one-month period from March 20 until April 19, 2020. There are 13 keywords used in order to collect 1,001,380 tweets regarding COVID-19, which are “Coronavirus”, “Covid”, “COVID-19”, “SARS-CoV-2 670”, “Stay home”, “covid19 134”, “lockdown”, “shelter in place”, “coronavirus truth”, “outbreak”, “pandemic”, “quarantine”, “social distancing”, “hoax”, “be kind”, “health heroes”, “ppe”, “isolation”, “homeschooling”, “school cancelled”, and “online teaching”. The researchers also used Valence Aware

Dictionary and Sentiment Reasoner (VADER) to determine the polarity of the tweets, whether it is positive, neutral, or negative sentiment.

Hung et al.'s (2020) sentiment analysis revealed that 48.2% (434,254) of the tweets have a positive sentiment, 20.7% (187,042) neutral, and 31.1% (280,842) of the tweets have negative sentiments. During this period, five overarching themes of the discussion has been identified in the United States such as “Health care environment” reflects the public’s concern about how governments are responding to COVID-19, “Emotional support” indicating a sense of solidarity among Americans during this difficult time, “Business economy” shows that concerns on economic issues related to job losses due to lockdowns or other measures taken in response to COVID-19 pandemic, “social change” used frequently suggesting an awareness amongst citizens regarding social inequalities exacerbated by COVID-19 crisis and “psychological stress” reflecting on mental toll caused by fear & uncertainty associated with coronavirus outbreak. Among the 50 states, Alaska, Wyoming, New Mexico, Pennsylvania, and Florida recorded the most negative sentiment, meanwhile, tweets from Vermont, North Dakota, Utah, Colorado, Tennessee, and North Carolina showed the most positive sentiment. Overall, positive tweets outweighed negative tweets. The sentiments can clarify the public response to COVID-19 and help guide government officials, private entities, and the public with information to manage the pandemic.

The opinions of the public changed during the long pandemic when the COVID-19 cases increased and when vaccination programmes were implemented. Mansoor et al. (2021) conducted a worldwide sentiment analysis of tweets connected to Coronavirus. There are four datasets that had used in this study which are the dataset for coronavirus tweets (165,116 tweets collected from January 1,2020 until June 29, 2020), online learning tweets (40756 tweets collected from February 19, 2020, until June 26, 2020), work from home (41,349

tweets collected from February 22, 2020 until June 26, 2020), and an existing dataset on COVID-19 obtained from Kaggle (data from January 22, 2020 until June 22, 2020). The analysis focused on the worst-affected countries, such as the United States, Brazil, and India. Next, the NRC emotion lexicon (also known as NRCLex) was used to categorize words into eight basic emotions (anger, fear, anticipation, trust and surprise, sadness, joy, and disgust). Raw emotion scores were calculated using the Python NRCLex package, which provide a count of the number of words in the text linked with each emotion. After that the visualisation of the number of confirmed cases was performed using data from the Kaggle COVID-19 cases dataset in order to compare the numbers to public attitude and feelings. Lastly, two deep learning models, Artificial Neural Network (ANN) and Long Short-Term Memory (LSTM) were used to determine the polarity of the thoughts stated in the tweets.

Mansoor et al. (2021) found that the accuracy of Machine Learning models on the coronavirus tweets dataset, 84.5% was obtained using LSTM and an accuracy of 76% was obtained using ANN. The emotion analysis on the worldwide shows that throughout the pandemic, the fear emotion has been substantially more prevalent than the trust emotion. Bangladesh, Pakistan, Mali, and South Africa are among the countries having a higher proportion of positive sentiment. Meanwhile, Australia, India, Canada, the US, Turkey, UK, and Brazil are among the countries with the highest share of negative sentiments. As for the analysis on the most hit country (United States, India, and Brazil), in US had a higher percentage of trust emotion in March, which could be attributed to the government's implementation of lockdowns to combat the infection. The higher percentage of fear feeling in April could be due to the exponential increase in the number of instances. The trust feelings in April in Brazil were linked to the Brazilian government offering financial help to the people. In India, there was an exponential increase of both positive and negative tweets

in May which corresponded with a spike in the number of cases. With the lockdown being implemented numerous times in May 2023, the percentage of trust tweets was higher, but the trust dropped in June when the lockdowns were lifted. The findings show that positive sentiments toward working from home have always outnumbered negative sentiment, while for online learning, the proportion of positive tweets has been higher.

In addition to studies related to sentiment analysis, other research endeavors in the field of infectious diseases and outbreaks have played a crucial role to aid understanding of public responses and to address public health challenges. The long movement restriction has impacted the physical and mental health of the public (Mustafa & Balla, 2020). Abdul Aziz et al. (2021) analysed how human emotions and concerns in Twitter changed during two periods, namely, March 1 to April 30, 2020, and September 1, 2020, to October 31, 2020. Their dataset is an open-source dataset that contains 942,149,169 tweets from many languages. However, only 567,064 English tweets were analysed. Two algorithms applied in this research which are the Latent Dirichlet Allocation (LDA) and lexicon-based approach. The LDA was used to extract the most common topics discussed from a tweet's text, and the Vader lexicon-based model was used in order to identify the tweets sentiments, whether it is positive, negative, or neutral.

Abdul Aziz et al. (2021) found that there are eight topics that was commonly discussed by the Twitter's users during the study period such as loses, drug research, updated cases, school closure, rules, lockdown, economy, and news. The "losses" topic had the highest percentage during the first period of this study, but "drug research" had the highest percentage during the second period. In addition, these eight topics were identified from each sentiment polarity categories, positive, neutral, and negative, hence it had word clouds individually. For the positive cases, "agreement", "ability", "advantage", "appreciate",

“accept”, “authority”, “assure”, “benefit”, “admit”, “asset” and “allow” were the most frequent words. The most neutral words for each topic were “accord”, “adult”, “adviser”, “access”, “academy”, “absence”, and “abundance”. The most negative words were “cancel”, “attack”, “avoid”, “burden”, “anxiety”, “abuse”, “accident”, “anger”, and “absentee”.

As discussions on COVID-19 evolve, it became apparent that there are controversial terms and research has shown an association between the use of controversial terms and open-mindedness. Lyu et al. (2020) has analysed the usage of controversial terms like “Chinese Virus” or “Wuhan Virus” versus non-controversial terms like “Coronavirus” when referring to COVID-19 on Twitter. The data collection applied Tweepy API to retrieve 17 million worldwide tweets using keyword, which was controversial and non-controversial filtering from 23 March 2020 until 5 April 2020. The controversial keywords consist of “Chinese virus” and “#ChineseVirus”, whereas non-controversial keywords include “corona”, “covid-19”, “covid19”, “coronavirus”, “#Corona” and “#Covid 19”. A total of 2,607,753 tweets for controversial dataset (CD) and 69,627,062 tweets for and the non-controversial dataset (ND) collected. The researchers applied classification models to predict Twitter users who are more likely to use controversial terms and finds that demographic and geo-location features are strong predictors of usage of controversial terms. The findings from this study show significant differences between Twitter users who use controversial terms like “Chinese Virus”, or “Wuhan Virus” compared to those who use non-controversial terms like “Coronavirus” when referring to COVID-19. The study found that young people tend to use the non-controversial terms to refer to COVID-19, as users in the non-controversial terms group have a larger social capital, such as more followers, friends, and statuses. However, users in the controversial terms group are more likely to be politically conservative and follow conservative politicians, and more likely to be located in the United States.

The spread of COVID-19 on a global scale has affected a lot of sectors, including economics, domestics, social and much more. Education is also known as one of the affected sectors as the implementation of movement restriction. To identify the impact of COVID-19 pandemic on academic survival among postgraduate students in Malaysia, Nasir et al. (2021) has conducted an online survey through Google Form in October 2020, participated by 606 postgraduate students from different backgrounds. Instruments used in this study were adapted from Kapasia et al. (2020) and Wang and DeLaquil (2020), who also employed a Likert-type scale of 1–5; “1 = Strongly Disagree”, “2 = Disagree”, “3 = Not Sure”, “4 = Agree”, “5 = Strongly Agree”. The findings suggested that postgraduate students have high level of social relationships in maintaining the social connections with their peers and academic advisors despite the closure of universities and the shift to online learning but they faced problems in academic performance and financial stress during the pandemic. The closure of universities as a measure to prevent the spread of the virus among students and staff due to the pandemic has led to difficulties in conducting research and accessing academic resources, which affected their academic performance. Furthermore, the closure of universities also led to financial stress among postgraduate students due to the loss of part-time jobs, reduced research grants, and increased expenses related to online learning. Thus, Nasir et al.’s (2021) study reveals that the COVID-19 pandemic has caused major concerns among postgraduate students in Malaysia, which requires strategies and actions to be taken to ensure the academic survival.

In conclusion, the studies on infectious diseases and social media, especially in relation to COVID-19, highlights the critical role that online channels play in the communication of health-related information. Social media is a popular source of medical information due to its accessibility and anonymity. The correlation between infectious

disease outbreaks and social media highlights the significance of comprehending and regulating public opinion during such crises.

2.3 COVID-19 Vaccines on Twitter

The unexpected emergence and speedy spread of the COVID-19 virus has not only put lives at risk but has also thrown the social and economic system into disarray. Therefore, the development of vaccine was urgently needed as an effort to fight against COVID-19. Herd immunity can be achieved by vaccination programmes without requiring a large proportion of the population to be infected. However, to get this level of immunity, a large enough fraction of the population must be vaccinated.

The introduction of COVID-19 vaccines became one of the most popular topics on social media, especially on Twitter. During the period of distributing the COVID-19 vaccines, there are a lot of discussion regarding this issue on social media, which then lead to various studies on this issue. To investigate the public perception of COVID-19 vaccination during the early stages of vaccination in the world, Malagoli et al. (2021) analysed over 12 million English-languages worldwide tweets within December 1st, 2020, to January 31st, 2021 (which considered as an important period that includes the launch of first worldwide COVID-19 vaccination campaign in UK) and examined the user engagement, sentiment, and psycholinguistic characteristics. Data collection was done using the Twitter API based on list of keywords decided “vaccine”, “vaccination”, “anti-vaccination”, “antivax”, “anti-vaccine”, “anti-vax”, “anti-vaxxers”, “NoForcedVaccination”, “getvaccinated”, “Pfizer”, “moderna”, “astrazeneca”, “covaxin”, “biontech”, “Novavax”, “coronavac”, “sputnik”, and “bnt162b2”).

Malagoli et al. (2021) found that the volume of tweets was highly correlated with external events such as vaccine rollout campaigns and reports of vaccine efficacy studies. In addition, verified user accounts tend to post more tweets and retweets, with 80% of the verified user accounts posted up to 18 tweets and 12 retweets during the collected period, against to five tweets and six retweets from the same fraction of non-verified user accounts. Sentiment analysis via SentiStrength shows the users tend to express positive sentiment when making comments towards vaccine, vaccination and the names of specific vaccines (bnt162b2, covaxin, biontech, novavax) keywords, while express negative sentiment when mentioning keywords that related to the anti-vaccination movement. The psycholinguistic analysis using the Linguistic Inquiry and Word Count (LIWC) lexicon revealed that tweets related to COVID-19 vaccination were more likely to contain words related to health, work, and religion.

Following that, to better understand the public perceptions, concerns, and emotions that might influence the achievement of herd immunity goals over time, Lyu et al. (2021) examined the public discourse about COVID-19 vaccines on worldwide Twitter data from March 11, 2020, the day the World Health Organization declared COVID-19 a pandemic, to January 31, 2021, by providing an in-depth analysis of topics and sentiments. A total of 1,499,421 tweets were collected by using the data set by Georgia State University's Panacea Lab (2020) using 13 keywords, which "COVID19", "CoronavirusPandemic", "COVID-19", "2019nCoV", "CoronaOutbreak", "coronavirus", "WuhanVirus", "covid19", "coronaviruspandemic", "covid-19", "2019ncov", "coronaoutbreak", and "wuhanvirus". Topic Modelling was conducted by using the LDA model, the sentiment and emotion analyses used the National Research Council of Canada Emotion Lexicon developed by

Turney and Mohammad (2010) to scores different emotions, such as anger, fear, anticipation, trust, surprise, sadness, joy, and disgust (Plutchik,1980).

Lyu et al. (2021) reveals 16 topics, which were grouped into five overarching themes, which were the “opinions and emotions around vaccination” (27.04%), “knowledge about vaccines” (23.7%), “vaccines as global issue” (20.76%), “vaccine administration” (17.79%) and “progress on vaccine development and authorization” (10.72%). The analysis on emotion found that “trust” reached its peak on November 9, 2020, when Pfizer announced 90% effectiveness of their vaccine. The sentiment analysis showed that the sentiment around COVID-19 vaccines was increasingly positive in general, despite fluctuations. Trust was the most predominant emotion expressed in the social media discussion, followed by anticipation, fear, and sadness. The study revealed that discussions on Twitter paralleled current mainstream media topics, providing a global viewpoint. Additionally, it underscored the varied opinions and emotions expressed by Twitter users regarding vaccination, encompassing doubt, hesitancy, trust, and advocacy. The prevalence of positive sentiment and trust in social media discussions could suggest increased acceptance of COVID-19 vaccines compared to previous vaccines.

Moreover, to evaluate the public attitudes towards a COVID-19 vaccine over time, Saleh et al. (2021) examined 2.4 million worldwide English tweets from nearly one million user accounts regarding the COVID-19 vaccine during its development between February 1 to December 11, 2020. This study used cross-sectional observational study of English-language tweets that had been obtained using matching keywords ((“covid” or “coronavirus”), which resulting into 948,666 tweets collected. Data analysis conducted through Topic Modelling via Machine learning algorithm called Correlational Explanation (CorEx), sentiment analysis based on Valence Aware Dictionary and Sentiment Reasoner

(VADER), TextBlob dictionary, and NRCLEx library and the emotion analysis based on Plutchik's wheel of emotions (anger, anticipation, fear, joy, disgust, sadness, surprise and trust) to provide insight into the evolution of public attitudes.

Saleh et al. (2021) found that daily means sentiment of tweets fluctuated with news event, but a majority of the sentiments were positive during the study period. Negative sentiment was spotted during several days in mid-March and on October 13, 2021, due to the declaration of pandemic by World Health Organization and Johnson & Johnson's halting of their vaccine trial. The sentiment trends were reflected by the primary emotion identified in the COVID-19 vaccine tweets by month. The study found that the three most predominant emotions were trust, anticipation, and fear. Fear was the most predominant emotion early in the study period but trust outpaced fear from April 2020 onward. Fear was more prevalent in tweets by individuals compared to organisations, specifically among women. The study suggests that these findings are concerning for COVID-19 vaccine hesitancy, but also identify targets for educational interventions. There were 15 main topics of discussion in the tweets during the study period which were the United States politics and election, Russian response and global partners, stock market and pharma, first vaccinations and recipients, comparison to influenza, vaccine development and supporters, impact of lockdown, clinical trials, philanthropy and public health, vaccine mechanisms and immunity, safety and side effects, emergency use authorizations, conspiracies and misinformation, FDA and CDC, and mask use and reaction. The study found the comparison to influenza and the influenza vaccine as well as discussion about conspiracy theories were important topics with negative sentiment that improved over time showing the public attitudes have become more positive as the development of vaccines has progressed throughout 2020.

In India, Dubey (2021) investigated the sentiment and emotions analysis of COVID-19 vaccination drive, that had been used in India which are the Covishield, developed by Oxford-AstraZeneca, and Covaxin, developed by Bharat Biotech. The data were collected using Twitter's API for five days, from January 14, 2021, until January 18, 2021. The sentiment analysis was performed using the TextBlob library in Python, which uses natural language processing techniques to classify the tweets as positive, negative, or neutral. The paper also uses visualisations to present the results of the sentiment analysis. Syuzhet package version 1.0.1 (2016) was used in order to classify the tweets on basis of sentiment, whether it is positive or negative, and also to categorize them into eight emotions (fear, joy, anticipation, anger, disgust, sadness, surprise, and trust). Two different datasets were prepared for tweets related the keyword “#Covidhield”, and the keyword “#Covaxin”. The sentiment analysis of tweets related to the COVID-19 vaccines “Covaxin” and “Covishield” in India showed that a majority of the tweets had positive sentiments towards both vaccines. However, when compared, tweets regarding “Covishield” were more positive than tweets regarding “Covaxin”. As for the analysis of emotions, this study found that trust (27%), anticipation (19%), fear (16%), and surprise (9%) were more common with “Covishield” than “Covaxin”, which had trust (25%), anticipation (18%), fear (15%), and surprise (9%). The analysis shows that while a majority of the population was posting with positive sentiments towards these vaccines, there are also negative sentiments associated with them, such as fear and anger.

Furthermore, in the United States, to explore public opinion regarding COVID-19 vaccines using Twitter data, Karami et al. (2021) proposed an approach using computational and human coding methods to collect and analyse a large number of tweets to provide a wider perspective on COVID-19 vaccine. The data used in study were collected by a service

provider called BrandWatch using the keywords (“vaccine” or “#vaccine”, or “vaccination” or “#vaccination”) resulting to 200,000 English tweets posted in US within November 1, 2020, until February 28, 2021. The collected tweets were pre-processed to remove irrelevant information, such as URLs, usernames, and stop words. The topic discovery in this study used LDA model with C_V method to measure the coherence number, in order to understand the overall theme of topics, two coders had qualitatively investigated the top words for each topic using the $P(W_i|T_k)$ and the top tweets of each topic using $P(T_k|D_j)$. The findings show that the negative sentiment regarding the COVID-19 vaccine had a decreasing trend between November 2020 and February 2021 with 33.64% were negative and other 66.36% were non-negative. It also found that Twitter users in the US have discussed a wide range of topics from vaccination sites to the 2020 election between November 2020 and February 2021. The top topics of negative tweets were related to “vaccine safety”, “side effects”, and “scepticism”, while the top topics of non-negative tweets were related to “vaccine distribution”, “vaccination sites”, and the “importance of getting vaccinated”. The study also found that Twitter users discussed a wide range of topics related to COVID-19 vaccines, including politics, conspiracy theories, and misinformation. Through this study, it concludes that Twitter data can be used to explore public opinion regarding the COVID-19 vaccine.

Considering that polarity of a text might expressed the emotions of the authors, Batra et al. (2021) has investigated the sentiments and emotions of people on Twitter regarding the COVID-19 vaccine and to evaluate any shift in polarity since the start of the pandemic on six countries (India and Pakistan from Asia, Canada and the US from North Africa, and Norway and Sweden from Europe) from December 2020 to mid-February 2021 during the second wave of coronavirus. Data collection was done using Twitter Search API known as Tweepy using keywords “lockdown”, “COVID19Pandemic”, “StayHomeSaveLives”,

“stayhome”, “Covid_19”, “COVID”, “Coronavirus”, “secondwave”, “pandemic”, “covid19”, and “vaccine”. During the pre-processing step, unnecessary symbols, spaces, and mentioned users from tweet text, punctuation and stop-words were removed. In total, there are 801,692 tweets from six countries in the final data set. The study used deep learning LSTM with pretrained embedding models to detect emotions from users’ tweets on Twitter. The polarity trend of the tweets over time was examined to evaluate any shift in sentiment polarity since the start of the pandemic, and to compare the sentiment of neighbouring countries to observe the similarities or differences.

Batra et al. (2021) found that people were mostly neutral about the vaccine and the second wave because there were only a few tweets on the vaccination in the second half of December 2020 and the early half of January 2021. However, the spread of the new Coronavirus variant caused a sudden change of emotion after January 15, 2021, across the six countries. Since the pandemic began, opinion has shifted toward the vaccine as more people have been vaccinated. Pearson’s correlation of data between countries shows that people of neighbouring countries have shown quite a similar attitude regarding the vaccination in contrast to their different reactions to the coronavirus outbreak. For example, a strong correlation in both positive and negative emotions of people from Pakistan and India (0.837 for positive sentiments and 0.865 for negative sentiments), between Norway and Sweden (0.703 for positive sentiments and 0.616 for negative sentiments) and the US and Canada (0.623 for positive sentiments and 0.624 for negative sentiments). Mixed emotions have expressed on Twitter such as many people were looking forward to the vaccines, while others were cautious about the side-effects and the conspiracy theories.

As an alternative to compare the public sentiment across different social media platform, Hussain et al. (2021) conducted a study to analyse public sentiments towards COVID-19 vaccines in the US and the UK by extracting information from more than 300,000 posts from Facebook and Twitter from 1 March to 22 November 2020. The data in this study was analysed using natural language processing and deep learning techniques. These techniques were used to predict average sentiments, sentiment trends, and topics of discussion in social media posts related to COVID-19 vaccinations in the US and the UK. The study discovered that the discussions on Facebook and Twitter in the US and the UK provided both complementary and contrasting insights, reflecting the unique characteristics of each platform. However, the sentiments obtained from Twitter were more negatively biased compared to Facebook for both US (30.57% on Twitter, and 17.73% on Facebook), and the UK (27.95% negative sentiment on Twitter, 17.04% negative sentiment on Facebook) and reflecting the respective user demographics. The negative sentiment in this study were mostly related to public apprehensions and concerns regarding the delays or pauses in vaccine trials, vaccine safety, corporations, and governments influencing vaccine availability and rights exclusivity for economic benefits.

The literature review in this section underscores the significant influence of news events on shaping public sentiments. The dynamic nature of sentiment, influenced by key occurrences such as vaccine rollout campaigns and efficacy studies, underscores the interconnectedness between news developments and public attitudes, which highlights the need for continuous monitoring to understand sentiment dynamics in response to evolving circumstances. Thus, it is important to observe the sentiments expressed among Malaysian Twitter users, considering a lot of incidents have happened through the year 2021.

2.4 COVID-19 Vaccination in Malaysia

Vaccination in Malaysia started on 24 February 2021, which is later than other countries such as the US and the UK, giving the opportunity for the Malaysian public to observe the vaccination campaign in other countries first. To observe the knowledge among Malaysians before the availability of vaccine, Azlan et al. (2020) conducted a cross-sectional online survey to collect data from 4,850 Malaysian residents between 27th March and 3rd April 2020 to determine the knowledge levels, attitudes, and practices toward COVID-19 among the Malaysian public. Azlan et al. (2020) reported that Malaysians reflected an acceptable level of knowledge on COVID-19, with an overall correct rate of 80.5%. Most participants knew that the virus could be transmitted through respiratory droplets and could be prevented by washing hands frequently. They also held positive attitudes toward the successful control of the disease, the ability of Malaysia to conquer the disease, and the way the Malaysian government was handling the crisis. In terms of practices, most participants were taking precautions such as avoiding crowds and practicing proper hand hygiene. However, the wearing of face masks was less common. The study also found that people living in the Central region had significantly higher knowledge scores than other regions. Additionally, the average knowledge score of students was significantly lower than those of other occupation categories. Finally, those earning below RM3,000 per month showed significantly lower knowledge scores. These findings suggest that tailored health education programs are needed to improve knowledge and understanding of the pandemic.

After the development of vaccine had started, Mohamed et al. (2021) investigated the knowledge, acceptance, and perception of the COVID-19 vaccine among the Malaysian adult population, as well as identified the factors associated with higher knowledge scores and willingness to get vaccinated. A cross-sectional online population-based survey was

conducted via Google Forms on December 1-15, 2020, with the semi-structured questionnaire was adapted from Reiter et al. (2020). Mohamed et al.'s (2015) shared the questionnaire link via online platforms including Facebook and WhatsApp.

Mohamed et al. (2021) suggested that while the majority of Malaysian adults were willing to get vaccinated against COVID-19, their knowledge about the vaccine was inadequate. Only 38% of respondents had good knowledge about COVID-19 vaccine, while 62% had poor knowledge. For example, 82.1% of the respondents answered correctly for the statement of "COVID-19 vaccines will be given via injection", while only 14.7% gave the correct answer for the statement "Everyone including children can receive COVID-19 vaccination", indicating poor knowledge about the eligibility criteria for the vaccine. Meanwhile, respondents with higher education levels, higher income, and those living with someone at higher risk of severe COVID-19 had higher knowledge scores, and respondents who were younger, female, and had higher education levels were more likely to be willing to get vaccinated. The findings suggest that there was a need for public health campaigns to increase knowledge and awareness about the COVID-19 vaccine, particularly among those with lower education levels and income during this period.

Following that, Alwi et al. (2021) examined the acceptance of the COVID-19 vaccine among general population of Malaysia through a cross-sectional survey from December 23, 2020, until December 29, 2020, with Malaysian adults as the target participants. Due to the limitations in employing face-to-face methods during an active outbreak, the data were collected using the Google Forms platform via an online questionnaire of 14 questions. A snowball sampling strategy was used to distribute the online questionnaire via social media (WhatsApp, Facebook, Twitter). A total of 1,411 respondents participated in the study with

young adults (40.7%), married individuals (52.9%), Malays (63.8%), Muslims (72.3%), females (62.8%), and those with tertiary education (86.8%). The findings show the overall acceptance rate of the COVID-19 vaccine was high (83.3%), with the lowest acceptance rates were observed among two specific groups, the elderly aged 60 years and above, and pensioners. Only 63.4% of the elderly aged 60 years and above were willing to accept the COVID-19 vaccine. Similarly, only 64.6% of pensioners were willing to accept the vaccine. However, the study found few predictors of vaccine hesitancy such as age, religion, and current residence, as respondents aged 60 years and above were found to be five times more hesitant to take the vaccine. In addition, respondents with diabetes mellitus and hypercholesterolemia were more hesitant to accept the COVID-19 vaccine. Muslim respondents also found more hesitant to accept the COVID-19 vaccine compared to non-Muslim respondents, which might be due to concerns regarding the halal status of the vaccine, as well as misinformation and rumours circulating on social media. There were also concerns regarding side effects, safety, lack of information, effectiveness. In addition, religious and cultural factors related to the COVID-19 vaccine were also the main reasons for vaccine hesitancy.

Due to restrictions on accessibility in Malaysia, the government conducted its vaccination campaign primarily via social media. Hassim et al. (2021) employed the qualitative method of focus group discussion to collect data from Malaysian youths about their perceptions of the “Let's Get Vaccinated Campaign” in order to observe the acceptances of Malaysian youths (individuals between the ages of 15 and 24) towards the vaccination campaign conducted by the Malaysian government on social media. The study conducted five focus group discussions with a total of eight participants for each session in order to obtain in-depth information regarding the informants' perceptions of the campaign. All

analyses were conducted using inductive Thematic Analysis. The findings indicated that Malaysian youth have a good view of the “Let's Get Vaccinated Campaign” conducted by the Malaysian Government on social media, considering that they provided positive feedback on the government’s messages and platforms. However, the campaign did not appear to have a significant effect on the beliefs and actions of Malaysian youths regarding the importance of vaccination, as the youths’ decisions and actions to take the vaccine were influenced by multiple factors, including self-awareness, parental and peer influence, and the experience of close friends and family members infected with COVID-19. Through this study, it can be concluded that social media is an effective tool to convey important messages to the youth population, particularly during a pandemic.

It is important to determine the level of acceptability and the factors affecting the vaccine acceptance of the COVID-19 vaccine in Malaysia. Marzo et al. (2022) has investigated the factors that influence the COVID-19 vaccine acceptance rate in Malaysia via an internet-based cross-sectional survey for public above 18 years old through snowball sampling from October 2020 to January 2021. The survey questionnaire was developed based on previous studies and was validated by experts. The questionnaire was distributed online through various social media platforms, including emails, Facebook, WhatsApp, Telegram, and Instagram. Descriptive statistics were used to describe the demographic characteristics of the participants, and logistic regression analysis was used to identify the factors that influence COVID-19 vaccine acceptance rates in Malaysia.

Marzo et al. (2022) found that the overall COVID-19 vaccine acceptance rate in Malaysia was 67.7%. The study identified several factors that influenced COVID-19 vaccine acceptance rates in Malaysia, including age, gender, education, income, and ethnicity. The study found that younger people were less likely to accept the COVID-19 vaccine than older

people, female respondents were more likely to accept vaccines compared to male respondents, people with higher education levels were more likely willing to get vaccinated than people with lower education levels, people with higher income levels has more tendency to accept vaccine than those with lower income levels, and people of Indian ethnicity were more willing to accept the vaccine than those of other ethnicities. The reasons for vaccine hesitancy among those who were not willing to accept the COVID-19 vaccine included fear of side effects, lack of trust in the vaccine, belief that the vaccine is not effective, belief that the vaccine is not necessary, and religious or cultural beliefs. In conclusion, the study contributes to the growing body of literature on vaccine acceptance and hesitancy, which is essential for controlling the COVID-19 pandemic.

This section has provided the insight of the perceptions and acceptance levels of Malaysian public towards COVID-19 vaccination through the pandemic period. It can be seen that the vaccine acceptances among Malaysian public were in the middle ground.

2.5 Thematic Analysis and Topic Modelling in Social Communication

Topic detection can be done online or offline, with the former seeking to identify dynamic themes as they appear over time, and the latter being retrospective, looking at documents in a batch and detecting subjects one by one (Chen, Guo et al., 2017). Following that, another common method to reveal the patterns of themes and topics by conducting Thematic Analysis. According to Alhojailan (2012) Thematic Analysis is considered the most appropriate for any study that seeks to discover using interpretations as it provides a systematic element to data analysis. There are a lot of approaches that can be used to study topic and themes expressed in a discussion, and this section presents the approaches of recent studies related to analysis of topics based on Topic Modelling and Thematic Analysis.

Thematic Analysis is a technique for studying qualitative data that involves looking through a data collection to find, examine, and document recurring patterns (Braun & Clarke, 2006). It is a technique for describing data but generating codes and creating themes by involving interpretation. One of the studies utilising Thematic Analysis in health-related research was Shepherd et al. (2015) who examined a single discussion in order to assess the role that Twitter can play as a medium for interpersonal communication by showing how people with mental disorders used social media to interact with each other. Shepherd et al. (2015) also sought to identify the role of tools like Twitter might play in giving feedback on and getting involved with the mental health service user experience. The data were collected using a hashtag conversation on “#dearmentalhealthprofessionals” on August 10-11, 2013, and was conducted in English, involving participants primarily from the UK and the US. Duplicate tweets were removed, and the remaining tweets (515) were reviewed and analysed using Thematic Analysis. Tweets were first read, and then were read again with a code that identified each one. This code used phrases from the original tweet to stay close to the original meaning. The tweets were then put into groups with descriptive headings, and larger themes were found. Through team discussion, the initial large number of codes that overlapped were narrowed down to three main groups. During research team meetings, overarching themes were talked about and developed.

Shepherd et al. (2015) found four overarching thematic headings, which were “The impact of diagnosis on personal identity and as a facilitator for accessing care” (95 counts), “Balance of power between professional and service user” (12 counts), “Therapeutic relationship and developing professional communication” (198 counts), and “Support provision through medication, crisis planning, service provision and the wider society” (77 counts). Among these topics, the theme “Therapeutic relationship and developing

professional communication” contained the greatest amount of material addressing the issue of diagnosis in mental disorder from a variety of perspectives on care provision, individual, nature of diagnosis, overshadowing, role and stigma. The second theme discussed was “The balance of power between professional and service user” containing tweets on the role of power, the ability to exert influence and control over a situation, and reflection in the experience of mental distress such as individual power, Political, Professional, Sharing, Systemic and Threatening. The following theme found was “Therapeutic relationship and developing professional communication” which includes various aspects of communication between professionals as well as professional attitudes. Finally, the “Support provision through medication, crisis planning, service provision and wider society” theme referred to concerns relating to an over reliance on medication as the primary treatment in response to mental distress. The study demonstrated the utility of Twitter as a platform where individuals with an experience of mental disorder can share information, develop understanding, and offer feedback to mental health service providers.

Corresponding to the global pandemic of Coronavirus in 2019, previous research has utilised COVID-19-related social media conversation. Mustafa and Balla (2020) analysed public reaction to COVID-19 pandemic on worldwide Twitter data collected from 13 April 2020 to 19 April 2020. Their study showed that most tweets were found in English, followed by Spanish and Portuguese. The data in this study were obtained using Twitter API on five keywords, which “covid19”, “coronavirus”, “COVID”, “corona”, and “COVID-19”. As the dataset was rather vast, a portion of the data was systematically selected to perform the coding for in-depth qualitative analysis, 400 tweets were selected and divided among four researchers for pilot study. This study identified six major themes among the tweets, including sentiments and feelings (3.8%), information (9.1%), general discussion and

comment (11.2%), political (5.1%), food (0.2%), and sarcasm or humour (2.3%). During this period, the topics discussed on Twitter regarding COVID-19 were mainly related to health, government response and conspiracy theories, marking that the conspiracy theories has been spread on social media in April. Sentiment analysis in this study found a large proportion of tweets (around 40%) had neutral sentiments while negative emotions dominated with more than 50% expressing fear or anger towards governments' response during this crisis period. In addition, the public opinion about government responses during the pandemic period was mostly negative with people expressing their dissatisfaction over lack of preparedness by governments in tackling this crisis effectively. Furthermore, discussions surrounding conspiracy theories have been widely spread through social media platforms like Twitter which has further added fuel to public anxiety and fear caused due to outbreak of virus leading them towards panic buying or hoarding essential items for survival. Through this study, the virus outbreak affected not only physical health but also mental health.

The COVID-19 vaccines were distributed on December 8, 2020, and the United Kingdom (UK) was the first country in the world to start administrating its citizens with a fully trialled and tested COVID-19 vaccine (Aljazeera, 2020). To study the prevalence of different types of vaccine hesitancy on Twitter and Facebook, Thelwall et al. (2021) used English-language tweets between March 10 and December 5, 2020, mainly from the US (62%), the UK (15%), Canada (4%), Australia (3%), India (2%), and South Africa (2%) through an inductive content analysis to identify the common topics of vaccine hesitancy COVID-19 tweets. The study found three major topics that caused vaccine hesitancy, which were the conspiracies (23.5%), development speed (16.1%), and safety (10.5%). These topics also included conversation relating to jokes, black risks, Russian or Chinese vaccines, development speed, efficacy, conspiracy theory, foetal tissue, and safety. The results showed

that vaccine hesitancy is primarily right-wing (79%) and expressed through a combination of far-fetched conspiracy theories as well as more plausible concerns about the speed and safety of development. This study also suggests that these conspiracy theories may be spreading through right-wing accounts or among African Americans, which could have serious implications if true.

To prevent the spread of this virus, vaccination has been implemented on a worldwide scale, resulting in conflicting public opinion. In India, Kumari et al. (2021) performed an exploratory descriptive research utilising focus group discussion (FGD) with the Indian population after obtaining approval from the Institutional Ethics Committee of All India Institute of Medical Sciences, New Delhi. In this study, Indian citizens over the age of 18 who could speak and comprehend Hindi and English were recruited using video conferencing on Google Meet under the supervision of a moderator, yielding a total of 19 males and 24 females as participants. Using an inductive Thematic Analysis, the acquired data were then analysed to find the original codes, which were subsequently condensed into subthemes. Kumari et al. (2021) found four sub-themes, “knowledge”, “attitude”, “perception”, and “concerns” on COVID-19 vaccination, which were grouped under the major theme as “views about the COVID-19 vaccine”. Kumari et al. (2020) showed that some groups, such as senior citizens, working professionals, young adults, and housewives, mostly rely on social media, local news, and discussions with friends and family to gain knowledge on vaccine, which resulting these groups scored worse on COVID-19 vaccination interest and accuracy, due to their reliance on less dependable information sources. In contrast, hospital workers such as doctors, and paramedics, demonstrated a higher level of COVID-19 vaccination knowledge.

Kumari et al. (2021) also found the factors that contribute to vaccine acceptance and hesitancy. For example, trust in the safety of vaccines, free access to vaccines for healthcare and first-line workers, a sense of national duty to eradicate COVID-19, perceived limited or no risk in vaccination, access to reliable information on the vaccine, and easy availability of the vaccine through hospital staff were the factors contributed to vaccine acceptances. On the other hand, the concerns that contributed to vaccine hesitancy include a lower number of active COVID-19 cases, a preference for natural immunity, misinformation about the vaccine, a lack of perceived safety, fear of side effects, fear of faulty or fake vaccines, and government conspiracies.

Topic modeling, a text processing technique that seeks out and displays patterns in textual material, referred to as themes, in order to alleviate information overload (Blei et al., 2003). Users will be able to navigate swiftly through a corpus of text or a collection, led by identified subjects, resulting in a better user experience (Blei & Lafferty, 2007). The most common method for Topic Modelling is to use unsupervised learning algorithms, which produce a summary overview of the discovered topics (Lee et al., 2017). Past study has applied Topic Modelling to uncover the discussion surrounding social event, for example, Sanandres et al. (2018) used Topic Modelling of Twitter conversations the in relation to social event, to investigate the financial crisis in the National University of Columbia by collecting every tweet with the hashtag #CrisisUNAL published from 2011 until 2015, which resulting into a corpus of 45,000 tweets. The data were analysed based on Topic Modelling using LDA. The study identified four frames, which include protest, anti-reform, investment, and peace based on 12 topics, which on the Protest frame (Topics 1, 2, 3, 5, and 9 cover student protests, strikes, movements, assemblies, and repression), Anti-reform frame (Topic 6 covers university reform), Investment frame (Topics 7 and 11 cover student demands for

investment to face the crisis, including infrastructure investment and university budget) and Peace frame (Topic 12 covers university peace, which includes terms such as peace, process, and talks). Sanandres et al. (2018) revealed that each frame represents a discursive environment for the financial crisis, which broadcasts not just the structural characteristics of the crisis but also symbolic representations of ongoing social events.

This section has discussed the studies had been conducted on identifying topics and themes via Thematic Analysis and computer-based modelling. While the primary goal of Topic Modelling is aligned with the objectives of the study, however it is important to note that this study did not employ computational Topic Modelling methods, instead, the study utilized inductive Thematic Analysis. Thematic Analysis provides a systematic and rigorous approach to analyse large amounts of qualitative data, which can help to identify patterns and trends in public opinion.

2.6 Sentiment Analysis and Categories

Sentiment analysis (also known as opinion mining) is the use of natural language processing, computational linguistics, and text analytics to identify and classify subjective views in a document or a phrase (Luo et al., 2013). In general, sentiment analysis attempts to determine a writer's stance on a certain issue or the overall contextual polarity of a piece. Liu (2012) defines sentiment analysis as the study of people's perspectives, sentiments, evaluations, appraisals, attitudes, and emotions towards products, services, organisations, persons, situations, events, topics, and their attributes.

Identifying sentiment on a specific topic was pioneered by Chen et al. (2012). Since then, several research on a range of issues have examined sentiment analysis. Previous research on this area has made substantial contributions to the theoretical and practical

foundations of sentiment analysis. On a regular basis, sentiment analysis has been used for health-related issues to investigate the sentiments expressed. Mamidi et al. (2019) was the first to do a sentiment analysis on a disease outbreak, focusing on the Zika pandemic from 2015 to 2016, with the objective to comprehend how positive, negative, and neutral views towards the Zika virus were communicated on social media platforms. 1.2 million tweets were gathered between February 24, 2016, and April 27, 2016, using Twitris 2.0 (a semantic Web) and the search terms on “Zika”, “Zika virus”, and “Zika virus therapy”. The study used machine learning techniques and algorithms to analyze the sentiment of tweets concerning Zika and classified them into three categories: positive, neutral, and negative. A supervised machine learning classifier was built and performed moderately well in classifying tweets into sentiment categories, with an F1 score ranging from 0.48 to 0.68. Tweets were deemed positive if they mentioned research discoveries related to Zika or reflected a positive attitude toward treatments, preventions, or funding for Zika; tweets were deemed neutral if they provided information without emotionally charged language such as hope, combat, and severe; and tweets were deemed negative if they discussed the birth defects/disorders caused by Zika. Topic Modelling was applied to examine the tweets in each sentiment category, with a specific focus on the negative sentiment category.

Mamidi et al. (2019) identified a total of 10 topics for each sentiment category. In the negative sentiment category, the study found three broad themes, “neural defects”, “Zika abnormalities”, and “reports and findings”. These themes were based on domain expertise and topics discussed in journals such as Morbidity and Mortality Weekly Report and Vaccine. The majority of topics in the negative sentiment category were related to symptoms of Zika, suggesting a need for public health officials to focus on spreading information about prevention and treatment research. The study demonstrated how sentiment expressed on

Twitter can be used to understand public sentiment regarding an epidemic and enable real-time addressing of specific elements of negative sentiment.

Considering the prevalence of the current infectious illness, COVID-19, the vaccine was developed as an efficient means of preventing its spread. However, the number of individuals who resisted vaccination was cause for global worry. Subsequently, Nuzhath et al. (2021) conducted a study to establish the public's attitude toward vaccination and to identify the primary thematic areas of safety concerns, misinformation, and rumours around the vaccine on Twitter. Twint package, an advanced Twitter scraping tool developed in python, was used to gather the data for this study, which resulted in 1,286,659 tweets containing the terms "vaccine" or "#vaccine" between July 19, 2020, and August 19, 2020. Tweets were lemmatized for Latent Dirichlet Allocation by removing URLs, tokenizing, lowering the case, removing leading and trailing whitespaces, and accentuating tweets. Derived from Mamidi et al.'s (2019) previous research, the tweet categories were established using a codebook with necessary definitions. Nuzhath et al. (2021) categorized positive tweets as those mentioning COVID-19 vaccine trial discoveries or expressing a positive attitude, negative tweets included references to vaccine misinformation, conspiracy theories, safety concerns, and deeming vaccines against coronavirus, conjunctivitis, or influenza as unnecessary.

Nuzhath et al.'s (2021) analysis revealed that 1,306 out of 4,868 tweets were classified as negative, with the majority (32.47%) classified as misinformation, followed by tweets expressing concern about vaccine safety and efficacy (21.13%), tweets related to conspiracy theories about potential COVID-19 vaccines (17.99%), and mistrust of scientists and governments (12.86%). In addition, 10.64% of tweets showed a lack of readiness to get the COVID-19 vaccine when it became available, and 3.60% of tweets regarded a future

required COVID-19 vaccine programme as limiting freedom of choice. Finally, 1.30% of tweets referenced concerns or limits regarding a prospective COVID-19 vaccination based on religious views. Negative emotions were then analysed to identify themes and sub-themes, yielding seven topics on disinformation (32.47%), safety and efficacy (21.13%), conspiracy theories (19%), mistrust (13%), readiness to vaccinate (10.7%), freedom of choice (3.6%), and religious views (1.7%). It is found that misleading statements such as the unnecessary need for immunization due to high survival rates and concerns about potential vaccine side effects were prevalent in the negative tweets.

Pang and Lee (2002) stated that machine learning methods often rely on supervised classification approaches, where the sentiment detection is framed as a binary (i.e., positive or negative) and requires labelled data to train classifiers. According to Zagibalov (2010), today's sentiment analysis research focuses on four main tasks: subjectivity analysis, sentiment classification, opinion summarization, and opinion extraction and mining. The goal of subjectivity analysis is to distinguish between subjective and factual text (documents, sentences) and its writings express private feelings, as opposed to objective (factual) texts, which express only objective information or facts.

Bravo-Marquez et al. (2013) proposed combining existing sentiment analysis methods and resources in a way that is efficient to improve two major sentiment analysis which are the subjectivity classification and polarity classification. The aim of the study is to improve Twitter sentiment analysis by combining different sentiment dimensions, such as opinion strength, emotion, and polarity indicators. To achieve this goal, Bravo-Marquez et al. employed supervised learning methods to amalgamate these diverse elements as input features, utilizing two established datasets, namely the Stanford Twitter Sentiment (STS) by Jiang et al. (2011) and the Sanders dataset by Kouloumpis et al. (2011). The researchers

introduced an approach that leverages pre-existing sentiment analysis methods and resources to generate meta-level features for sentiment classification on the Twitter platform. The performance of multiple learning algorithms, including CART, J48, Naive Bayes, Logistic Regression, and RBF SVMs, was evaluated on datasets such as STS and Sanders. To ensure robust results, a 10-fold cross-validation evaluation was conducted, and machine learning technique parameters were fine-tuned through a grid-search procedure with nested cross-validation. Various feature subsets were explored, ranging from all features to subsets specifically oriented towards polarity, strength, and emotion. The classifiers were assessed using performance metrics such as accuracy, precision, recall, and F1.

Bravo-Marquez et al. (2013) found that the combination of sentiment dimensions, including opinion strength, emotion, and polarity indicators, significantly improves Twitter sentiment classification tasks such as polarity and subjectivity. The novel sentiment classification approach for microblogging messages or short texts, utilizing a combination of existing lexical resources and sentiment analysis methods, outperforms state-of-the-art methods by a notable margin. The experimental validation demonstrates very significant improvements, with the classifiers achieving more than a 5% increase in both accuracy and F1 points compared to any single method.

The term “sentiment classification” refers to the process of labelling text based on its emotional content. For sentiment categorisation, there are a variety of methods and approaches to choose from such as sentiment and subjectivity, supervised sentiment classification, and sentiment classification and linguistics. Saif et al. (2012) introduced a novel sentiment classification method incorporating semantics as additional features in the training set. They compared entity extraction and concept identification tools—AlchemyAPI, Zemanta, and OpenCalais—selecting AlchemyAPI for its superior

performance in terms of quantity and accuracy of sentiments. The study utilized three Twitter datasets: Stanford Twitter Sentiment Corpus (STS), Health Care Reform (HCR), and Obama-McCain Debate (OMD). Semantic features involved hidden concepts (e.g., “Steve Jobs”) representing entities, enhancing sentiment analysis. AlchemyAPI excelled in entity extraction and semantic concept mapping.

Saif et al. (2012) proposed three methods (semantic replacement, augmentation, and interpolation) for Naïve Bayes (NB) classifier training, with interpolation yielding the best results. Extensive experiments compared the semantic approach with three baselines: unigram features, Part-of-Speech (POS) features, and Sentiment-Topic Features. Semantic features outperformed Unigram and POS baselines in both positive and negative sentiment, displaying superiority in precision for positive sentiment. Evaluation of entity extraction tools revealed nuances, with Zemanta excelling in categorizing music-related entities. The study emphasized the impact of dataset size and thematic focus on feature selection accuracy, noting that the semantic approach excels in large, diverse datasets.

Sentiment categories and analysis were discussed in this section. By categorising tweets into positive, negative, neutral, the major thematic areas about a potential COVID-19 vaccination based on Twitter data contents can be observed. This study applied sentiment categories based on Nuzhath et al.’s (2021) codebook as a guide to categorise the sentiments as positive, neutral, and negative. Codebook was used as it provides a formalized operationalisation of the codes and key aspects of the topic investigated (MacQueen et al. 1998; Crabtree & Miller 1999; Fereday & Muir-Cochrane 2006; Fonteyn et al. 2008). This approach provides a nuanced understanding of public attitudes, concerns, and misconceptions, offering insights for tailored interventions and communication strategies.

2.7 Appraisal Theory

To evaluate the sentiments expressed by Malaysian Twitter users on the COVID-19 vaccination better, it is important to understand more about evaluation and how it is expressed linguistically. According to Martin and White (2005) in their Appraisal Theory, evaluation and stance can be separated into different categories according to the function of the evaluation as it illustrates categories and subcategories that evaluative language fits into. Generally, Appraisal Theory is an extension of Systemic Functional Linguistics (SFL) interpersonal meta function, describes how speakers or writers use a variety of linguistic resources to adopt stances towards both the material they present and those with whom they communicate (Martin & White, 2005). Overall, the Appraisal framework developed by Martin (2000), Martin and Rose (2003) and Martin and White (2005) provides a systematic account of language resources for expressing emotions and attitudes (Attitude), the sources of evaluation and the play of voices within and across texts (Engagement), as well as the amplification of both Attitude and the degree of Engagement (Graduation).

Attitude is when the speakers or text attach intersubjective value to emotional responses, and further divided into three sub-categories, i) Affect (refers to language resources for expressing emotions), ii) Judgement (consists of language resources for evaluating people's behaviors), and iii) Appreciation (deals with the evaluation of "things", process of natural phenomena). In general, "Attitude" can be expressed implicitly or explicitly as positive or negative. The second aspects of Appraisal Theory are "Engagement" which describing the position of a text's proposal and propositions inter-subjectively divided into monoglossic (no recognition of dialogistic alternatives) and heteroglossic (recognition of dialogistic alternatives). Heteroglossic is then divided into four sub-categories: i) Disclaim (the textual voice positions itself as at odds with, or rejecting, some contrary

position), ii) Proclaim (by representing the proposition as highly warrantable), iii) Entertain (by explicitly presenting the proposition as grounded in its own contingent, individual subjectivity own opinion, and iv) Attribute (proposition as grounded in the subjectivity of an external voice. The third aspect is Graduation, which concerns the values used to provide grading or scaling in terms of interpersonal force that consists of two categories: i) Force (variable scaling of intensity) and ii) Focus (sharpening or blurring of category boundaries).

The goal of developing an appraisal framework, according to Martin and White (2005), is to broaden traditional accounts of speaker or writer evaluation, certainty, commitment, and knowledge, and consider how the textual voice positions itself in relation to other voices and positions in the discourse. Hence, this theoretical approach leads us to focus on “meanings in context and rhetorical effects rather than grammatical forms” (Martin & White, 2005, p. 94), since language grammar and discourse are viewed as a set of resources that “make” meanings rather than rules that organise structures.

In Indonesia, a study of sentiment analysis based on Appraisal Theory algorithm was conducted by Alamsyah et al. (2015) on tweets related to two popular smartphone products in Indonesia, Nokia Lumia and Sony Xperia. The purpose of this research is to summarise market opinions from abundance data on the internet’s, especially opinions about these two products. The researchers used data mining techniques, known as Knowledge Discovery in Database (KDD) to collect data from Twitter via Twitter API from January 1, 2015 until June 30, 2015 on tweets in Bahasa Indonesia that contained basic descriptions on appraisals theory (attitude, graduation, engagement) and target (Lumia, Xperia and/or its feature). The collected data were then pre-processed to remove irrelevant information and to extract only the relevant tweets related to the two smartphone products, Nokia Lumia and Sony Xperia. Alamsyah et al. (2015) analysed the tweets data using entity and aspect level in sentiment

analysis. The entity level looks at language constructs such as documents, paragraph, sentences, clauses or phrases, while the aspect level directly looks at the opinion of positive or negative sentiment itself. Then sentiment analysis was performed based on target and appraisal-related information in the sentences level and the tweets level, for example, the most often used words as appraisal were calculated, which involving “Banget” means “Very”, “Kecewa” means “Disappoint” and “Keren” means “Cool” that commonly used. The total target score refers to the number of times a particular target (such as “Lumia” or “Xperia”) was mentioned in a positive or negative context. The results of Alamsyah et al.’s (2015) sentiment analysis showed that Nokia Lumia had more positive sentiment than Sony Xperia, with Lumia has the total target score of +6 (positive) indicating a positive sentiment towards the product, while Xperia has a total score of -68 (negative), indicating a negative sentiment towards the product and people often expressed disappointment and dissatisfaction with the services provided by Xperia.

An approach to examine the tactic of going negative in political discourse and communication, Ross and Caldwell (2020) analysed a selection of President Donald Trump’s tweets to investigate his use of the appraisal system to attack and undermine the character of his political opponents as a method for examining the strategy of negativity in political discourse and communication. The selection of data centred on tweets from Donald Trump between 29 June 2016 and 21 August 2017, a time frame that encompassed the conclusion of his election campaign and the months following his inauguration as president. The data analysis employed a corpus-based comparative keyword analysis and the analytical framework of evaluation from SFL to examine evaluation within language via the semantic resources used to negotiate emotions, Judgements, and valuations. Ross and Caldwell (2020) concentrated on tweets by President Donald Trump that contain the phrase “Crooked Hillary

Clinton” as it was a catchphrase used by Trump during his campaign and presidency to criticise Hillary Clinton’s character and undermine her credibility.

Ross and Caldwell (2020) discovered that Trump used a variety of evaluation resources to implement a “going negative” strategy in his tweets, with the goal of attacking and undermining the character of his political opponents. The study identifies three distinct themes that Trump employs to criticise Clinton, particularly her personality, her political record, and her family, and her husband, former President Bill Clinton. The “Attitude” resources show Trump used Affect to express his negative feelings toward Clinton, via derogatory terms like “Crooked Hillary” and “Lying Ted”. In one tweet, he states, “Crooked Hillary Clinton is the greatest (and worst) loser in history”. Trump employed the word “worst” to convey his negative assessment of Clinton. Ross and Caldwell (2020) found that “Graduation” commonly used to intensify his negative evaluations of his opponents, such as capital letters and exclamation marks were often used to emphasise his negative opinions, with “TOTAL DISASTER” and “SO DISHONEST!”. In one tweet, he wrote, “Crooked Hillary Clinton is a fraud who has put the public and country at risk by her illegal and very stupid use of e-mails”. Here, Trump uses the words “fraud” and “illegal” to intensify his negative evaluation of Clinton. The “Engagement” resource was used to involve his audience in his negative evaluations of his opponents, for example, he writes, “The crooked Hillary Clinton campaign refuses to say that Hillary Clinton is healthy”, and Trump often used rhetorical questions to encourage his audience to agree with his negative opinions, such as “Can you believe this?” and “Sad!”.

The use of Appraisal Theory in past studies on health-related issue has been conducted extensively to understand expressed emotions and reactions. Following that, social media plays a significant role in the distribution of vaccines by sharing, informing, persuading, and influencing people with positive information about COVID-19 vaccination. However, various media outlets often convey that vaccinations are detrimental, presenting them as potentially unsafe due to insufficient testing on variant cases.

In Indonesia, Samsi et al. (2021) used the Attitude system (based on Affect, Judgement, and Appreciation) of Appraisal Theory to analyse words, phrases, or discourses related to news about vaccination and the reported types of vaccines in Indonesian newspapers. The corpus of this study consists of news articles pertaining to COVID-19 vaccine discourses in the post-pandemic that appeared in Indonesian newspapers on March 1-16, 2020. Eight news articles from the Jakarta Post containing 6,563 words were obtained via the newspaper official online website. Antconc software in KWIC was utilised with words of affect clues (sad, cheerful, anxious, comfortable, bored, angry, impressed, fearful, and a similar word/intention of mentioned word), judgement clues (lucky, tragic, powerful, weak, brave, despondent, honest, fake, fair, evil, etc.), and appreciation clues to obtain a specific news by exploring attitude words through the search term (engaging, dull, lovely, balance, elegant, plain, unique, etc.). The occurrences of the top ten keywords were further analysed using collocations and concordance lines, and these words were classified according to a variety of attitudes, including affect level, judgement level, and appreciation level.

Samsi et al. (2021) found that the analysis of the attitude system surrounding vaccination in the Jakarta Post revealed that most of the categories have a positive polar rather than a negative one in the Affect category, as evidenced by the high frequency of the

words “need”, “hope”, and “fear”, indicating that people tended to feel fearful when injecting a Sinovac vaccine and to express a strong desire to overcome this situation while putting their faith in the government. In contrast to other subtypes, the judgement category was only occasionally presented in an article published by The Jakarta Post between the first and second weeks of March in 2021. The corpus reveals that the words “power” and “fair” appeared only once, whereas “ability” appears twice. The term “able” in this context alludes to the ability to accomplish anything or the capability to claim as a part of social life, which might be interpreted to mean that this category rarely realises its potential in this circumstance. Lastly, the Appreciation category was divided into three types: reaction, composition, and evaluation, with the negative polar of the phrase “not-like” and the word “difficult” and the positive polar of the words “clear” and “important”. In addition, the word “clear” indicates that the information about vaccination is organised correctly and is sufficiently clear. Finally, the word “important” appears to be a claim made by an expert or a sage to the government or other players. It is evident from the analysis that individuals do not value or appreciate the government’s efforts. This was demonstrated by the fact that people use the word “essential” to emphasise how crucial it is to safeguard their health from the virus, despite their somewhat negative reaction. Samsi et al.’s (2021) findings also stressed that the media, which was realised by journalists, persuaded society to vaccinate against COVID-19 in order to normalise all aspects of human life following the disruption era, whether they be economic, health-related, or other.

Furthermore, the ideology of the ruling party has played an essential role in managing the situation as a result of the disease outbreak. A study by Oztürk et al. (2021) examined the tweets of the Minister of Health of the Republic of Turkey (Dr. Fahrettin Koca) relating to COVID-19 on Twitter during the global epidemic within the framework of affect, which

is a subcategory of the Appraisal Theory system called attitude. Oztürk et al. (2021) sought to determine how the attitude of the Turkish Minister of Health towards combatting COVID-19 is linguistically formed in terms of affect. The affect subfield of Appraisal Theory was selected to analyse the data in this study because it was believed that this system could be effective for the development of linguistic constructs in a disease-related issue, as the affect subfield is concerned with reactions and emotions. The official account of Minister of Health of the Republic of Turkey was used to collect data, resulting in the collection of 1,703 tweets between the March 11, 2020, until January 26, 2021. As Oztürk et al. (2021) primarily focuses on tweets posted in Turkish, non-COVID-19-related and English-language tweets were eliminated, yielding 951 tweets for the analysis. To perform the analysis, the subfield of affect was analysed under three headings: happiness/unhappiness, security/insecurity, and satisfaction/dissatisfaction, which were then subdivided into positive and negative subcategories.

Oztürk et al. (2021) found 769 tweets containing affect elements, with in/security being the most prevalent category (frequency of 517), followed by un/happiness (frequency of 186) and dis/satisfaction (frequency of 66). Security was well ahead of the other two subclasses of affect due to the necessity of instilling trust in people, as the Health Minister's role was to prevent the spread of the sickness and reassure the public. Positive security (372) is used more frequently than negative security (372) (145). Similarly, in the subfield of un/happiness, positive-happiness (140) appears more frequently than negative-unhappiness (46), and in the subfield of satisfaction, positive-satisfaction (55) appears more frequently than negative-dissatisfaction (11). Oztürk et al. (2021) found that 80.8% of the tweets on affect, with 73.74% of linguistic resources expressing positive affect as it can give emotional impact on the society.

The ability of Appraisal Theory to reveal the language of evaluation can provide insights into the attitudes, beliefs, and values of the speaker or writer. Therefore, the present study applied the Appraisal Theory to evaluate the sentiments expressed by Malaysian Twitter users to gain a better understanding of how the Malaysian Twitter users react and expressed their emotion towards the COVID-19 vaccination through all the three phases of disease spread and control. This framework allows categorization of the different types of appraisals that are reflected in the discussion during the different phases of disease spread and control.

2.8 Chapter Summary

This chapter provides a review of the literature on the infectious disease and how the discussion related to health has been discussed through the social media platform, such as Twitter. This chapter also provides the literature related to the Thematic Analysis and Appraisal Theory, as the approaches applied in this study.

To sum up this chapter, past studies on infectious disease has proved the ability of Internet and social media as the platform for finding and gaining knowledge on health-related information. However, despite the advantages of the quick and easy access in seeking health-related information on social media, the validity of the sources was not fully trusted. A more worrying situation was the ability the news influenced one's decision. As mentioned by Fox and Rainie (2000), 70% of Internet users claimed that the content on the Web influenced their medical decisions. Through the studies, it can be seen that the public opinion and reactions on COVID-19 change over time, for example, the sentiment analysis on worldwide data and Europe countries became negative over time (Kruspe et al., 2020; Prabhakar Kaila & Prasad, 2020). However, another study suggests that sentiments of Nepal,

United Kingdom, Mali, South Africa and Pakistan was mostly positive during the COVID-19 outbreak (Hung et al., 2020; Mansoor et al., 2021 Pokharel, 2020) with concerns changing over time (AbdulAziz et al., 2021; Naseem et al., 2021).

Vaccination was one of the alternatives that can be taken to reduce the spread of an infectious disease, which in study, the infectious disease focused on was the COVID-19. It is important to observe the sentiments and reactions around vaccination to observe the hesitancy and acceptance of the public. Past studies on COVID-19 vaccination found that the sentiments on the public depended on the news event (Lyu et al., 2021; Malagoli et al., 2021; Saleh et al., 2021). For example, the sentiments among public become more positive when news announced the effectiveness of a vaccine. Past studies also reveal common emotions found around COVID-19 vaccination (Batra et al., 2021; Dubey et al., 2021) were mostly fear and trust.

With regard to analysing the public sentiment and opinions, each sentiment expressed by the public reflects the area of concerns and misconceptions that public have about vaccines. Vaccine confidence is becoming an increasingly significant global on public health issue (Brown et al., 2010). In addition, sentiments expressed on social media can affect other views, particularly on their vaccination behaviour, such as trust and confidence, which needed to ensure the success of vaccination campaign. As reported by Cnet.com (February 17, 2023), as the country moves out of the emergency phase of the pandemic, the US Food and Drug Administration has a plan regarding how the COVID-19 vaccination programme will operate the future, with the boosters and vaccines will benefit the same way as yearly flu shots do. In early 2023, the Omicron variant continued to drive cases with the rise of a new subvariant called XBB.1.5 (WHO, 2023) marks that the virus is not over yet.

In Malaysia, vaccination has played an important role to public health intervention that can prevent the spread of infectious diseases and save lives. Past studies on COVID-19 vaccination in Malaysia has shown the factors of vaccine acceptances and hesitancy (Jafar et al., 2022; Marzo et al., 2022). Malaysians were worried about the safety and effectiveness of the vaccine, mistrusted scientists, and governments, and lacked intent to get a COVID-19 vaccine and these factors influenced the vaccination rate of a country. Hence, the present study investigated the sentiments related to COVID-19 vaccination in Malaysia through the lens of Twitter, as one of main social media platform used to disseminate information related to COVID-19 and its vaccines. These past studies presented provided a rich empirical framework for the interpretation of the result of this intended study on Malaysian sentiments.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter describes the research design, corpus, instrument, data collection procedures and the data analysis procedures for the study on sentiments in tweets on COVID-19 vaccination. The ethical considerations on the data also have been presented in this section.

3.2 Research Design

A descriptive research design was selected for this study on sentiments in tweets on COVID-19 vaccination. A descriptive research design allows researchers to describe a phenomenon and its characteristics by focusing on the “what” than “how” or “why” something has occurred (Gall & Borg, 2007). The sentiment analysis carried out in the study focussed on descriptions of the characteristics of the Twitter users’ sentiments on the spread of the infectious disease. In the present study, the sentiments were analysed using qualitative techniques of analysis, and subsequently the frequencies and percentages were calculated to determine the patterns.

3.3 Corpus

The corpus was gathered from Malaysian Twitter users using keywords that were selected based on their relevance to the topic of interest, which is the COVID-19 vaccination in Malaysia. In order to comprehensively cover discussions on this topic on Twitter, these keywords were selected to encompass a wide spectrum of terms commonly linked with COVID-19, its vaccines, and related conversations on various social media platforms such

as “coronavirus”, “COVID19”, “C19”, “vaccine(s)”, “vaccination(s)”, “vaccinate(d)”, “vaccination drive”, “pandemic”, “immunization”, and the names of vaccines available such as “Pfizer”, “AstraZeneca”, “Sinovac”, “CanSinoBIO”, “Sputnik V”, “Moderna”, “Janssen”, “Johnson & Johnson”, “Sinopharm”, and “Covaxin”. The usage of geotagged Twitter data, by deciding the corpus from Malaysia provided better option to identify the Malaysian Twitter users’ opinions and reactions on the related issue.

Among the social media platforms, Twitter was selected to examine public opinion on COVID-19 vaccination because of several reasons. Firstly, restriction movement and lockdown during COVID-19 pandemic has turned social media platforms such as Twitter as one of the most important means of sharing information and expressing feelings regarding COVID-19 (Mohammed & Ferraris, 2021; Younis et al., 2020). Secondly, Twitter offers real-time content and easy accessibility to publicly accessible collection of data (i.e., tweets) that are taken at a certain period from a specified geographic location (Sinnenberg et al., 2017). Data on Twitter can be classified as “public” considering anybody with Internet access can access content on Twitter. There is no need to subscribe, create a password, or pay to access the data. By consenting to Twitter’s terms and conditions, the users already consent to their information being collected and used by third parties (Twitter, 2016). Regardless, Twitter’s “terms of service” already informed new users that public tweets are available to anyone, regardless of whether they have a Twitter account or not. Therefore, this study only included tweets that were marked as public, and the third-party application used, TweetDeck did not have the ability to extract tweets that came from private account. Thirdly, another study (Novak et al., 2020) has found high similarity in results from

questionnaire studies and qualitative analysis of naturally occurring data, supporting the validity of using Twitter data as a reliable source for studying public opinion on COVID-19 vaccination.

The collection of tweets comprised data from the entirety of 2021, spanning from January to December. The year 2021 was chosen for the tweets on COVID-19 vaccination because this was the year when the key events related to vaccination happened in Malaysia, from before the arrival of the vaccines to the implementation of the booster shots. January marked the time when the first vaccine shot arrived in Malaysia. December 2021 marked the time when the vaccination for teenagers along with the third dose or booster dose programme was underway in Malaysia. Analysing one year of data enables researchers to see a clearer trend in the change of sentiments. Past studies had shorter periods of data collection. Esra et al. (2022), Saleh et al. (2021), and Lyu et al. (2021) analysed 10 months of data. Other researchers had even shorter periods of data collection such as one month (Ansari & Khan, 2021; Hung et al., 2021) and one week (Mustafa & Balla, 2020). The long-time span in this study allowed the researcher to observe major shifts in topics and sentiments throughout the pandemic.

Following past studies, the target of corpus in this study was about 30,000 words, from approximately 2,000 tweets. For an analysis of professional texts, a language corpus of 20,000 to 30,000 is sufficient (Greenbaum, 1991; see also Dong et al., 2015; Jean et al., 2007; Klakow et al., 2002). In addition, previous research has shown that qualitative content analysis can be done using less than a thousand tweets (Lee et al., 2014). However, in the present study a larger set of tweets was collected to ensure optimal representation of the public's opinions on social media.

3.4 Instrument

Three instruments were used to guide the data analysis. For Objective 1 on themes in tweets on COVID-19, Thematic Analysis was carried out, guided by the six steps of Thematic Analysis given by Braun and Clarke (2006), as shown in Table 3.1.

Table 3.1: Six steps of Thematic Analysis from Braun and Clarke (2006)

Steps	Analysis activities
Step 1: Familiarization	The researcher becomes familiar with the entire data set, which entails repeated and active reading through of the data.
Step 2: Generating initial codes	The researcher generates “codes” by first taking notes on potential data items of interest, questions, connections between data items, and other preliminary ideas.
Step 3: Searching for themes	The researcher examines the coded and collated data extracts to look for potential themes of broader significance.
Step 4: Reviewing themes	The researcher review, modify and develop the preliminary themes that were identified in Step 3 by checking several requirements, such as, “Do the themes make sense?”, “Does the data support the themes?”, “If

Table 3.1 continued

	themes overlap, are they really separate themes?” and “Are there other themes within the data?”
Step 5: Defining and naming themes	The researcher creates a definition and narrative description of each theme, including why it is important to the broader study question.
Step 6: Producing the report/manuscript	The researcher writes up the final analysis and description of findings.

(Taken from Braun & Clarke, 2006)

Next, for the second objective of this study to analyse sentiments in tweets, two instruments were used. The first instrument was for categorising the sentiments in the tweets into positive, negative and neutral sentiments. Reference was made to Nuzhath et al.'s (2021) codebook which analysed the public's exposure to misinformation, conspiracy theories, and concerns on Twitter regarding a potential COVID-19 vaccination as shown in Table 3.2.

Table 3.2: Sentiment categories of tweets taken from Nuzhath et al. (2021)

Categories	Definitions
Positive	The tweets encourage others to take vaccine by mentioning research discoveries related to the COVID-19 vaccine, or the tweet reflects a positive attitude toward the COVID-19 vaccination.
Neutral	The tweet's overall sentiment is neutral, that is, if tweets provide information without using emotional words or provide general information about COVID-19 vaccine.

Table 3.2 continued

Negative	The tweets say vaccines are unnecessary, provide misinformation and conspiracy theories, or raise safety and effectiveness concerns about vaccine.
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(Taken from Nuzhath et al., 2021)

The second instrument to guide the analysis of sentiments in tweets was based on Martin and White's (2005) Appraisal Theory, whereby emotional reactions (positive, negative, neutral) were analysed to identify the three aspects of emotional reactions of Attitude, Engagement and Graduation. The three subtypes of Martin and White's (2005) Appraisal utilised by presenters and writers in connection to the material and the intended audience: (a) attitude (e.g., one's emotional reactions, evaluation of behaviour, and evaluation of things); (b) engagement (e.g., how one positions their text's proposal and propositions intersubjectively, such as rejecting, agreeing, or voicing own opinions); and (c) graduation (e.g., one's use of language to amplify (force) or diminish (focus) the attitudes and engagement). Table 3.3 presents the categories and examples for the Appraisal Theory.

Table 3.3: Features of Appraisal Theory taken from Martin and White (2005)

Aspects	Categories	Examples
Attitude Speakers/text attach intersubjective value to emotional responses	Judgement Value of statement made (positive or negative) regarding human behaviour	Corrupt, brave, cruel, etc.
	Appreciation Value of statement made (positive or negative) regarding process	Beautiful, ugly, pretty, etc.

Table 3.3 continued

	Affect Emotional or affectual response	Sad, proud, trauma, hate, etc.
Engagement Position a text's proposal and propositions intersubjectively	Disclaim The textual voice positions itself as at odds with, or rejecting, some contrary position	No, didn't, never, yet, although, but, amazingly
	Proclaim By representing the position as highly warrantable (compelling, valid, plausible, generally agreed, reliable, etc.)	Of course, no wonder, predictably
	Entertain By explicitly presenting the proposition as grounded in its own contingent, individual subjectivity	It seems, apparently, perhaps, probably, maybe, it's possible, in my view, I believe
	Attribute Proposition from the text's internal authorial voice by attributing it to some external source	X said, X believes, reportedly, according to, X says
Graduation Degree of the speaker's personal investment in text.	Force Strengthened or mitigated propositions	Slightly, very, surely, obviously, etc
	Focus Sharpening or blurring of semantic boundaries	Effectively, truly, etc

(Taken from Martin & White, 2005)

3.5 Data Collection Procedures

Although Twitter data are open to the public, nevertheless, ethics approval was sought because personally identifiable data are involved. The outcomes of data analysis could draw attention to specific persons, groups, or trends although no names were included in the research report. Appendix 1 shows the letter which confirms ethical approval was granted from the Human Research Ethics Committee of Universiti Malaysia Sarawak in this study and that no consent from individual participants was needed as all the data collected were public data.

Data collection in this study was conducted to collect tweets from January 1 to December 31, 2020. These dates were selected because it includes three different phases of Malaysia vaccination progress:

- (1) Unavailability of the vaccine: January 1, 2021, to February 23, 2021. Malaysians were waiting for the arrival of the first vaccine shot.
- (2) Vaccine distribution: February 24, 2021, to September 24, 2021. Malaysians receive their first and second dose of vaccination.
- (3) Announcement of booster dose programme. September 25, 2021, to December 31, 2021. Malaysians experience loosening of restrictions.

These periods enable the changes in sentiments of Malaysian Twitter users towards COVID-19 vaccine to be analysed.

The data collection was from Twitter via TweetDeck, a third-party app that connects to Twitter via Twitter API (Miller, 2011) which allows users to sort Tweets in columns according to user-specified criteria (Jefferis, 2016). TweetDeck also has convenient features. It allows a search of keywords needed. It also allows the time for the collection of data to be set. In addition, the researcher can select the location and the language of the tweets. The

Twitter platform also allows users to view multiple timelines in one easy interface. Tweets were extracted using COVID-19 vaccines keywords (for details, refer to Section 3.3).

3.6 Data Analysis Procedures

The section describes the data analysis procedures relating to Thematic Analysis, and sentiment analysis based on the Appraisal Theory.

After collecting the data, the data went through the pre-processing steps following the procedure from American Standard Code for Information Interchange (ASCII) in order to filter the tweets, where: 1) The tweets selected must contain at least one of the vaccine keywords decided, 2) The duplicate tweets were removed, and 3) The urls, username and links were removed. Davidov et al. (2010) was concerned that tweets with #hashtags are noisy. Hence, the hashtags in the tweets were eliminated during filtering process.

As the dataset ($n=5,766$), which refers to the total number of tweets collected for analysis was large, a detailed analysis of the whole dataset using the Appraisal Theory was not feasible. Therefore, a subset ($n=150$) of the dataset which was a smaller selected portion of the entire collection of the dataset was chosen using systematic sampling that involves choosing data points at regular intervals, ensuring a balanced representation of the overall dataset for in-depth qualitative analysis. After filtering the tweets, 150 tweets (5200 words count) from 150 different Malaysian Twitter users on Malay and English languages have been systematically chosen from each phase for the analysis. Initially, the researcher divided the total of tweets, which is 150 into 3 phases of the study, resulting 50 tweets were collected from each phase. Then, to make sure all the data represented the discussion of the timeline from the phases, the selection of tweets was made based on dates on each phase, following

the steps presented in Figure 3.1. These steps were designed to ensure a balanced representation of the comprehensive dataset and to effectively manage the analysis of a large dataset and to capture critical moments in the discourse across different phases.

- (1) Phase 1: The duration for this phase is 54 days. Two tweets selected from a day apart (the first and last tweet from the date), however, only one tweets selected on the mean date of each month (the first tweet from the date).
- (2) Phase 2: The longest duration compared to other phases, which is 213 days. The date selection was made based on the ration 1:5 (one tweet in five days). To complete the numbers of 50 tweets, an extra tweet was collected on the mean of each month, as it might be the turning point of the topics to fluctuated. All tweets selected was the first tweet from the date.
- (3) Phase 3: The duration is 100 days. One tweet was selected from a day apart (the first tweet from the date).

The 150 tweets were labelled as Tweet 1 to Tweet 150. However, to signify when the tweets were written, P1, P2 and P3 were added to the code used as Phase 1, Phase 2 and Phase 3. In addition, as the Twitter data were in both Malay and English, there is a need to translate the Malay tweets into English to include in the description of results in Chapter 4. A direct translation method was used to retain the authenticity of the data. The translation was checked by the researcher's supervisor to ensure the accuracy of the translation. For example, P3-Tweet 140 was originally in Malay and was translated as follows:

Lambakan kematian akan berterusan hanya disebabkan pilihan bodoh dari ketamakan urusaniaga vaksin.

(Tons of deaths will continue solely due to the foolish choices from the of the vaccine business.)

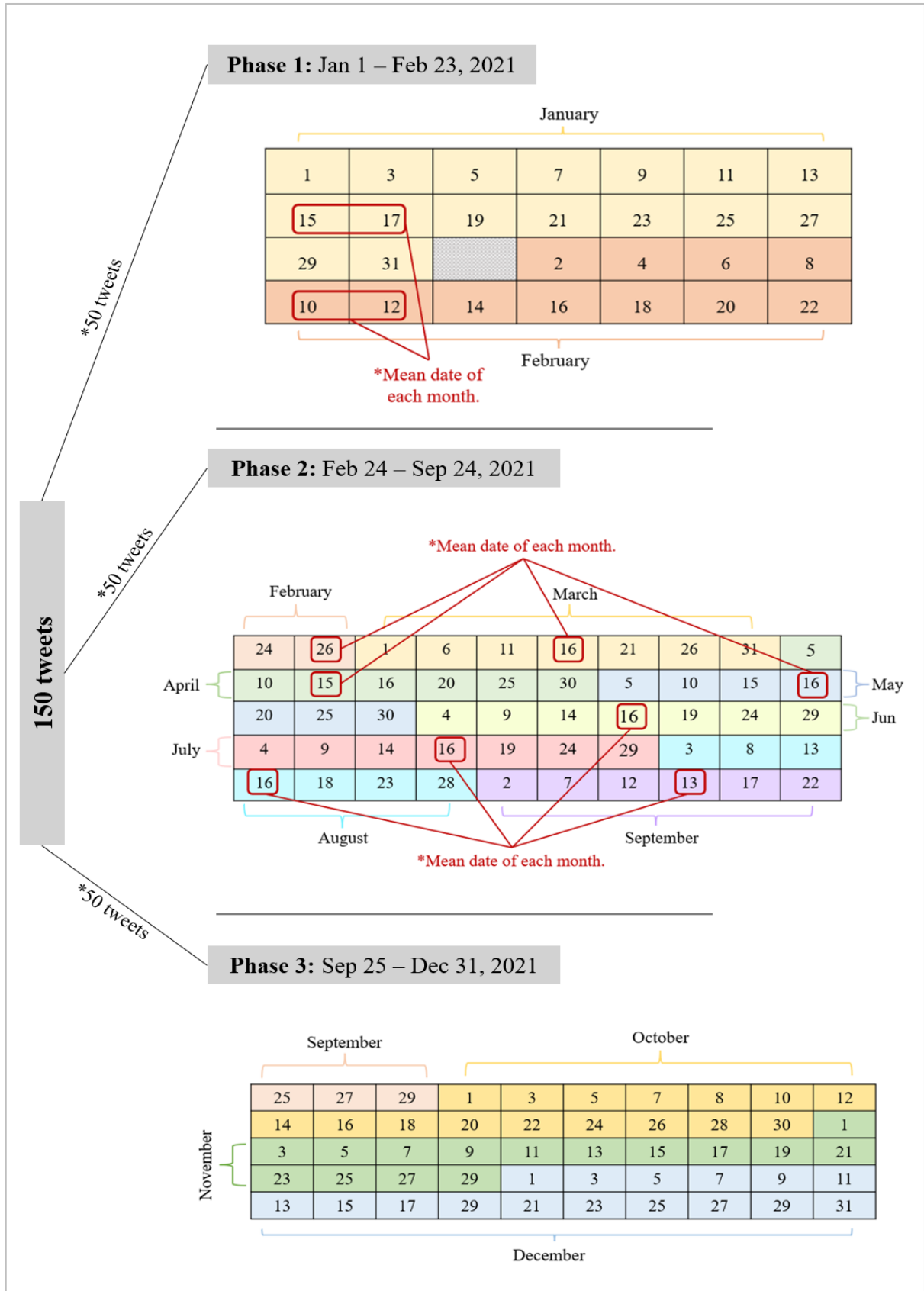


Figure 3.1: The Selection of Tweets based on Dates

3.6.1 Thematic Analysis

Some researchers stated that content analysis is a quantitative methodology which limits the qualitative insights because it restricts coding to a small number of predetermined themes and subthemes (Bengtsson, 2016). In contrast, Thematic Analysis can offer in-depth insights because it involves qualitative analysis of the rich details in the data. Thematic Analysis is a method of analysing qualitative data to identify, analyse, and interpret the patterns and interior hidden themes of qualitative data (Guest, MacQueen, & Namey, 2012).

According to Braun and Clarke (2006), Thematic Analysis:

... is a method for identifying, analysing, and reporting patterns (themes) within data. It organises and describes your data set in (rich) detail at a high level. It frequently goes beyond this, however, and interprets various aspects of the research topic. (p. 79)

This study employed inductive Thematic Analysis for objective 1 to gain a clearer understanding of the themes and sub-themes of discussion on COVID-19 vaccination by Malaysian Twitter users. In inductive reasoning, the research begins with very specific observations, which enables the identification of potential patterns in order to develop initial hypotheses that can be explored further. Inductive Thematic Analysis was employed because inductive reasoning is more open-ended and exploratory, particularly in its beginning phases, whereas deductive reasoning tends to have a fixed focus and is oriented on testing a hypothesis (Bryman, 2008; Trochim, Donnelly, & Arora, 2014). It is acknowledged that inductive Thematic Analysis is an effective technique for determining the viewpoints, opinions, knowledge, and experiences of individuals. This analysis method is also adaptable in terms of data interpretation, especially when dealing with massive data sets, as it allows for easy categorization into broad themes.

The selected data were exported in Microsoft Word and divided into three different tables based on the three phases. Following Braun and Clarke (2006), the researcher read through the data several times for familiarization purpose while actively observing meanings and patterns that appeared across the data set. The second stage of analysis was generating the initial codes by highlighting the tweets and assigning nodes that represent the meaning and patterns. Next, based on the nodes found, topics of the tweets were generated. To search for the themes from the data, all the topics were grouped and combined based on the content of the tweets that were closely similar. In the final phase, the themes were further refined, modified, and merged. The application of Thematic Analysis in this study allowed the researcher to identify the trends in the themes and sub-themes on COVID-19 vaccination during the year 2021.

3.6.2 Sentiment analysis

Sentiment analysis is used to identify and classify users' attitudes and feelings (positive, negative, or neutral) in texts to determine their attitudes on products, subjects, or services (Salur & Aydin, 2020). Sentiment Analysis is a technique for extracting relevant views, emotions, and attitudes from written text (Lombardo et al., 2019). This study uses Nuzhath et al.'s (2021) manual for sentiment analysis (see Table 3.2). Researchers stated that codebook is a reliable approach because it provides a formalized operationalization of the codes (Crabtree & Miller, 1999; Fereday & Muir-Cochrane 2006; Fonteyn et al., 2008; MacQueen et al., 1998).

Based on the codebook (Table 3.2), there are four categories of sentiment which are the positive, neutral, negative and irrelevant. However, this study does not take into account the irrelevant categories as all the data were collected based on the search keywords (See Section 3.3), therefore, all the data were related to the topic of this study, that is on “COVID-19 vaccination”. The same word does not always express the same sentiment because the meaning depends on the context in which the word is used. Hence, sentiment analysis may include semantic-level analysis in order to solve word ambiguity and correctly capture the meaning of each word according to its context. For example, “happy” is a positive sentiment but “not happy” is a negative sentiment. The presence of the negation changes the category of the sentiments. In the present study, attention was given to meaning through the detailed semantic-level analysis. Multiple reading was carried out to ensure that a good understanding of the meaning of the tweets before deciding the categories.

3.6.3 Analysis based on the Appraisal Theory

The objective of the evaluation approach is to comprehend how speakers convey their emotions, how they emphasise them, and how they may incorporate the voices of others into their talks (Samsi et. al, 2021). Past studies (Cascini et al., 2022; Cuesta-Cambra et al., 2019; Germani & Biller-Andorno, 2021; Javanainen, 2020) observed that social media messages are a source of naturally occurring interactions that may be examined to indicate pro- and anti-vaccination attitudes, emotions, and perspectives. Given this perspective, Martin and White’s (2005) Appraisal Theory was adopted to determine the types of evaluations Twitter users in Malaysia employed in 2021 when discussing the COVID-19 immunisation.

A systematic selection of the manually analysed data was made in order to identify the evaluation aspects used in Twitter messages based on Table 3.3. The total occurrences of each appraisal criteria (attitude, engagement, graduation) were then compared in order to determine its trends. By using Appraisal Theory, this study was able to uncover how Malaysian Twitter Users expressed their feelings, tastes, and opinions with varying degrees of intensity and directness, as well as how they interpreted propositions as more or less contentious or justifiable in relation to the post about COVID-19 Vaccination.

3.7 Limitations

Current research indicates that social media platforms such as Twitter can be utilised to investigate disease outbreak discussions. Nonetheless, the current study has some limitations that can be addressed in future research.

Firstly, this study was conducted using a single social media site, Twitter, which cannot adequately represent the overall Malaysian public's opinion. Other social media sites, such as Facebook, Instagram, etc., can be employed in future research, as these are platforms where individuals typically share their ideas and emotions in real-time. The data can then be accessible using keywords or hashtags when conducting research on Twitter. However, the keywords used to obtain data may not be able to capture all of the data generated on a particular topic. This study, for instance, aimed to capture mentions of COVID-19 using the phrase COVID-19, which may have excluded those who referred to the virus without stating it in their tweets or who used other abbreviations or slang for the virus and its vaccines. Thirdly, this study is limited to Malay and English tweets, thus it excludes examine tweets posted in other languages, such as Mandarin, Tamil, and others.

Due to their nature, tweets lack the depth that might be present the ability to provide the depth of insight that can be obtained through traditional qualitative methodologies like focus groups or interviews. One significant limitation is the lack of demographic information in tweets, which is a feature that could be present in more conventional qualitative methods like surveys or interviews. It is crucial to recognize the significant differences that have been seen between offline and online behavioral patterns, indicating that conclusions drawn from Twitter may not always coincide with conclusions drawn from more traditional qualitative research methods. Finally, it's also critical to acknowledge the importance of Twitter data in providing affordable access to aspects of human behaviours and thought. It is therefore best used in conjunction with other methodological approaches as a complimentary source of research data.

3.8 Chapter Summary

This chapter has provided an overview for the methodology of the qualitative descriptive study on sentiments pertaining to COVID-19 vaccination expressed by Malaysian Twitter users.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

Chapter 4 describes the results of the study on sentiments of the Malaysian public on COVID-19 vaccination expressed on social media, Twitter. The results address two objectives of the study on: (1) themes on COVID-19 vaccination that were discussed in tweets; and (2) patterns of sentiments on COVID-19 based on the Appraisal Theory (Martin & White, 2005).

4.2 Themes and Sub-themes of Tweets on COVID-19 Vaccination

This section presents the results for objective 1 on the themes and sub-themes of the discussion by Malaysian Twitter users on the COVID-19 vaccination from January 1, 2021, until December 31, 2021. The year 2021 is a crucial year in disease spread and control for COVID-19. The themes and sub-themes were analysed based on the inductive approach of Thematic Analysis by Braun and Clarke (2006). The arrangement of these themes, designated as Theme 1 (Vaccine Administration), Theme 2 (Impact of Vaccine), and Theme 3 (Vaccination and COVID-19 Control), is based on the frequency of occurrences across three phases (Phase 1, Phase 2, and Phase 3) during the specified time frame. The resulting themes and sub-themes offer valuable insights into the interests and concerns of the public, shedding light on their perspectives on the vaccine, its administration, and its implications for COVID-19 control measures. These outcomes are visually represented in the concept map in Figure 4.1, showing the distribution of sentiments and the prominence of each theme in the discourse.

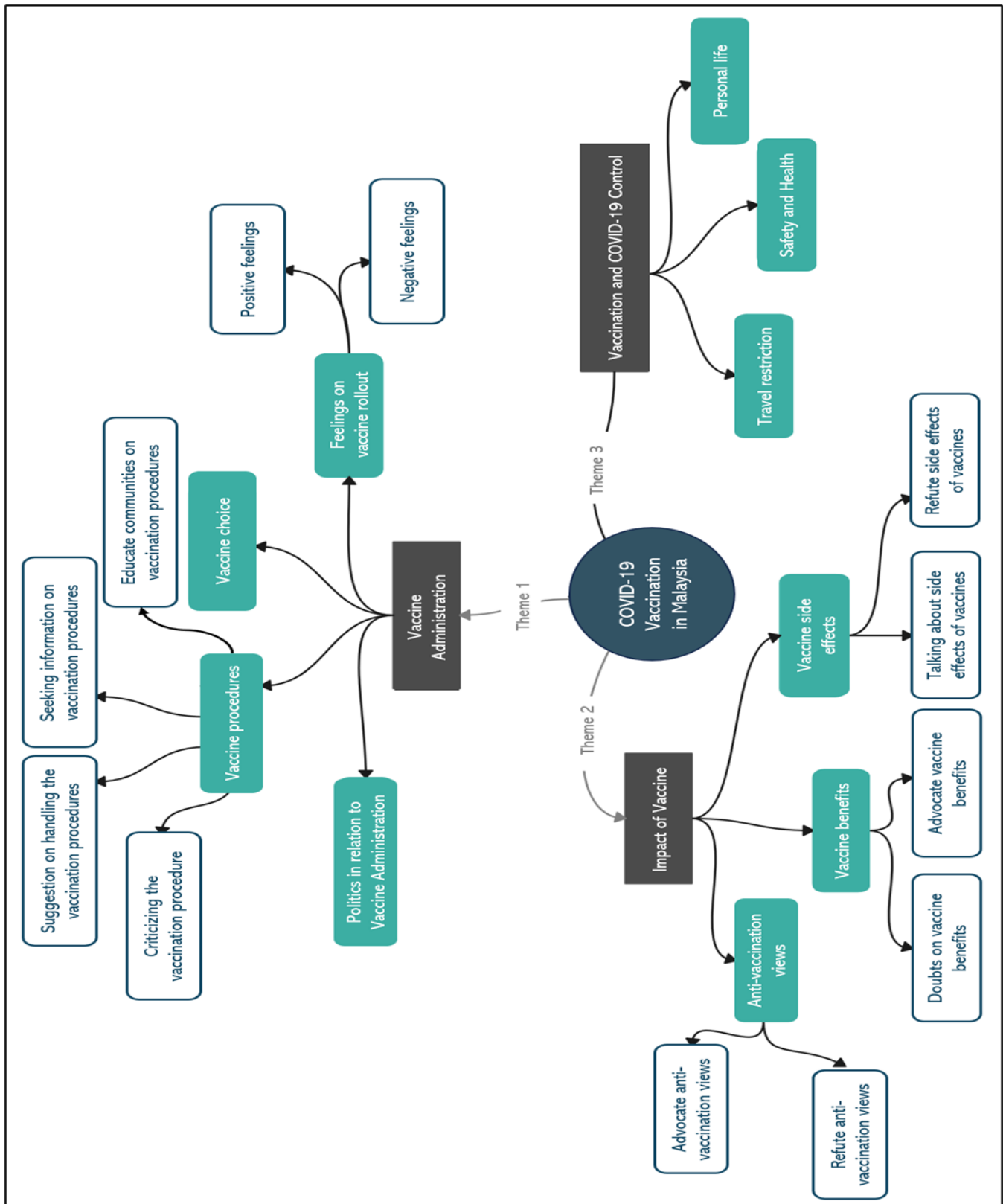


Figure 4.1: The Concept Map of the Themes and Sub-themes in the Discussion of COVID-19 Vaccination among Malaysian Twitter Users

4.2.1 Tweets on Vaccine Administration (Theme 1) according to its Phases

The first theme of conversation by Malaysian Twitter users on COVID-19 vaccination is the “Vaccine Administration”, which consists of four sub-themes which are the “Politics in Relation to Vaccine Administration”, “Vaccine Procedures”, “Vaccine Choice”, and “Feelings on Vaccine Rollout”.

a) Politics in Relation to Vaccine Administration

The first sub-theme under the theme “Vaccine Administration” is “Politics in Relation to Vaccine Administration” encompassing tweets that either mention the names of politicians or allude to political figures. The “Politics in Relation to Vaccine Administration” sub-theme refers to the ways in which political factors and decision-making influence vaccination policies, practices, and attitudes. Vaccination is a public health intervention that can have significant social, economic, and political implications, and political actors can play a role in shaping the distribution, access, and uptake of vaccines.

The analysis revealed that a large number of politics-related tweets were about a spike in COVID-19 cases following the Sabah state election. In early 2020, Malaysia experienced a near-zero number of positive cases due to the Movement Control Order (MCO). However, in May 2020, state elections were held in Sabah, a big East Malaysian state in northern Borneo that is home to nearly 3.9 million people. The Malaysian election system requires registered voters to cast their ballots in person at their registered residential areas. This resulted in huge gatherings of people and lead to the spread of the virus. This incident has led the public to express their hate and judgement towards Malaysian’s politicians who were too keen to have elections, such as:

P1-Tweet 4:

Hold elections quickly now vaccines are here, says Ahmad Maslan *Tolong tukar nama Mat Bongong... Sial*

(Hold elections quickly now vaccines are here, says Ahmad Maslan Please change the name to Mr. Dump... Damn)

In P1-Tweet 4, the phrase “election” and the use of the politician’s name “Ahmad Maslan” indicated that the criticism was directed at the politicians’ reckless disregard of the pandemic. The disapproval or frustration with Mazlan’s statement was expressed and his priorities were criticized. Following this, the former prime minister acknowledged that the elections in Sabah played a role in the rapid spread of the virus (The Star, 2020, November 18). This prompted the Malaysian people to criticize the politicians for being self-centred.

The criticism towards politicians were made more extensively during the vaccine distribution phase (Phase 2). Politicians had preferential treatment when the vaccination roll-out first began (P2-Tweet 57). They received the vaccine shot earlier than expected date and the Twitter users were not happy like P2-Tweet 85 who talked about double standards.

P2-Tweet 57:

Who has priority over vaccination, MPs Ministers and their families, or OKUs?

P2-Tweet 85:

We rakyat beg all the politicians whether in the Govt or politicians stop abusing their power & trust given. Work to clear the burden of rakyat. @JKJAVMY @KKMPutrajaya start vaccination in biggest scale without any manipulation or corruption. @MKNJPM stop double standards.

Here the background on the perceived double-standard in vaccination is provided. On February 24, 2020, Malaysia launched its National COVID-19 Immunisation Programme (PICK), with priority given to frontliners, senior citizens, and high-risk citizens. However, claims of queue-jumping have surfaced on social media, sparking a public outcry. The public made allegations that several political aides and senior government officials received their vaccination despite not qualifying for the first phase of the national plan (The Strait Times, 2021, March 1). Both P2-Tweet 57 and P2-Tweet 85 indicated that the public urged politicians to distribute the vaccine without favouring certain groups of people. The former Minister of Science, Technology, and Innovation, Khairy Jamaluddin, however denied the allegations and stated that there was confusion regarding the definition of “frontliners”, which resulted in several political aides and senior civil servants skipping the queue. Based on the analysis, no political tweets were detected during the implementation of the booster dose (Phase 3), possibly due to a shift in interest among Malaysian Twitter users.

b) Vaccine Procedures

The second sub-theme under the theme “Vaccine Administration” is the “Vaccine Procedures” which consist of tweets that criticize, suggest, seek information, and educate others on the vaccine rollout in Malaysia. Tweets about “Vaccine Procedures” encompassed the tweets that provide valuable information and updates for individuals who are seeking to get vaccinated or are interested in understanding the processes involved in vaccine distribution and administration. The “Vaccine Procedures” were the most dominant sub-theme under “Vaccine Administration”. There are four minor themes under the “Vaccine Procedure” which consist of tweets that “Criticizing the Vaccination Procedures” (n=17),

“Suggestion on Handling the Vaccination Procedures” (n=16), “Seeking Information on Vaccination Procedures” (n=7), and “Educate Communities on Vaccination Procedures” (n=7).

i. Criticizing the Vaccination Procedures

The first minor theme of “Vaccine Procedures” is the tweets on “Criticizing the Vaccination Procedures”. Criticism of the vaccination procedure has become a hot topic in recent times, with concerns ranging from the effectiveness and safety of vaccines to the logistics of administering them. This minor theme shows the tweets that expressed their criticism towards the vaccination procedures implemented in Malaysia during the study period.

During Phase 1, discussion on vaccine distribution recorded the highest occurrences by criticizing the administration procedures due to the late progress of the vaccination in Malaysia. The first vaccine shot was distributed in the UK during December, followed by other countries, which marked the beginning of vaccine administration worldwide. Malaysia, thus far, received the vaccine in February 2021 which was a few months late compared to other countries. The delay became a hot topic among the public, as news reports of rapid progress in other countries continue to spread. P1-Tweet 19 and P1-Tweet 21 both said that Singaporeans would get vaccinated earlier than Malaysians.

P1-Tweet 19:

So my friend (a Malaysian who currently work in SG) is scheduled for his vaccine shots by end of this month. Our country? Well, end of February. Lol

P1-Tweet 21:

I am very jealous that people in Singapore have gotten the vaccine already. It's just pure incompetence for the delay here in Malaysia, nothing else.

In response to criticism about the “Vaccination Procedures”, Malaysian Twitter users started to compare other country's vaccination progress while waiting for the arrival of the vaccine. For example, P1-Tweet 19 criticized Malaysian authorities for the slow vaccination progress, while P1-Tweet 21 was expressing the dissatisfaction and jealousy over other's country vaccination progress.

Finally, the vaccine arrived in Malaysia in April 2021. At that point in time, neighbouring Southeast countries had already begun their vaccination. For example, neighbouring Singapore had more than 23% of the population vaccinated once already while 4% in Indonesia had received their first dose of the vaccine (The Edge Market, 2021). The Malaysian Twitter users expressed their impatience and urged the authorities to hasten the process. P2-Tweet 66 made references to the fast and furious movie to imply that Malaysia needed to hurry up. P2-Tweet 68 said that Malaysia needed to speed up the vaccination of the senior citizens.

P2-Tweet 66:

No, the world does not need ANOTHER fast & furious movie. the world needs faster vaccination process.

P2-Tweet 68:

Well, please hurry up with the vaccination for senior citizens. Plenty have yet to receive their appointment dates.

The phrases related to the minor theme of “Criticizing the Vaccination Procedures” were “faster vaccination process” (P2-Tweet 66) and “hurry up” (P2-Tweet 68) and reflected the pressure of the public to get vaccinated as soon as possible. However, during Phase 3, criticisms towards the vaccine procedure decreased. There were only two tweets on this minor theme in Phase 3. Based on the tweets P2-Tweet 66 and P2-Tweet 68 it appears that there was frustration and concern among some Twitter users about the pace of the COVID-19 vaccination process. While one Twitter user argued that resources should be directed towards improving the vaccination process rather than towards entertainment, the other Twitter user specifically called for a faster vaccination process for senior citizens. Both tweets suggest that there is a sense of urgency and a desire for more efficient and effective vaccination efforts.

ii. Suggestion on Handling the Vaccination Procedures

The second minor theme of “Vaccine Procedures” is the “Suggestion on Handling the Vaccination Procedures”, which refers to the tweets that proposed a new or improved process for administering COVID-19 vaccines in Malaysia. Within the minor theme of “Suggestion on Handling the Vaccination Procedures”, the Malaysian Twitter users voiced their suggestion on their expectation for the government and authorities to handle the vaccine rollout plan. These suggestions were made after the news from other countries has spread. They called for action from the authorities to handle the vaccine administration in more professional way. For example, P1-Tweet 26 stated that the government should not practice discrimination.

P1-Tweet 26:

Our Govt must not discriminate when it comes to vaccinating foreign.

P1-Tweet 26 reflects a concern for ensuring that everyone has access to COVID-19 vaccinations and that discriminatory practices are not employed in the distribution of vaccines. During the early vaccine rollout in the US, Black adults consistently reported more hesitancy than White adults due to the racial discrimination (Willis et al., 2022). Therefore, there were suggestion by the Malaysian public to not discriminate foreigners in the vaccine rollout plan to ensure the higher effectiveness level of the vaccination plan. The Malaysian Twitter users were advocating the rights of foreign workers to be equally protected against the COVID-19 virus infection.

Another suggestion that was made by the Malaysian Twitter users during the phase of waiting the vaccine arrival was to embark on a massive promotion of vaccines to the public (P1-Tweet 25):

P1-Tweet 25:

Wahai kerajaan now, Kenapa tiada promosi besar-besaran about vaccines yang bakal tiba tak lama lagi? Promote la besar-besaran, aduiiiiii. Tak macam negara luar dia punya promote.

(Oh, government now, why is there no massive promotion about vaccines that will arrive soon? Promote it massively, *aduiiiiii*. Unlike other countries our promotions.)

P1-Tweet 25 suggests that a large-scale promotion of the vaccines would increase public awareness and understanding of the vaccine, which could potentially increase vaccine uptake and help in the fight against COVID-19. By using the phrase “*aduiiiiii*” the user

expressed the disappointment or annoyance at the government's lack of action in promoting the vaccines. The tweet also highlights the importance of effective communication and promotion of vaccines to encourage public trust and participation in the vaccination process.

In Phase 2, vaccination distribution began in Malaysia. However, the statistics of the vaccine uptake in Malaysia during the early distribution phase was not as high as expected due to the continued spread of vaccine-related rumours and misinformation. Therefore, the public offered the government several recommendations on how to take action on this problem. For example, P2-Tweet 70 moved from talking about vaccination for the elderly to those above 18 years old while P3-Tweet 103 talked about vaccinating children.

P2-Tweet 70:

We heard that for phase 2 vaccination for elderly, quite some numbers didn't show up due to safety concern regarding side effects. We hope for phase 3 for above 18, the postmortem from the 2 phases could be done to improve the vaccination rate.

P3-Tweet 103:

For children vaccination, PPV should expect the crowd number will be doubled. Each kid at least accompanied by one parent. Imagine if the family has 3 children to be vaccinated. They have to repeat 6 trips to PPV to complete two doses...

P2-Tweet 70 suggested that the vaccination rate can be increased through a transparent and detailed explanation of side effects that might occur post the vaccination based on the former cases. In addition, P3-Tweet 103 suggested the authorities to provide more facilities for both children and parents who will be assisting their children at the vaccination centre to ensure a smooth vaccination process for teenagers in Phase 3. Both tweets suggest that there is a need for ongoing evaluation and improvement of the

vaccination process in Malaysia, particularly in regard to addressing safety concerns, increasing vaccine uptake, and addressing logistical challenges.

iii. Seeking Information on Vaccination Procedures

The third minor theme of “Vaccine Procedures” is “Seeking Information on Vaccination Procedures” which includes the tweets that request information about the process of receiving or administering COVID-19 vaccines, such as information on vaccine availability, scheduling of appointments, vaccine side effects, or other relevant information. Due to the uncertainty of the vaccine procedures, Malaysian Twitter users were actively seeking information regarding the vaccination procedure as shown in P3-Tweet 106.

P3-Tweet 106:

@JKJAVMY my fully vaccinated status in mySJ has been changed to not vaccinated after i updated my COVID-19's self-test result. I have emailed my SJ's help desk but no response. i received my vaccination abroad. Please assist. Thank you in advance.

The Malaysian government has introduced the vaccination application to assist in managing the COVID-19 outbreaks in the country during the pandemic. MySejahtera (MySJ) apps was introduced for Malaysians to register for the vaccination, but they can also do so online on JKJAV website and call the registration line. However, several problems surfaced when some people found that their “Low Risk, No Symptoms” status was changed to “Home Surveillance Order” or “Person Under Surveillance” (PUS). Some other users encountered a change in their vaccination status from “vaccinated” to “unvaccinated”. This has caused Twitter users like P3-Tweet 106 to request assistance from JKJAV to resolve the issue and restore the individual's fully vaccinated status on the MySJ app. The tweet

highlights the need for a clear and effective system for tracking international vaccinations in the country.

iv. Educate Communities on Vaccination Procedures

The fourth sub-theme of “Vaccine Procedures” is “Educate Communities on Vaccination Procedures” touches on the other perspective on of “Seeking Information on Vaccination Procedures” (third sub-theme described earlier). Twitter users also spread information to educate the public on the vaccine administration. Tweets on “Educate Communities on Vaccination Procedures” may include a variety of information related to the COVID-19 vaccine, such as how to register for the vaccine, where to get vaccinated, vaccine safety and efficacy, and the process of receiving the vaccine. These are examples of tweets sharing useful information on the vaccine administration in Malaysia. In order to ensure the vaccination rollout plan in Malaysia run smoothly, it is important for individuals to share credible sources of vaccine-related news and updates from trusted organizations or healthcare professionals to spread the knowledge. For example, P1-Tweet 48 was explaining the main objective and mission of Malaysia’s National Vaccination Programme to educate the public.

P1-Tweet 48:

Our National Vaccination Programme main objective&mission is to vaccinate a sufficient percentage of population eg 80%, with an end view to buildup herd immunity.

Malaysia announced the mission and objective of COVID-19 vaccines at the end of February 2021 right before began the PICK. A special committee was established, and it is known as the Special Committee for Ensuring Access to COVID-19 Vaccine Supply, *Jawatankuasa Khas Jaminan Akses Vaksin COVID-19* (JKVAV), that is responsible for the COVID-19 vaccine supply. According to JKVAV, the government aims to inoculate at least 80% of Malaysia's population with the vaccines by February 2022 to lessen infections, hospital admissions, and fatalities. The action of sharing information expressed in P1-Tweet 48 shows that the Twitter user is performing a citizen duty of sharing the information he/she has to promote public health and to reduce the spread of COVID-19 in Malaysia.

Following that, the information on the vaccine steps also has been spread by the Malaysian Twitter users to promote the vaccination. The COVID-19 vaccination was administered free of charge to all Malaysians, including citizens and non-citizens, and official registration began on 1 March 2021. Registration via MySJ was the easiest and most convenient among the three registration methods; however, the registration procedures were unfamiliar to those with less experience using mobile devices. P2-Tweet 59 tried to help people who were not familiar by sharing the steps to register via MySJ.

P2-Tweet 59:

Have you registered for COVID-19 vaccination? I have. Follow the steps below: 1. Update MySejathera apps, 2. Choose COVID-19 Vaccination, 3. Check details:name, IC & area of stay. Click Ok, 4. Answer 4 simple questions & send, 5. Registration done with the record showing *vaccine for xxx*

The problem of the advance registration steps was common among the senior citizens, which were given the priority to get the first batch of vaccine. Thus, Minister Khairy Jamaluddin has announced that people could register for the vaccination on behalf of their family members for the COVID-19 vaccine starting from 12 March 2021 onwards (Wong, 2021), which help increased the numbers of registrations through MySJ.

Next, the information on the recent vaccination news were also updated by the Malaysian Twitter users. In response to the booster dose implementation in Phase 3, the Malaysian government had decided to implement the National COVID-19 Immunization Programme Booster (PICK-B) on 13 October 2021 in order to combat the waning vaccine efficacy caused by the Delta variant. P3-Tweet 142 seemed to be well-versed with the government's intention to limit benefits in order to counter the public's unwillingness to receive a booster shot.

P3-Tweet 142:

In Malaysia, people who had Sinovac can get a booster after 3 months, and after 6 if they got AZ or Pfizer. Today it was announced that anyone who got Sinovac and doesn't get a booster by the end of February 2022 will have their status downgraded from 'fully vaccinated'.

On 3 December 2021, Malaysia reported its first Omicron case. As additional government measures to prevent another COVID-19 pandemic due to the Omicron variant, Health Minister Khairy Jamaluddin insisted that high-risk individuals (those older than 18 with Sinovac doses and those older than 60) acquire an additional shot by February 2020. If they fail to do so, their vaccination status will revert to incomplete, and will no longer be eligible for the privileges accorded to fully vaccinated individuals (Bala Krishnan, 2021).

As of 10 February 2022, 98% of the country's adult population eligible for vaccination had completed the required doses and been effectively vaccinated, while 53.9% had received booster injections in response to rising infection rates. In a way, P3-Tweet 142 was helping the dissemination of information originating from the government to the Twitter community in Malaysia.

c) Vaccine Choice

The third sub-theme of "Vaccine Administration" is tweets that discuss their "Vaccine Choice". During the data analysis, tweets on the following are categorized as "Vaccine Choice": discussions or debates around individuals' ability to choose which type of vaccine they receive, or their preference for a certain vaccine based on perceived efficacy or safety. Most of the tweets about "Vaccine Choice" expressed preferences for or doubts of a particular vaccine brand that has received regulatory approval. During Phases 1 and 3, discussions regarding vaccine choice were more frequently observed.

There were eight different vaccines that have been approved for use in Malaysia, which are Moderna, Pfizer, CanSino, Johnson & Johnson, AstraZeneca, Sinovac, Sinopharm, and Covaxin. Of these, Pfizer, Sinovac, and AstraZeneca have the greatest distribution rates in Malaysia (61.2%, 29.8%, and 7.9%, respectively).

Under the "Vaccine Choice" sub-theme, the Malaysian Twitter users seemed to have a clear idea of which vaccine they prefer, based on valid or invalid reasoning. In response to the rumours spread on the effectiveness of Pfizer's in other countries, some people chose Pfizer while waiting for the vaccine to arrive. P1-Tweet 50 suggests that people can choose which brand of COVID-19 vaccine they prefer.

P1-Tweet 50:

*Kalau apply utk vaccination programme tu. Bleh pilih ke nk brand Pfizer je.
Hahahaha*

(If apply for that vaccination programme. Can choose whether want to get Pfizer brand only? Hahahaha.)

The discussion on “Vaccine Choice” is underpinned by unverified information on effectiveness of certain vaccines. According to the Edge Market (2021), there were rumours on vaccine effectiveness based on the brand, 95% for Pfizer, 94% for Moderna, 66% for Johnson & Johnson, and Sinovac had the lowest efficacy at 50.4%. (Balasubramaniam, 2021). In addition, a survey covering South-east Asia found that COVID-19 vaccines from American firms Pfizer and Moderna emerged as Malaysia’s most preferred brands after gaining 48% of votes from respondents (Lim, 2022). In the analysis of the tweets, it is clear that Pfizer and Moderna were the preferred brands in Malaysia.

During the vaccine distribution phase (Phase 2), there was not much emphasis on the choice of vaccine. However, during Phase 3, there was a sudden increase in the sub-theme of “Vaccine Choice” as the public became curious about the booster dose. For example, P3-Tweet 141 raised the concern of mixing vaccines.

P3- Tweet 141:

*Aku nak tanya, takpe ke 1st n 2nd vaksin sinovac. Tetibe booster Pfizer? Ghisauuu
aku ttbe jadi zombie plak nt*

(I want to ask, is it okay 1st and 2nd vaccine Sinovac? Then suddenly booster Pfizer? I’m worried I will suddenly become a zombie.)

In P3- Tweet 141, the user was expressing concern about the idea of receiving a booster dose of the Pfizer vaccine after already receiving the Sinovac vaccine for the first two doses as they were worried about potential negative effects and even jokingly express concern about becoming a zombie. However, a study from Chile Health Ministry (2021) found that this combination increased vaccine effectiveness from 54% to 95%, which is a good improvement of the immune system to protect against the virus.

d) Feelings on Vaccine Rollout

The fourth sub-theme of “Vaccine Administration” is the tweets that show their “Feelings on Vaccine Rollout” in Malaysia, which divided into “Positive Feelings” and “Negative Feelings”. In the data analysis, if the tweets contain words related to feelings about the vaccination process, they were categorised under this sub-theme. Rapid rollout of the COVID-19 vaccine has created different emotional responses across the globe (Greyling & Rossouw, 2022) which affected the vaccine administration plan. It is important to note that individuals’ feelings can influence public sentiment towards vaccination. The analysis in this study has found the dominant feeling expressed towards the vaccine administration was the “Positive Feelings” (n=18) compared to “Negative Feelings” (n=5) showing the high acceptance of vaccines among the Malaysian Twitter users on the vaccine administration.

i. Positive Feelings

The first sub-theme of “Feelings on Vaccine Rollout” is the tweets on “Positive Feelings”. The data analysis showed that the sentiment around COVID-19 vaccines was

increasingly positive in general, and the dominant feelings in the social media discussion were hope, gratefulness, and excitement.

Throughout all three phases of disease spread and control, most of Malaysian Twitter users expressed their hope and “Positive Feelings” regarding the vaccination. Hope is a significant emotional motivation and a crucial coping resource that can contribute to proactive health behaviours (Ahorsu et al., 2020), which may also act as a predictor of vaccine uptake. In phase 1, for instance, P1-Tweet 9 expressed the feeling of hope. The user was expressing hope for the safe and quick distribution of a tested vaccine to address both the economic and health issues that the country was facing.

P1-Tweet 9:

Both economy & health are important. Let's hope for safe tested vaccine to be distributed to all soonest possible.

This tweet indicates that P1-Tweet 9 believes that the vaccine will bring positive changes to both aspects and that the hope for a better future is essential during these difficult times.

By the time of Phase 2, the Twitters were hoping for the vaccination to reach 50% of the population, as shown in P2-Tweet 84.

P2-Tweet 84:

Kalau ikut vaccination rate skrg around 180k/day, lagi dua bulan baru boleh sampai 50% population vaccinated. Mcm negara luar, mostly bila 50% vaccinated, dah boleh mula back to normal life, no mask, no social distance. Hopefully.

(If follow the current vaccination rate of around 180k/day, it will take another two months to reach 50% population vaccinated. Like other countries, mostly when 50% are vaccinated, already can start back to normal life, no mask, and no social distance. Hopefully.)

The “hope” during Phase 2 was towards a return to a pre-pandemic way of life. The COVID-19’s effects on Malaysia’s economy can be seen in the high jobless rate and the drop in the value of the Malaysian Ringgit against the US dollar. Malaysia’s unemployment rate was 3.3% in 2019 (nearly 508,200 people jobless), which continued up to 5.3% in May 2020 (Fahmi, 2020). Therefore, by expressing their sense of optimism and hope, the Malaysian Twitter users manage to control their emotion in a positive way. These expressions of hope can help to uplift and motivate individuals and communities during difficult times and provide a sense of optimism for the future.

Another “Positive Feelings” expressed by Malaysian Twitter users was gratitude. Muslim people say “*Alhamdulillah*” as shown in P2-Tweet 51 and P3-Tweet 130.

P2-Tweet 51:

Alhamdulillah, today I along with the frontline staff, including Director General of Health Tan Sri Dr Noor Hisham Abdullah received the COVID-19 vaccine injection at the Putrajaya District Health Office. Muhyiddin Yassin _ Prime Minister of Malaysia.

P3-Tweet 130:

My family member infected with covid... vaccinated. *Alhamdulillah* Stage 1/2. What is there to lose?

Both P2-Tweet 51 and P2-Tweet 130 expressed the gratitude and their tweets served as a source of comfort and reassurance during uncertain times. Malaysia is known for establishing the “religion of the Federation”, with the majority of its population practicing Islam (63.7%), Buddhism (17.7%), Christianity (9.4%), and Hinduism (6.0%) (reported in SharifStudy, 2023, March 21). On the other hand, the Arabic phrase “*al-Ḥamdu lillāh* (الْحَمْدُ لِلَّهِ)” conveys the meaning of “Praise or thanks to Allah” (Baldi 2008, p. 152), is one of the most common expressions used by Muslims to convey gratitude and thankfulness. In the analysis of the tweets, it was found that the Malaysian Twitter users conveyed gratitude for the vaccination rollout plan and the acceptance of the vaccination among the Muslim population in Malaysia.

Following that, the commonly used positive words to describe “Positive Feelings” were “glad” and “excited” as shown in P2-Tweet 76 and P2-Tweet 87.

P2-Tweet 76:

Glad they’ve opened another rollout for registration for senior citizens this Sunday.
Register your elderly loved ones!

P2-Tweet 87:

So glad that vaccinator in my ppv, show the bottle and syringe in front us, explain something but I am not bothered to listen (excited to get the vaccine) and let us take picture/video. You guys are amazing.

During all three phases of the study, the prevailing sentiment among Malaysian Twitter users with regards to COVID-19 vaccines was predominantly positive. Overall, these findings suggest that there is a generally positive outlook towards COVID-19 vaccination among Malaysian Twitter users.

ii. Negative Feelings

In contrast to the “Positive Feelings”, there were also tweets on “Negative Feelings” that have been expressed as the second sub-theme of “Feelings on Vaccine Rollout”. “Negative Feelings” related to vaccine administration include fear, anxiety, and uncertainty about vaccine safety, efficacy, and potential side effects. Tweets collected in Phase 1 did not have much on “Negative Feelings”, compared to tweets during Phase 2 and Phase 3 as more users started to share their bad experiences.

In Phase 2 when the vaccination was on-going, Malaysian Twitter users were unhappy about “queue-jumping”. This rumour has led the public to express their “Negative Feelings” towards the vaccine rollout. For example, P2-Tweet 79 said that he/she was “sad” about the discrimination.

P2-Tweet 79:

So sad like this, even if you want a vaccine, you have been discriminated.

Although the government has taken strict measure to make sure all the public get vaccinated following their turn, some user felt that the rich (e.g., ministers and their family) were given preferential treatment over the poor. The former Health Minister, Adham Baba, has disputed these rumours, stating that he would take stern action against those who propagate them.

Another incident which gave rise to negative feelings started with an unexpected incident involving rumours of people receiving a “empty syringe” of vaccine. For instance, P2-Tweet 86 vented his/her frustration on the carelessness which occurred during vaccine administration.

P2-Tweet 86:

I don't know where and when this happened! It was a drive-through vaccination centre and can be seen the jab was not pumped at all. If this did happen in Malaysia, those involved must really face the music to upkeep the image of our saluted frontliners!

According to Malaysiakini news (July 19, 2021), the COVID-19 Immunisation Task Force (CITF) had received multiple complaints alleging that vaccine recipients who were supposed to receive the COVID-19 vaccine received empty syringes instead. The government acknowledged the claims and blamed “human negligence” after a nurse admitted she had administered the “empty vaccination” by error due to exhaustion (Sky News, 2021, July 23). The former Minister of Health, Adham Baba, stated that those individuals who were proven to have received a COVID-19 vaccination from an “empty syringe” will receive a new injection. In addition, the government has implemented new regulations mandating that the frontliner show the syringe to the recipient before administering the shot.

Phase 3 marked beginning of vaccination for teenagers and booster dose in Malaysia. The negative feelings were mostly expressed by parents who believed that the vaccination would harm their children (P3-Tweet 116).

P3-Tweet 116:

Pfizer are telling us that their piss is safe to use in 5-11 yo after a study on 280 kids. How is that ever even tolerated???

The “Negative Feelings” expressed in P3-Tweet 116 was a mix of scepticism and concern regarding the safety of the Pfizer vaccine for children aged 5-11 years old. The use of the word “piss” is a derogatory term that implies the tweet author’s disapproval or lack of trust towards Pfizer’s statement. According to Free Malaysia Today (2021), the vaccine’s efficiency against infection among these youngsters decreased from 68% in mid-December 2020 to 12% at the end of January 2021, compared to children who did not get vaccinated, prompting parents to oppose this shot for their children. In response, the Ministry of Health (MOH) has stated that no restrictions would be imposed on children aged five to eleven who did not receive the COVID-19 vaccine.

“Negative Feelings” on vaccination can be a barrier to vaccine uptake because the social media users influence one another. The analysis of the tweets had identified the various reasons behind negative feelings towards vaccination and the analysis also showed that the government had addressed the concerns to promote vaccine uptake.

4.2.2 Tweets on Impact of Vaccines (Theme 2) according to its Phases

The second theme of discussion among Malaysian Twitter users is the “Impact of Vaccines”. The impact of the vaccine included sub-themes which are “Anti-Vaccination Views”, “Vaccines Benefits”, and “Vaccines Side Effects”. The dominant topic under this theme is “Anti-vaccination Views” (n=34) which might be an impact of rapid spread of misinformation about vaccines that spread worldwide.

a) Anti-vaccination Views

The first sub-theme of “Impact of Vaccine” is the tweets on “Anti-vaccination Views”, which is divided into “Advocate Anti-vaccination Views” and “Refute Anti-vaccination Views”. Tweets on “Anti-vaccination Views” are the opinions or beliefs that oppose vaccination, often based on misinformation or misconceptions about vaccines.

i. Advocate Anti-vaccination Views

The first minor theme under “Anti-vaccination Views” is tweets that “Advocate Anti-vaccination Views”. Anti-vaccination sentiments in tweets reflect the reluctance, uncertainty, and false beliefs among Malaysian Twitter users. These false beliefs, including misinformation and conspiracy theories, caused some individuals to be hesitant to get vaccinated or refuse to adopt preventive measures to curb the spread of the virus. Malaysia encountered the same issue of false news, vaccine conspiracies, and denial of COVID-19 that obstructed efforts to control the pandemic, indicating a need to address these challenges (Masngut & Mohamad, 2021).

During Phase 1 of the study, when COVID-19 vaccinations were not yet available, the frequency of tweets “Advocate Anti-vaccination Views” on misinformation was frequent among Malaysian Twitter users. Some misinformation that has been spread among them was on how the vaccine was made. P1-Tweet 34 was discussing a common misconception that it was dangerous to inject vaccines containing weakened bacteria or viruses. However, this is a misunderstanding of how vaccines work.

P1-Tweet 34:

“Vaksin mengandung bakteri/virus yg dilemahkan.” Maksudnya, menyuntik vaksin ke dlm badan bermaksud, menyuntik bakteri/virus! Mcm mana suntikan bakteri/virus ke dlm badan boleh menjadi imunisasi, sedangkan suntikan tersebut mengandung bakteri?

(“The vaccine contains weakened bacteria/virus.” Meaning, injecting the vaccine into the body means injecting bacteria/virus! How can injecting bacteria/virus into the body be immunization whereas the injection contains bacteria?)

In reality, vaccines are designed to trigger an immune response by introducing a small, harmless piece of the virus or bacteria (like a protein or a piece of its genetic material) into the body. This allows the immune system to recognize the virus or bacteria and develop immunity to it without actually causing the disease. The weakened bacteria or virus in the vaccine is not capable of causing the disease in a healthy individual, but it is enough to stimulate the immune system to produce protective antibodies that will recognize and fight the real virus or bacteria if the person is exposed to it in the future.

Furthermore, during Phase 1, the uncontrolled rumours spread on the COVID-19 vaccine caused some individuals to refuse to get vaccinated (P1-Tweet 36).

P1-Tweet 36:

Hmm, I still have a lot of doubt on this covid 19 vaccine. If it is available, I don't think I'll get the injection.

P1-Tweet 36 user was unsure about the safety and efficacy of the vaccine and was reserved about getting vaccinated.

In Phase 2, “Anti-vaccination Views” were still spreading, and the misinformation caused fears among the public. P2-Tweet 52 shows the fears expressed by the user to receive their vaccine shot.

P2-Tweet 52:

When I’m reading about vaccination on news, something triggered my brain.
‘Painkiller’ jab. :(

P2-Tweet 52 was referring to a concern or fear about the potential side effects of the COVID-19 vaccine. The user mentions that reading about vaccination in the news triggered a thought about a “painkiller jab”. There are people who are afraid of needles, and their fear of experiencing pain or discomfort during the vaccination process is tremendous. Generally, the “Anti-vaccination Views” in Phase 2 were either caused by fear of unwanted side effects or discomfort from the jab. As a result of the misinformation, the MOH has to consistently combat and clarify the misleading information by disseminating factual information through their social media platforms. The government even threatened to take legal action against those who are found to have incited public opinion against the Immunisation Programme.

During Phase 3, the “Anti-vaccination Views” concentrated on religious concerns. The public with certain religious beliefs started to demand the government to declare the ingredients used for the vaccine to ensure that it is safe and *Halal* (permissible) for the Muslims people. One such view was expressed by P3-Tweet 123:

P3-Tweet 123:

Halal vaccine involve ensuring the raw materials, production method, production facility etc are syariah complaint. Some virus (main component of vaccines) they

grow in pig to get the vaccine raw mat in quantity. Got some use pork-based gelatine as stabilizer.

The *Halal* issue in Malaysia is a sensitive issue that can occasionally lead to racial tensions. To dispel vaccine concerns on religious grounds, the Fatwa Committee of the National Council for Islamic Religious Affairs carried out a *muzakarah* (discussion) and came to the resolution that the use of the COVID-19 vaccine is not only permissible (*harus*) in Islam, but also obligatory (*wajib*) for groups which have been identified by the government (Hazlin Hasan, February 15).

Despite the government's efforts to safeguard the community from the deadly variant by administering a booster dose, tweets on deaths due to vaccination spread later in Phase 3, for example:

P3-Tweet 140:

Omicron...????? *Semua cerita pembohongan menakutkan yg bodoh untuk terima suntikan booster. Yang mati dan terus sakit adalah mereka yang dah disuntik. Lambakan kematian akan berterusan hanya disebabkan pilihan bodoh dari ketamakan urusan niaga vaksin.*

(Omicron...????? All the terrifying lies to foolishly accept booster shots. Those who are dying and continuously suffering are the ones who have already been injected. The surge in deaths will persist solely due to the foolish choices driven by the greed of the vaccine business.)

One of the claims made by Malaysian Twitter users was that the booster dose was administered solely for profit and business. The claim that vaccines exist solely for commercial gain is not substantiated by scientific evidence. Even though pharmaceutical

companies earn a profit from the production and sale of vaccines, the development of these life-saving medical interventions is not solely motivated by financial gain. As part of their commitment to promoting global health security, several nations have contributed funds to support the development and global distribution of COVID-19 vaccines. For example, the US has pledged 2.5 billion towards vaccine research and production as well as supporting vaccination programs in low-income countries (Reuter, 2021, February 19), and Japan donated over US\$11 million to UNICEF to keep COVID-19 vaccines at the right temperature and support effective and inclusive vaccination in Latin America and the Caribbean (UNICEF, 2021, August 12). Vaccines have been instrumental in reducing global morbidity and mortality from vaccine-preventable diseases over time, which has substantial public health benefits that exceed any potential profits made by vaccine manufacturers.

In conclusion, the “Anti-vaccination Views” changed over time. In Phase 1, “Anti-vaccination Views” were on the vaccine safety and efficacy. In Phase 2, the “Anti-vaccination Views” were on the concern or fear about the potential side effects of the vaccine shot. In Phase 3, the “Anti-vaccination Views” were on religious concerns.

ii. Refute Anti-vaccination Views

The second minor theme under “Anti-vaccination Views” is tweets that “Refute Anti-vaccination Views”. Tweets on “Refute Anti-vaccination Views” usually provide accurate information and evidence-based facts to debunk myths and misinformation about vaccines. These tweets aim to educate and persuade those who are hesitant or opposed to vaccines, highlighting the importance of vaccination in protecting individuals and communities from infectious diseases. As “Anti-vaccination Views” have become one of the major factors for

vaccine hesitancy, the numbers of tweets to take refute the false claims also shows an increasing pattern over time.

In regard to the issues regarding the safety and effectiveness of vaccine that was developed at a rushed speed, Malaysian Twitter users like P1-Tweet 6 and P1-Tweet 16 explained that it was the collaboration and better technology which hastened the process, and not omission of testing procedures.

P1-Tweet 6:

Summary: The vaccine was able to be completed in a short time with equally good quality because we spent more money & scientists spent less time waiting for money to come in or for volunteers to sign up. There was also a lot more collaboration & better technology made it faster.

P1-Tweet 16:

The vaccine has been going through R & D, tested thoroughly and vigorously and those companies spent billions to produce vaccines. They have tested the vaccine successfully to humans and if Petra says it doesn't work, then those human body should be different than our body.

P1-Tweet 6 attributed the speed and quality of the vaccine's development to increased funding, collaboration, and technological advancements. P1-Tweet 16 highlighted the extensive research and testing that has gone into the development of the vaccine. The COVID-19 vaccines are developed more quickly than traditional vaccines, but there was no compromise on rigorous testing and clinical trials before being approved for use by regulatory agencies such as the Emergency Use Authorization (EUA). There have been 232

vaccine candidates, and EUA approved nine candidates from different countries, including the UK, the US, Canada, Russia, China, and India (Kashte et al., 2021).

In Phase 2, there were already tweets that refuted religious beliefs that the vaccine was not halal, like P2-Tweet 96 who said that people should give it a try.

P2-Tweet 96:

Aku pernah baca, ada antivax ni xnak amik vaccine takut nnti mati sbb vaccine. Lg sanggup mati sbb covid sbb nanti syahid. Hang ikhtiar pon tak, cemani eh nak cakap dgn org camni

(I once read that some anti-vax individuals refuse to take the vaccine because they're afraid of dying because of vaccine. More willingly to die from COVID because will be a martyr. You don't even try, how to even talk to someone like this)

According to sahih hadiths, as affirmed by the Mufti of Federal Territory's Office (2020), anyone who dies from the COVID-19 pandemic is considered a martyr. Nevertheless, since a vaccine has been developed to reduce the harmful effects of the COVID-19 virus, it is considered a sin for individuals to refuse vaccination after they know about the potential consequences. According to Penang Mufti, Datuk Seri Dr Wan Salim Wan Mohd Noor (as reported in The Sun Daily, 2021, February 15), Islam forbids its adherents from placing themselves in danger, hence taking the vaccine is both permitted (*harus*) and required (*wajib*).

In Phase 3, some Malaysian Twitter users refuted the demand for the government to release the ingredients used for making the vaccines. For example, P3-Tweet 113 questioned whether the demand is reasonable and said that people would not understand what the ingredients are.

P3-Tweet 113:

Ada juga #Antivax yg MENYALAK nak tahu apa kandungan bahan2 dlm vaksin. Ini 1 cth kandungan dlm #Pfizer. Pd golongan Doktor & Saintis tahu la apa element2 yg dinyatakan. Kita ni rakyat biasa mana tahu. Nak suruh KKM terangkan satu2 ke sbmlm nak cucuk? Jenuh la sampai kes 100k x habis

(There are also #Antivax individuals who CURSE and want to know the contents of the ingredients in vaccines. This is an example of the contents in #Pfizer. Doctors and scientists in the medical field know what elements are stated. We, as ordinary citizens, may not know. Do you want the Ministry of Health to explain each one before getting vaccinated? So tiring, it won't ended even after 100k cases.)

The P3-Tweet 113 argues that it is unreasonable to demand a detailed explanation of each ingredient from the Ministry of Health before getting vaccinated, as this would be time-consuming and could delay vaccination efforts. Concerning the *Halal* status of the COVID-19 vaccine, a freelance preacher Dr Abdul Rahman A. Shukor (reported in Malaysia Mail, 2021, January 25) stated the issue of the use of prohibited substances in vaccines has already been resolved following extensive deliberations by religious scholars, and he can confirm that the vaccine does not contain any prohibited substances. The bright side in this issue is that there are Malaysian Twitter users who came forward to “Refute Anti-vaccination Views” by repeating press releases by the Mufti on the *Halal* status of the vaccine.

b) Vaccine Benefits

The second sub-theme of “Impact of Vaccine” is “Vaccine Benefits” which includes tweets expressing “Doubts on Vaccine Benefits” and tweets that “Advocate the Vaccine

Benefits”. Tweets discussing the “Vaccine Benefits” including the prevention of infectious diseases, the protection of vulnerable people, and the potential to achieve herd immunity. Tweets on “Vaccine Benefits” have been frequent especially during Phase 3, as the public started to see the effectiveness of the vaccine in protecting them.

i. Doubts on Vaccine Benefits

The “Doubts on Vaccine Benefits” consist of tweets that highlight the questions about the effectiveness of vaccines and their potential risks. The users compared effectiveness of different brand and types of vaccine, for example P1-Tweet 39 questioned the effectiveness of the AstraZeneca-Oxford vaccine against certain variants of the COVID-19 virus.

P1-Tweet 39:

Covid-19 virus mutates. There are many variants. Some such as South African variant are more contagious. AstraZeneca-Oxford vaccine cannot protect patients with this type of variant. We hope that such variant will not appear in Malaysia.

The South African variant (B1.351) was identified in October 2020 in South Africa (Zhou et al., 2021) but AstraZeneca vaccine did not seem to be effective, and the country suspended the use of AstraZeneca’s COVID-19 vaccine. The news has spread worldwide and raise doubt on whether AstraZeneca can provide protection against more dangerous variants.

During Phase 3, the doubt on the effectiveness of the different vaccine brands was also discussed among Malaysian Twitter users. As the government urged adults who have received both the first and second doses of the Sinovac vaccine to take an additional injection

to increase their protection against the Omicron, users like P3-Tweet 127 questioned the vaccine's efficacy. For example:

P3-Tweet 127:

So kiranya all vaccines are not the same la kan? Im so confused, if all vaccines serves the same purpose then y sinovac paling tinggi bilnganya.

(So, it seems like all vaccines are not the same, right? I'm so confused, if all vaccines serve the same purpose then why Sinovac has the highest number)

Tweet P3-127 was uncertain about the differences in efficacy, safety, and quality of various vaccines and sought clarification. According to a study that analysed plasma samples from 101 participants in the Dominican Republic, the spread of Omicron has reached a critical level by December 2021, as the two-dose Sinovac vaccine alone exhibited no detectable neutralisation against Omicron (reported in Free Malaysia Today, 2021, December 31). Thus, booster dose was the suggestion provided by the Malaysia government to fight against more dangerous variants.

Lastly, "Doubts on Vaccine Benefits" seemed reasonable because of the large number of deaths of vaccinated people. Malaysian Twitter users also has addressed on this issue such as:

P3-Tweet 121:

The simple answer is 5 million people have died due to vaccines, infections to families also come from individuals who have been vaccinated. That is the fact of every country.

P3-Tweet 121 expressed doubt about the benefits of vaccines by making a misleading claim that 5 million people have died because of vaccines, which not supported by any credible evidence. Due to the pervasive use of COVID-19 vaccines, including in the elderly and in patients with pre-existing medical conditions, there have been fatalities and serious illnesses that are unexpected and unrelated to vaccinations (WHO, 2022). Although fatalities resulting from COVID-19 vaccination have been documented worldwide, their rates remain significantly lower than those following an outbreak.

ii. Advocate the Vaccine Benefits

Tweets that “Advocate the Vaccine Benefits” highlight the importance of getting vaccinated to be protected against diseases, reduce the spread of diseases, and help to achieve herd immunity. These tweets also share information on the safety and efficacy of vaccines, highlight success stories of vaccination programs, and encourage people to get vaccinated to protect themselves and their communities. Twitter users were actually helping the government by convincing other Twitter users on the effectiveness of vaccines.

During Phase 1, Malaysian Twitter users were actively posting tweets advocating the benefits of vaccination to encourage people to get vaccinated once the vaccine was available in Malaysia. For example, P1-Tweet 27 acknowledges the potential benefit of receiving vaccine shots.

P1-Tweet 27:

The more we vaccinate, the higher chances we can achieve herd immunity, as virus will be stopped in its tracks!

P1-Tweet 27 highlights the benefits of vaccine in encouraging people to get vaccinated as a means of protecting not only themselves but also the larger community. The goal of the vaccination plan under PICK was to increase herd immunity. The many tweets on benefits of vaccines show that the Malaysian Twitter community had positive attitudes and knowledge regarding vaccination.

During Phase 3, Twitter users began using their own experience to talk about benefits of vaccination. For example, P3-Tweet 117 and P3-Tweet 125 highlight the effectiveness of the vaccines based on their own real-life experiences.

P3-Tweet 117:

Candidly, I had Covid infection early last month, but luckily, my symptoms were just minimal. I think it's because of my 2 doses of Pfizer vaccination. TQ Pfizer!

P3-Tweet 125:

It is so not, as someone who was vaccinated and got covid and had close contact with 18 people who were also vaccinated, none of whom got infected. Most of these close contacts were in vaccinated only pubs. Bottom line vaccines work and having vaccine only social outlets work!

Both users in Tweet P3-117 and P3-Tweet 125 did not get infected or had minimal symptoms after getting infected. These tweets suggest that vaccines are effective in preventing or reducing the severity of COVID-19 infections. They advocate getting vaccinated and highlighted the importance of vaccines in protecting individuals and achieving herd immunity.

c) Vaccine Side Effects

The third sub-theme of “Impact of Vaccine” is the “Vaccine Side Effects” consisting of tweets that “Talking about Side Effects of Vaccines” and “Refute Side Effects of Vaccine”. Tweets on side effects of vaccines have been frequent especially during Phase 2 and Phase 3, as the public has experienced the post vaccination effects for themselves.

i. Talking about Side Effects of Vaccines

The sub-theme on “Talking about Side Effects of Vaccines” consisted of tweets that discussed the negative side effects they experienced following vaccination. Tweets on “Vaccine Side Effects” usually contain personal anecdotes or experiences of individuals who have received the vaccine and are reporting any side effects they may have experienced. The side effects of vaccine were one of the biggest concerns among the public, as it is one of the factors of the vaccine hesitancy. In Phase 3, individuals reported that the adverse effects of the booster dose were more severe than those of the first and second doses. For instance, P3-Tweet 124 described the negative side effects experienced after receiving a booster dose of the vaccine.

P3-Tweet 124:

The booster dose felt the worst for me, my whole body was just weak, and I had fever. Then I went to the KK, they didn't wanna accept me, said I had covid-like symptoms.

The personal experiences of the P3-Tweet 124 were not completely wrong. On July 2021, while the U.S. was reviewing on the need for booster dose to fight the COVID-19 virus, a U.S health official stated the second dose for two-shot COVID-19 vaccine regimens

was associated with higher rates of side effects, suggesting a third dose could potentially come with even greater risks (reported in Reuters, 2021, July 2021). Therefore, the claims of Malaysian public that the side effects of booster dose much worse compared to the other shot is logical. More intense reaction after a booster injection indicates a stronger immune response to the vaccine, but this is what the public might not understand.

Some Twitter users also reported blot clots and minor strokes. For example:

P3-Tweet 101:

My dad got a mild stroke and weakness in leg 2 days after his 2nd dose AstraZeneca vaccine. On the 6th day in HKL, my dad passed away. He was in perfect condition before this. No diabetic, hb. *Wallahualam.*

P3-Tweet 101 said that his/her father had a mild stroke and weakness in his leg, and subsequently died. Although the death may be a coincidence, the concern of P3-Tweet 101 is not unfounded. Overseas news reports indicate that there have been reports of blood clots occurring after receiving certain types of COVID-19 vaccines, particularly the AstraZeneca and Johnson & Johnson vaccines. Since March 2021, the Public Health Agency (2021) stated UK and other countries have received reports of an exceedingly rare condition characterised by thromboembolic events (blood clots) and thrombocytopenia (low platelets) following the first dose of the AstraZeneca COVID-19 vaccine. As a result, the former Health Minister, Adham Baba (reported in Malay Mail, 2021, March 22) announced that Malaysian government gave special financial assistance to those who experienced severe adverse reactions after receiving the COVID-19 vaccine, with RM50,000 for long-term treatment and RM500,000 for permanent disability or death because of the COVID-19 vaccines.

ii. Refute Side Effects of Vaccines

Malaysian Twitter users also rose to the occasion to “Refute Side Effects of Vaccines” to counter the misinformation and rumours. They highlighted the safety and efficacy of the vaccine, provided statistics on the low incidence of adverse reactions, and described good personal experiences of individuals who have received the vaccine with minimal or no side effects. For example, P2-Tweet 60 and P3-Tweet 133 refuted the belief that the COVID-19 vaccine has severe and dangerous side effects by providing personal experiences of individuals who have received the COVID-19 vaccine, specifically focusing on the absence of severe side effects.

P2-Tweet 60:

24hours after vaccination. *Alhamdulillah tak demam. Takde side effect teruk pon. Lengan masih lenguh, lenguh ringan je.*

(24 hours after vaccination. *Alhamdulillah* no fever. No terrible side effects. Arm still sore, just mild soreness)

P3-Tweet 133:

How do I feel after my Pfizer booster shot? 6 Common Side Effects after 24hrs
Injection site pain, Muscle Pain, Fatigue – Yes. Headache, Fever & Chills - No. All Malaysian go for it.

P2-Tweet 60 highlights that the individual only experienced mild soreness in the arm after receiving the vaccine, while P3-Tweet 133 said that the side effects after receiving the booster shot was common. There are several typical side effects, such as fever, head or body aches, and sore arm, and would disappear in a day or two days (WHO, 2022, April 14). According to the aforementioned tweets, the side effects noted were “sore arm”, “injection

site pain”, “muscle pain”, and “fatigue”, which are all considered to be minor. According to the Centers for Disease Control and Prevention (CDC), COVID-19 vaccinations have proven to be secure and reliable, which the adverse effects are typically mild and temporary, similar to other regular vaccinations.

There are individual differences in tolerance of side effects. For example:

P2-Tweet 80:

I suffered giggling cold internally. Body aching... light headache. Weak hands. But she just cleaning the house! Strong lady my love.

Based on P2-Tweet 80, it is noted that the user was sharing the difference reactions towards the vaccine side effects. The CDC claims that it is difficult to predict how individuals will respond to the vaccine because it relies on several variables, including age group, immune system, and allergy reaction. However, the adverse reactions following a COVID-19 vaccination are typically minor, and transient.

4.2.3 Tweets on Vaccination and COVID-19 Control (Theme 3) according to its Phases

The third theme was the “Vaccination and COVID-19 Control” which consist of tweets that discuss the control measures and restriction that goes along with the vaccination to prevent the spread of the virus. There are three sub-themes under the “vaccination and COVID-19 control” which are travel restriction, personal life, and health and safety.

a) Travel Restrictions

The first sub-theme under the theme of “Vaccination and COVID-19 Control” is “Travel Restrictions”. Tweets on “Travel Restriction” in response to COVID-19 control include travel restrictions imposed by governments or institutions to curb the spread of the virus covering the effectiveness, fairness, and impact of travel restrictions on individuals, families, and businesses.

Here is some background information on the “Travel Restriction” during the pandemic. In response to the spread of COVID-19, countries across the globe implemented international travel restrictions between February 2020 and June 2021, which bans entry, quarantines, self-isolation, and suspension of visa-free agreements. The Movement Control Order (MCO) went into effect in Malaysia on March 18, 2020, in an effort to increase social distance and reduce the rate of virus transmission. However, the MCO order was repeatedly extended and replaced by the Conditional Movement Control Order (CMCO), the Recovery Movement Control Order (RMCO), or the Enhanced Movement Control Order. (EMCO).

Twitter users eagerly anticipated to have their normal life back. In P1-Tweet 20, the user highlights the importance of vaccination so that people can start travelling again and the tourism industry can be revived.

P1-Tweet 20:

Cepatlah mula vaccination. Aku dah tak sabar nak gi Singapore & Jakarta once border dah bukak. Setahun mengidam nak makan murtabak Bussorah St, martabak telur, and manis

(Hurry up and start vaccination. I can't wait to go to Singapore and Jakarta once the borders open. I've been craving to eat *Bussorah St's murtabak, martabak telur*, and sweet for a year.)

The tweet reflects how "Travel Restrictions" have significantly impacted people's lives and their ability to carry out their daily routines, such as travel and trying out new food in different places.

After nearly a year of being unable to visit their family in the village, P2-Tweet 97 suggested that the government allow fully vaccinated individuals to travel interstate:

P2-Tweet 97:

Rata2 semua nak rentas negeri jumpa mak ayah. Boleh lah YB beri kelonggaran kepada mereka yg dah lengkap 2 dose & mak ayah kt kampung pon dah lengkap 2 dose utk berjumpa. Perlu sediakan dokumen vaccine cert etc. Mcm renyah tp we do whatever it takes to meet our parents.

(Almost everyone wants to cross state borders to see their parent. Can YB give flexibility to those who have completed 2 doses and parent in the village have completed 2 doses to meet. Need to prepare vaccine cert documents etc. It's complicated but we do whatever it takes to meet our parents.)

P2-Tweet 97 expressed a sentiment shared by many people who were separated from their elderly parents due to movement restrictions. In addition, the tweets also highlight the emotional toll that "Travel Restrictions" can have on families who are separated from their loved ones during the pandemic. As the Malaysian public was hoping for interstate travel, the public's hopes were dashed when former Prime Minister Tan Sri Muhyiddin Yassin announced that Malaysia would be placed under MCO from May 12, 2021, to June 7, 2021,

which prevented family reunions when Muslims celebrated the *Eidul Fitri*. However, the interstate travel ban was lifted in October during the transition to the endemic phase. Furthermore, by this time, the recorded vaccination rate was of 90% of the adult population.

Other worries related to “Travel Restrictions” include the worries about the approved types of vaccine in certain countries. Saudi authorities announced that they approved only four types of vaccine, which are Pfizer-BioNTech, AstraZeneca, Johnson & Johnson and Moderna. Malaysians who wished to travel to Saudi countries were worried as 29.8% (as for March 2023) of Malaysian population received the Sinovac dose. This issue was addressed in the social media post (P3-Tweet 116) as it might impact their flexibility to travel.

P3-Tweet 116:

Sinovac tk lulus lagi dari arab suadi cano nk bt umrah

(Sinovac is not yet approved in Saudi Arabia how can I perform *umrah*?)

P3-Tweet 116 expressed a concern that the Sinovac vaccine has not been approved by the Saudi Arabian authorities, which may hamper the religious pilgrimage of *Umrah*. Many Muslims worldwide were eager to perform *Umrah* after the lifting of “Travel Restriction”. In order to resolve this problem, the Malaysian government negotiated with the Saudi Arabian government for individuals wishing to perform the *Umrah* trip (reported in The Star, 2021, October 20). The same problem was also faced by Indonesia. On October 12, 2021, Saudi Arabia announced that individuals vaccinated with Sinovac would be permitted to conduct the *umrah* if they received a third dose of the vaccine.

b) Safety and Health

The second sub-theme under the theme of “Vaccination and COVID-19 Control” is “Safety and Health”. Tweets under “Safety and Health” were the tweets that about safety measures such as wearing face mask and staying away from big gatherings.

The high frequency of tweets on “Safety and Health” shows that Malaysian Twitter users were aware that vaccination was just one part of a comprehensive strategy to control the pandemic, and that multiple measures need to be taken to effectively control the spread of the virus. The discussion on the control measure has been frequently discussed among the Malaysian Twitter users, especially during Phase 2 and Phase 3. For example, the users in P2-Tweet 98 and P3-Tweet 126 emphasize the importance of taking additional precautions and measures to prevent the spread of infections, even after getting vaccinated.

P2-Tweet 98:

Looking back, I wish I'd taken more precautions. And my advice is don't leave it all up to the vaccine. Wear masks, stay away from big gatherings with unvaccinated people, cut down on travel, at least until things calm down.

P3-Tweet 126:

Vaccine alone don't prevent the spread of infections. Combining them with other measures/SOPs do i.e ventilation, mask usage, avoid crowd, TRIIS, reduce risk factors, boosters vax, etc)

Both tweets stress the importance of taking responsibility for one's own health and safety and being proactive in preventing the spread of the virus. P2-Tweet 98 highlighted the need to continue wearing masks, avoiding large gatherings, and limiting travel to help control the spread of the virus. Meanwhile, P3-Tweet 126 suggested that combining

vaccination with other measures such as proper ventilation, mask usage, and reducing risk factors can be effective in controlling the spread of infection.

Despite the availability of vaccines, the use of a face mask is mandated in Malaysia to prevent the spread of the virus. In accordance with Regulation 17 (1) of the Prevention and Control of Infectious Diseases Regulations 2021, for instance, any individual who refuses to wear a face mask may be fined up to RM1,500. However, the use of face masks has become optional in Malaysia since May 1, 2022 (reported in Local News, 2022, April 27).

c) Personal Life

The third sub-theme under the theme of “Vaccination and COVID-19 Control” is “Personal Life”. Tweets on “Personal Life” covered the personal life experiences in response to the control measure taken alongside the vaccination in Malaysia. This topic surfaced in Phase 3 and was hardly found in tweets written during Phase 1 and Phase 2.

Although the Malaysian government has announced that it is not compulsory to get the vaccine shot but the government announced that unvaccinated individuals would lose out on the privileges of vaccinated people. For example, P3-Tweet 111 highlights the advantages to dine in at the restaurant after completing the “waiting” phase post vaccination.

P3-Tweet 111:

This restaurant just refused to serve a family who has not completed 14 days after 2nd dose vaccination. Mad respect.

The restriction on the compulsory wait of 14 days is important to allow time for the vaccine to provide maximum protection against the virus. P3-Tweet 111 suggests that the user has a positive opinion of the restaurant's decision to prioritize public health and safety by enforcing this rule and regards it as a responsible action.

Former health minister Khairy Jamaluddin stated on October 16, 2021, that the government would make life extremely difficult for unvaccinated individuals who did not contribute to the vaccination effort (Independent, 2021, October 18). The government's relaxation of SOPs allows those who are fully vaccinated to visit retail malls, dine in restaurants, and attend religious services with special treatment or privileges. Before entering any building, individuals must show a vaccine certificate through MySJ proving that they have been completely vaccinated.

The restriction to allow the sectors to operate when the workers has taken the vaccine shot has caused several companies to require all of their employees to be fully vaccinated in order to come to work. This action has forced those with medical conditions to receive the vaccination despite their health problem. This has resulted in a serious problem, as individuals at high risk tend to experience severe side effects that can led to mortality (P3-Tweet 122).

P3-Tweet 122:

A close family friend passed away today morning. Stroke n diabetic patient was forced to take Pfizer vaccination if not no salary. He was unconscious at 5am today, called 999 for emergency assistance, took 40min to reach. Pronounced dead.

This tragic incident highlights the importance of considering individual health circumstances and providing necessary accommodations in situations where vaccination may pose risks to individuals with underlying medical conditions.

4.2.4 Frequency of the Themes and Sub-themes

This section presents the frequency and percentages of themes and sub-themes of Malaysian Twitter users' discussion on COVID-19 vaccination. The frequency of themes and sub-themes discussed by Malaysian Twitter users on COVID-19 vaccination can be found in Table 4.1. The analysis revealed three main themes and a total of 17 sub-themes that dominated the discussion during the study period. The themes and sub-themes were categorized as T1 to T17.

Table 4.1: Frequency of Themes and Sub-themes based on Phases

		n=50	n=50	n=50	n=150	
No.	Themes/Sub-themes	Phase 1	Phase 2	Phase 3	Freq.	Per %
1	Vaccine Administration	30	35	20	85	56.7%
	T1: Politics in Relation to Vaccine Administration	5	3	0	8	
	T2: Criticizing the Vaccination Procedures	7	9	0	16	
	T3: Suggestion on Handling the Vaccination Procedures	3	8	4	15	

Table 4.1 continued

	T4: Seeking Information on Vaccination Procedures	4	2	2	8	
	T5: Educate Communities on Vaccination Procedures	2	2	4	8	
	T6: Vaccine Choice	3	1	3	7	
	T7: Positive Feelings	6	7	5	18	
	T8: Negative Feelings	0	3	2	5	
2	Impact of Vaccine	19	12	21	52	34.7%
	T9: Advocate Anti-vaccination Views	11	1	4	16	
	T10: Refute Anti-vaccination Views	5	7	6	18	
	T11: Doubts on Vaccine Benefits	1	0	2	3	
	T12: Advocate the Vaccine Benefits	2	3	5	10	
	T13: Talking about Side Effects of Vaccines	0	1	3	4	
	T14: Refute Side Effects of Vaccine	0	1	0	1	

Table 4.1 continued

3	Vaccination and COVID-19 Control	1	3	9	13	8.7%
	T15: Travel Restrictions	1	2	3	6	
	T16: Safety and Health	0	1	4	5	
	T17: Personal Life	0	0	3	3	

The analysis of the Twitter messages related to COVID-19 vaccination in Malaysia revealed that there were three main themes and 17 sub-themes that dominated the discussion during the study period.

Out of the 150 Twitter messages related to COVID-19 vaccination in Malaysia that were analysed, 85 (56.7%) of the tweets focused on “Vaccine Administration”, with the highest frequency was “Positive Feelings” (n=18). Additionally, there was more focus on “Vaccine Procedures”, as indicated by a high frequency of tweets “Criticizing the Vaccination Procedures” (n=16), and “Suggestion on Handling the Vaccination Procedures” (n=15). This suggests that Malaysian Twitter users generally hold a positive attitude towards COVID-19 vaccination and are interested in the logistics of the vaccine rollout, including its availability and the vaccination process.

Meanwhile, 52 tweets (34.7%) of the tweets expressed concerns about the “Impact of Vaccines”, with more tweets on “Refute Anti-vaccination Views” (n=18) and “Advocate Anti-vaccination Views” (n=16). The discussion also centered around potential side effects and effectiveness, highlighting the need for effective communication strategies to address public concerns and improve vaccine acceptance during the study period. In contrast, the

least discussed topic in the Twitter messages was 13 tweets (8.7%) was on the “Vaccination and COVID-19 Control” discussing other COVID-19 control measures in conjunction with the vaccine to reduce the spread of the virus. This result suggests that the discussion on Twitter primarily centered around the vaccine. This is a crucial finding, as it underscores the need to educate the public about the importance of other control measures, such as social distancing, wearing masks, and hand hygiene, even after getting vaccinated.

Since the social media posts selected were on the topic of COVID-19 vaccination, it is expected that there would be more health-related comments because it concerns the spread of the disease (Van Brakel, 2006).

Overall, the study provides valuable insights into the interest and concerns of Malaysian Twitter users regarding COVID-19 vaccination during the study period. By understanding these perspectives, policymakers and public health officials can develop more effective communication strategies to address public concerns and improve vaccine acceptance and its administration, rather than other control measures.

4.2.5 Comparison of Themes and Sub-themes according to its Phases

Table 4.2 shows the presence of sub-themes discovered in this study. The ticks (✓) show that the sub-theme is present in the tweets.

Table 4.2: The Presence of Themes and Sub-theme during the Different Phases

Themes	Sub-themes		Phase 1	Phase 2	Phase 3
Vaccine Administration	Politics in Relation to Vaccine Administration		✓	✓	
	Vaccine Procedures	Criticizing the Vaccination Procedures	✓	✓	✓
		Suggestion on Handling the Vaccination Procedures	✓	✓	✓
		Seeking Information on Vaccination Procedures	✓	✓	✓
		Educate Communities on Vaccination Procedures	✓	✓	✓
	Vaccine Choice		✓	✓	✓
	Feelings on Vaccine Rollout	Positive Feelings	✓	✓	✓
		Negative Feelings		✓	✓

Table 4.2 continued

Impact of Vaccine	Anti-Vaccination Views	Advocate Anti-vaccination Views	✓	✓	✓
		Refute Anti-vaccination Views	✓	✓	✓
	Vaccine Benefits	Doubts on Vaccine Benefits	✓		✓
		Advocate the Vaccine Benefits	✓	✓	✓
	Vaccine Side Effects	Talking about Side Effects of Vaccines		✓	✓
		Refute Side Effects of Vaccine		✓	✓
Vaccination and COVID-19 Control	Travel Restrictions		✓	✓	✓
	Safety and Health			✓	✓
	Personal Life				✓

This study found 17 sub-theme that has been commonly discussed among the Malaysian Twitter Users from January 1, 2021, until December 31, 2021, as shown in Table 4.2. Some topics were “evergreen” and persisted in all three phases, but some new topics surfaced in Phase 3.

For the first theme of “Vaccine Administration”, the public consistently talked about vaccine choice, explained vaccine procedures, sought information on the vaccine procedures, and suggested ways of handling the vaccine procedure. The dominant emotion was the “Positive Emotion” through all the three phases, which reflects the interest of the Malaysian Twitter users to stay informed about the latest developments in COVID-19 and to receive the vaccine shot. This finding concurred with past studies conducted in Malaysia that show that Malaysians have good knowledge, attitudes, and perception of COVID-19 prevention measures (Nor et al., 2020), and they are receptive towards COVID-19 vaccination.

The theme of “Impact of Vaccine” was found in all three phases. Based on the tweets observed, the misinformation on vaccine was mainly due to lack of trust of the vaccine effectiveness, the rapid development of vaccines, and religious belief. However, Malaysian Twitter users countered the misinformation using factual information.

The discussion under the theme of “Vaccination and COVID-19 Control” shows that the Malaysian Twitter users was concerned on the travel restriction by the government after two years of living under strict movement control conditions. This theme was found in all three phases.

As time went by, several new topics emerged. For example, the discussion relating to the side effects of vaccine started to show during Phase 2, when the public already get the vaccine shot. The number of tweets sharing the minimal side effects and adverse side effects was similar. This situation might be due to the different experiences and tolerance level towards the vaccine shot.

4.3 The Malaysian Twitter user's Patterns of Sentiment

In this section, the results for objective 2 on patterns of sentiments on COVID-19 vaccination are described.

With the rise of social media, sentiment analysis is the most effective method for understanding people's positive, negative, or neutral sentiments. In healthcare, for instance, sentiment analysis categorises patient opinions. In this study, the tweets collected during the phases of COVID-19 disease spread and control measure taken via vaccination in 2021, from January 1st to December 31st, 2021. This period spanned three phases, that is, from the unavailability of vaccines to distribution of the vaccines, and until the implementation of the booster dose after the adult's population reached 90%. For the analysis of sentiment, the tweets were categorised as positive, neutral, and negative according to the codebook described in Table 3.2, while the analysis on emotional reactions was based on the analysis framework on the theory presented in Table 3.3. The flowchart of the data analysis is presented in Figure 4.2.

The following section will present the result for positive, negative, and neutral sentiments for each of the sub-categories together with the Appraisal Theory that applies to different types of sentiments.

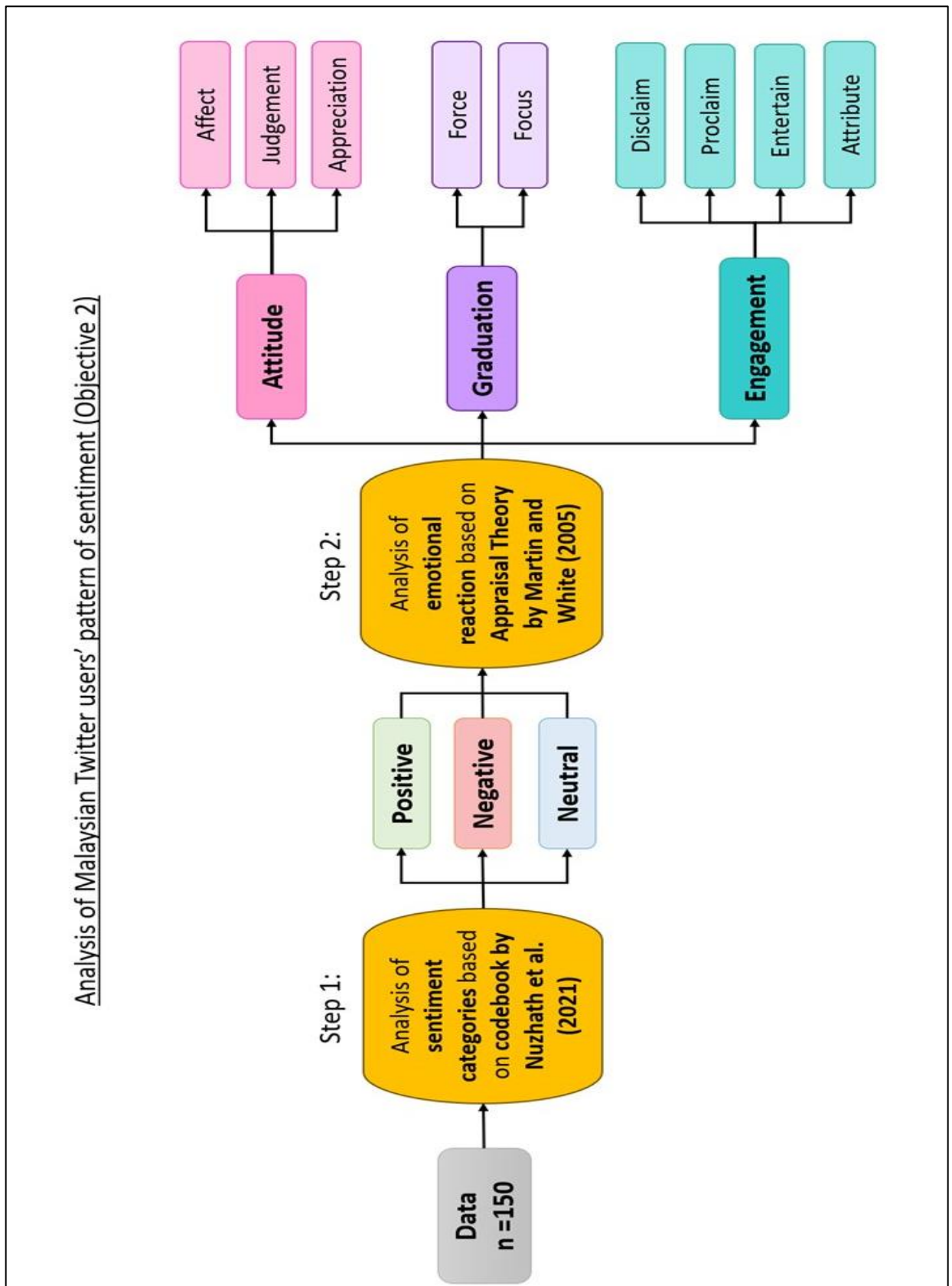


Figure 4.2: The Flowchart of Analysis Pattern of Sentiment (Objective 2)

4.3.1 Positive Sentiments

The study on Malaysian Twitter users' sentiment towards COVID-19 vaccination shows that the majority of tweets expressed positive sentiment towards vaccination, particularly during the vaccine distribution phase. Table 4.12 shows that 60.7% of 150 were positive, with Phase 1 (n=26), Phase 2 (n=35), and Phase 3 (n=30). Overall, the dominant positive sentiment was about the COVID-19 vaccine itself as a tool to combat the pandemic and protect public health. Following that, the positive sentiment also includes the information on vaccine safety, vaccine efficacy, and personal experiences of getting vaccinated.

The positive sentiments were the most during Phase 2, when the vaccine distribution to the public commenced. During this phase, the Malaysian Twitter users expressed hope and positive emotion on the vaccination process. For example:

P2-Tweet 56:

Covid 19 vaccination today! Hopefully everything went well.

The use of exclamation marks and the word “hopefully” shown in P2-Tweet 56 indicates that the person was looking forward to the vaccination and has a positive outlook towards it. The phrase “everything went well” suggests that the person was optimistic about the outcome of the vaccination, which could have a positive impact on their health and well-being.

In addition, during this phase, the Malaysian Twitter users also expressed more positive sentiment through the vaccine administration to promote vaccination (P2-Tweet 71) to those that were hesitant.

P2- Tweet 71:

Done with vaccination! Don't worry so much with all the myths about vaccination and blood clot, the vaccine is safe, and it will help to protect you against Covid-19 infection in the community.

Based on P2-Tweet 71, the tweet shows the relief, reassurance, and positivity of the user. The use of the phrase “Done with vaccination!” suggests that the person was happy and relieved to have received the vaccine. Positive affirmation was used corresponding to reassure others who may have concerns or doubts about the safety of the vaccine by mentioning “the vaccine is safe”. The positive tweet also included with positive message such as “it will help to protect you against COVID-19 infection in the community” to emphasize the protective benefits of the vaccine not only for the individual, but also for the wider community.

Promoting and expressing favorable opinions about vaccinations can build public trust. Prime Minister Tan Sri Muhyiddin Yassin was the first to receive the vaccine as part of government efforts to reassure people of its safety. Malaysia’s mass immunization rate was among the world’s fastest despite global COVID-19 vaccine distribution inequality that slowed dose delivery in the early months of its inoculation push (The Star, 2021, July 26).

In Phase 1, there was positive sentiments as Malaysian Twitter users waited for COVID-19 vaccines to put the end of the pandemic. For example, P1-Tweet 2 expresses the positive sentiment through her/his hope on the vaccination.

P1-Tweet 2:

Saya berharap tahun ini akan membawa sinar baharu dengan adanya vaksin covid19 yg diharapkan dapat mengembalikan kestabilan ekonomi negara dan kehidupan normal seperti biasa.

(I hope this year will bring a new light with the existence of the COVID-19 vaccine, which is hopefully can restore the country's economic stability and return life to normal as usual.).

P1-Tweet 2 shows the use of the phrase “*sinar baharu*” (new light) and “*diharapkan dapat*” (hopefully can) suggest that the person was optimistic about the impact of the COVID-19 vaccine on the economy and daily life. The statement “*mengembalikan kestabilan ekonomi negara dan kehidupan normal seperti biasa*” (restore the country's economic stability and return life to normal as usual) emphasized the positive outcomes that the vaccine could bring, such as stabilizing the economy and returning to a sense of normalcy.

Since the first COVID-19 case was recorded in Malaysia on January 25, 2020 (DG of Health, 2020, January 25), the virus has spread through more clusters. The third wave of MCO has been the most severe, with daily infections hitting 5,725 on January 29, 2021 (DG of Health, 2020, January 29). After several months of living under the strict restrictions, the public was willing and ready for the vaccination to prevent the virus spread.

The Malaysian Twitter users has also responded positively towards the vaccine's efficacy (P3-Tweet 117) during Phase 3 as the vaccine recipients have confirmed its validity and quality.

P3-Tweet 117:

Candidly, I had Covid infection early last month, but luckily, my symptoms were just minimal. I think it's because of my 2 doses of Pfizer vaccination. TQ Pfizer!

Positive sentiment towards the COVID-19 vaccine and its ability to mitigate the severity of COVID-19 symptoms was expressed in P3-Tweet 117. The use of the word “luckily” suggests that the person feels fortunate to have had minimal symptoms despite having contracted COVID-19. In addition, the user also expressed positive gratitude towards the vaccine manufacturer for developing an effective vaccine with the use of the phrase “TQ Pfizer!” adds the positive views on the vaccine efficacy. Tweets like P3-Tweet 117 are important because they give personal testimony of vaccine efficacy to increase public confidence in vaccination. By December 2021, 97.3% of the adult population in the country have completed their COVID-19 vaccination as of Saturday, with 98.7% of the adult population, or 23,094,811 individuals have received at least one dose of the vaccine by December 11, 2021 (The Edge Markets, 2021, December 12).

In summary, the sentiment analysis of Malaysian Twitter users reveals a prevailing positive outlook towards COVID-19 vaccination, particularly during distribution phases. Positive sentiments were evident in expressions of hope, personal experiences, and endorsement of vaccine safety and efficacy. The public’s optimism, reinforced by influential figures and successful immunization rates, played a crucial role in fostering trust and compliance with vaccination efforts in Malaysia.

a) Appraisal Aspects of Positive Sentiments

This section aims to examine the positive sentiments of appraisal aspects expressed by Malaysian Twitter users regarding COVID-19 vaccination. The following subsections provide a breakdown of the appraisal aspects of “Attitude”, “Graduation”, and “Engagement”.

i. Attitude in Positive Tweets

Three sub-categories of “Attitude” presented under this section, which are “Affect”, “Judgement” and “Appreciation”. The results on appraisal aspects of Attitude in positive tweets focus on how individuals evaluate, express emotions, and make Judgements about the content they are sharing.

Affect

In terms of “Affect” in positive tweets, the users conveyed both positive and negative emotional responses through either adjective, noun phrases or verb phrases. Based on the analysis, the Malaysian Twitter users commonly expressed positive “Affect” than negative “Affect”. The positive “Affect” usually used to express their hope towards the vaccination. For example:

P1-Tweet 37:

2021 - I am more **excited** [A: Affect: Positive] to wait & receive Covid 19 vaccine then my soulmate! My health is more important than anything else.

During the phase of waiting for the vaccine arrival, the Malaysian Twitter users mostly expressed their positive “Affect” by expressing their hope and excitement for vaccination rollout plan in Malaysia after almost two years living in pandemic conditions. The user expressed the positive “Affect” through the adjective word “excited” to bring the meaning that something good is going to happen, which in this context is the vaccination.

In contrast with the positive “Affect”, the number of negative “Affects” also were recorded as the public expressing their criticism on the late vaccination plan in Malaysia compared to other countries. For example:

P1- Tweet 21:

I am very **jealous** [A: Affect: Negative] that people in Singapore have gotten the vaccine already.

In Singapore, the vaccination campaign for COVID-19 started on December 30, 2021, a few months earlier than Malaysia. Thus, the Malaysian Twitter users said they were “jealous” of other countries.

After the vaccination were distributed in Phase 2, more positive “Affect” has been found as the Malaysian Twitter users began to hope for their turn to be vaccinated such as:

P2- Tweet 56:

Covid 19 vaccination today! **Hopefully** [A: Affect: Positive] everything when well.

The long-awaited vaccine was finally distributed in Malaysia starting February 24, 2021. During Phase 2, the users expressed their positive “Affects” with words such as “hope”, “glad”, “pleased” and “excited” which shows the high acceptance on the vaccination rollout plan in Malaysia. Meanwhile, the negative “Affect” was mostly fears and worries to receive the vaccine shot, such as:

P2-Tweet 96:

*Tak nak amik vaccine **takut** [A: Affect: Negative] nnti mati sbb vaccine.*

(Don't want to take the vaccine **afraid** [A: Affect: Negative] later will die because of the vaccine.)

The results were consistent with a survey conducted by Oppotus (2021) which found 26% of Malaysians were very happy that the vaccine finally available, and 61% of the Malaysians have a positive view of the vaccine. Meanwhile, 17% of the Malaysians respondents were cautiously optimistic, indicating that they were pleased with the vaccine but also worried about potential side effects, whereas another 22% of Malaysians were simply worried about the vaccine in general. Similar results were obtained in the analysis using the Appraisal Theory because there was more positive "Affect" than negative "Affect".

Following that, the numbers of positive "Affect" has been increasing in Phase 3, which reflects better acceptance of the vaccine in Malaysia. For example:

P3-Tweet 138:

It's a day that we should **thank** [A: Affect: Positive] the millions of Malaysians who **believe** [A: Affect: Positive] in science.

In October 2021, the Malaysia reached its target of vaccinating 90% of the adult population, a milestone that allowed the government to end a month-long ban on interstate travel. This incident has led Twitter users to express their gratitude for those vaccinated by using the word "thank" and "believe".

In summary, the analysis of positive tweets on "Affect" of "Attitude" within Malaysian Twitter users on COVID-19 vaccination reveals a predominant positive orientation with a dynamic narrative, evolving from anticipation and excitement to gratitude

and belief as the vaccination efforts progressed in Malaysia. The findings suggest an increasing acceptance of the vaccine among Malaysian Twitter users reflecting the overall success of the vaccination campaign in Malaysia.

Judgement

Positive tweets with “Judgement” include tweets with language for criticising, praising, and condemning. The “Judgement” words could be adjective, adverbs, noun phrases, verb phrases or metaphors. The numbers of negative “Judgement” were higher than positive “Judgement”.

The positive “Judgement” was usually expressed towards their family members for being able to resist the side effects after the vaccine shot. For example:

P2- Tweet 80:

Post vaccination: I suffered giggling cold internally. Body aching. light headache. weak hands..but she just cleaning the house! **strong** [A: Judgement: Positive] lady my love.

The vaccine shot did not leave the same side effects on all the individuals as it depends on the immunity and ability of one’s body. The tweet suggested the difference of the side effects of him and his wife, by describing the wife as “strong” for being able to resist the worst side effects.

The negative “Judgement” was more frequently used by Malaysian Twitter users as they expressed their dissatisfaction towards the government for not managing the vaccination campaign properly. For example:

P1- Tweet 8:

We better have a fresh election as this government **failed** [A: Judgement: Negative].

Meanwhile, stay safe ourselves by wearing masks or stay home until vaccine can to rescue.

The word “failed” expressed negative views of the government not implementing lockdown to prevent the spread of the virus.

In addition, the slow vaccine distribution also opened the space for the public to criticize the government, such as:

P2-Tweet 69:

You know the fourth wave is coming. So just be ready financially, physically, and mentally. Vaccination is the only exit door for MOH, they are too **slow** [A: Judgement: Negative] and **incompetent** [A: Judgement: Negative]. Let’s pray for everyone.

Negative “Judgement” was reflected in words like “slow” and “incompetent” to describe the Malaysian government’s slow vaccine distribution and insufficient supply of vaccine. This was the time the government warned the public of the possibility of fourth wave.

In conclusion, while positive “Judgement” is evident in the form of individual resilience to vaccine side effects, the prevailing sentiment of Malaysian Twitter users leans toward negativity, primarily reflecting discontent with the government’s handling of the vaccination campaign. However, it is crucial to note that the negative Judgements directed at the authorities may stem from a positive view on vaccination, with users expressing a genuine desire for a prompt and effective vaccination process. This nuanced perspective

highlights the need for addressing concerns, improving communication strategies, and swiftly executing the vaccination campaign to foster a more positive perception among the public, aligning their expectations with the shared goal of achieving widespread immunization against COVID-19.

Appreciation

Interestingly, “Appreciation” was the most frequently used attitudinal expression in the tweets analysed in positive tweets. The positive tweets were mostly expressing positive “Appreciation”, reflecting the high use of positive lexical strategies.

The positive “Appreciation” mainly used to explain the process of the vaccination. For example, as the rumours questioning the validity of vaccines that were provided in a rapid time, the public denied it by providing information on how the vaccine has been developed under a strict process. For example:

P1-Tweet 16:

The vaccine has been going through R & D, tested **thoroughly** [A: Appreciation: Positive] and **vigorously** [A: Appreciation: Positive] and those companies spent billions to produce vaccines. They have tested the vaccine **successfully** [A: Appreciation: Positive] to humans.

The frequent use of positive “Appreciation” in describing the process of developing vaccines suggests that the user viewed the vaccination as being discussed positively. There was confidence among Twitter users that no developmental or regulatory shortcuts were taken. The vaccine was able to be produced rapidly as the development was facilitated by extensive prior research, unprecedented levels of international collaboration among

researchers, massive public investment in R&D and manufacturing capacity, and the approval processes were accelerated in part by procedures that allow the acceptance of more preliminary evidence. Thus, the tweet emphasized that the vaccine was developed “thoroughly”, “vigorously” and “successfully” and with high validity.

Similarly, during Phase 2, the tweets reflected “Appreciation” when the Twitter users described the process and procedures of vaccine in a positive way, such as:

P2-Tweet 76:

Went to *CucukMYAZ* this morning. It was a **hassle-free** [A: Appreciation: Positive], **smooth sailing** [A: Appreciation: Positive], process.

As the vaccination has started at the end of February 2021, the public expressed their gratitude and experiences through the vaccination process to encourage others to take the vaccine shot. The tweet describes the process positively by mentioning “hassle-free” and “smooth sailing” remarks the excellent services provided by the government,

Nevertheless, there were also tweets describing negative “Appreciation”. They complained about the vaccination process. For example:

P3-Tweet 102:

It’s NOT working, vaccination for teenagers by appointment under the **hot** [A: Appreciation: Negative] sun and **endless** [A: Appreciation: Negative] queue!

The usage of word “hot” and “endless” shows the struggles of parents to vaccinate their children. The Malaysian’ government arranged for teenagers below 18 years old to be vaccinated when the vaccination rate among adults’ population has reach 90% as the preparation for the reopening of schools in October. This is to reduce the risk of infection in schools as well as to prevent the occurrence of clusters and cases among school children.

However, the unorganized vaccination process led the parents to express their views negatively since the vaccination process was held by the vaccination centre as not smooth compared to the adults and senior citizens. Thus, the MOH has announced that the parents should not rush to vaccinate their children as they have sufficient supply. The government also suggested that the parents have to follow the vaccination appointment as stated in MySJ, to minimize crowds at the vaccination centre.

In conclusion, positive tweets expressed by Malaysian Twitter users predominantly express “Appreciation” for the COVID-19 vaccination process, emphasizing confidence in the thorough development of vaccines and commending hassle-free experiences. Despite the overall optimism, some negative “Appreciation” highlights challenges like long queues, indicating the importance of addressing logistical issues for an improved vaccination experience. The nuanced interplay of positive and negative sentiments within the “Appreciation” category reflects the complexity of public perspectives on the vaccination effort.

Frequency of Attitude in Positive Tweets

The analysed appraisal aspect, “Attitude”, pertains to the evaluation of the object or event being appraised. Table 4.3 shows the frequency and percentages of the appraisal aspects of “Attitude” expressed in positive tweets. Throughout the three phases of vaccination program, there was a dominance of positive appraisal of “Attitude”, suggesting widespread satisfaction and positivity likely driven by the perceived effectiveness of the vaccination efforts at each phase.

Table 4.3: Frequency and Percentages of Attitude in Positive Malaysian Tweets

ATTITUDE (n=81)		PHASES			Total	Per %
Aspects	Categories	Phase 1	Phase 2	Phase 3		
Appreciation (n=37)	Positive	18	9	9	36	44.4%
	Negative	0	0	1	1	1.2%
Affect (n=29)	Positive	4	7	8	19	23.5%
	Negative	4	4	2	10	12.4%
Judgement (n=15)	Negative	2	5	4	11	13.6%
	Positive	0	1	3	4	4.9%

In the analysis of “Attitude” of positive categories tweets, the Malaysian Twitter users expressed their “Attitude” in terms of “Affect”, “Judgement”, and “Appreciation”. The dominant “Attitudes” expressed was the “Appreciation” in positive way (n=36), followed by “Affect” in positive (n=19), and “Judgement” in negative (n=11).

The analysis highlights the “Appreciation” is the most frequently expressed appraisal aspect (n=37) with the majority of these tweets (36 out of 37) were positive, showing an “Appreciation” for the government’s vaccination program and the public’s efforts in getting vaccinated during Phase 1. Only one tweet expressed a negative “Appreciation” aspect, indicating a lack of trust in the vaccine’s efficacy when the booster dose was introduced in Malaysia.

Following that, the results on “Affect” shows that the pattern of tweets on positive “Affect” increased as the vaccination program progressed and more people got vaccinated, while negative “Affect” decreased. Out of these tweets, positive “Affect” recorded the highest frequency in Phase 3 (n=8) indicating an increase in positive emotions towards COVID-19 vaccination after the implementation of the booster dose.

Lastly, the “Judgement” is the least frequently expressed appraisal aspect (n=15) with more negative expressions of “Judgement” compared to positive “Judgement” in all three phases. The frequency of negative “Judgement” increased over time as more people received the vaccine and restrictions were lifted, there may have been more critical evaluations of the vaccination program. However, there was a slight increase in the number of positive expressions of “Judgement” in Phase 3 indicating a positive evaluation of the vaccination program’s effectiveness and the government’s efforts in controlling the pandemic.

Overall, the findings of “Attitude” in positive tweets underscore a generally optimistic sentiment among Malaysians regarding COVID-19 vaccination efforts, emphasizing appreciation and positive assessments. This was reflected in their expressions of high positive “Affect”, positive “Judgement”, and positive “Appreciation”.

ii. Graduation in Positive Tweets

This section presents the results on appraisal aspects of “Graduation”, with a particular focus on its positive sentiments in Malaysian Twitter users’ tweets related to COVID-19 vaccination. The two sub-sections discussed are the “Force” and “Focus” of “Graduation”.

Force

The analysis of “Force” in positive tweets reveals that “Graduation” of “Quantification” of “Force” was dominant in their tweets related to COVID-19 vaccination compared to the “Graduation” of “Intensification” of “Force”, suggest that the Twitter users were trying to convey a clear and precise message about the positive aspects of the COVID-19 vaccination.

By using “Quantification” of “Force”, they emphasized the importance of these positive aspects and presented them in a factual and objective manner. For example:

P1-Tweet 6:

Summary: The vaccine was able to be completed in a short time with **equally** [G: Force: Intensification] good quality because we spent **more** [G: Force: Quantification] money & scientists spent **less** [G: Force: Quantification] time waiting for money to come in or for volunteers to sign up. There was also a lot **more** [G: Force: Quantification] collaboration & better technology made it faster.

In the given statement shown in P1-Tweet 6, the “Force” of “Graduation” refers to the degree or intensity of the evaluation or appraisal of the COVID-19 vaccine development process. The phrase “equally good quality” suggests a moderate level of evaluation, as it indicates a positive assessment but without extreme enthusiasm. The word “equally” is an example of “Intensification”, as it emphasizes the degree of the positive evaluation of the quality of the vaccine, which referring to the quality of the vaccine. The phrase “spent more money”, on the other hand suggests a higher degree of evaluation, indicating that the investment made in the vaccine development process was significant and likely contributed to its success. In the statement, “more money” is an example of “Quantification”, as it

provides numerical information about the amount of money that was invested in the vaccine development process.

Another example of “Quantification” of “Force” was used in the lexical “less time” and “more collaboration” referring to the used as a comparative adverb to indicate a reduction in the amount of time spent waiting for money or volunteers and indicate an increase in the amount of collaboration and the use of better technology, which hastened the process. The phrase “scientists spent less time waiting” suggests a lower degree of evaluation, as it merely states a fact and does not express a particularly strong evaluation, while the phrase “a lot more collaboration” suggests a higher degree of evaluation, indicating that increased collaboration was an important factor in the success of the vaccine development process. The “Force” of “Graduation” in this statement is mixed, with some higher and some lower degrees of evaluation, reflecting a nuanced and balanced appraisal of the vaccine development process.

“Graduation” was high in tweets that deny misinformation regarding the vaccination to emphasize their certainty and confidence in denying the rumours, which can help to create a strong impression that the rumours are false and can help to counteract any doubts or concerns that others may have. For example:

P3-Tweet 149:

Loads [G: Force: Quantification] of unverified claims as always, if a **fraction** [G: Force: Quantification] of what he said is true, **all** [G: Force: Quantification] those who received Pfizer & Moderna would’ve been sick. 1.4billion people have been vaccinated, we’re fine.

In P3-Tweet 149, the words “loads”, “fraction”, and “all” are examples of “Graduation” of appraisal, which is a linguistic device used to express degrees of certainty, emphasis, or intensity. The word “loads” is a “Quantification” that suggests a large number of unverified claims, which used by the speaker emphasizes the volume and magnitude of the claims being made. In addition, the word “fraction” is also a “Quantification”, but it suggests a smaller amount or percentage of truth in the claims being made, allows the speaker to express a degree of skepticism or doubt about the veracity of the claims. Finally, the word “all” is another “Quantification” that emphasizes the scale and scope of the potential consequences if the claims were true, suggesting that the impact of the claims would be widespread and affect everyone who received the Pfizer and Moderna vaccines. Overall, the use of “Graduation” of appraisal in the P3-Tweet 149 serves to convey the speaker’s skepticism and confidence in the claims being made about the vaccines, and to emphasize the potential consequences if the claims were true.

Malaysian Twitter users predominantly use “Quantification” of “Force” to emphasize the positive aspects of COVID-19 vaccination through their positive tweets. This involves providing factual and numerical information to highlight the significance of certain factors, such as increased funding, reduced waiting time, and enhanced collaboration in the vaccine development process.

Focus

In positive tweets about COVID-19 vaccination, “Graduation” of “Focus” was often used to emphasize the degree of excitement, enthusiasm, and optimism about the vaccine to help in creating more positive and supportive social environment for vaccination efforts. The analysis revealed that Malaysian Twitter users often “Sharpen” the “Focus” when discussing

the COVID-19 vaccination to emphasize important points and create a sense of urgency or concern. For example:

P1-Tweet 21:

I am **very jealous** [G: Focus: Sharpen] that people in Singapore have gotten the vaccine already. It's just **pure incompetence** [G: Focus: Sharpen] for the delay here in Malaysia, **nothing else** [G: Focus: Soften].

P1-Tweet 21 shows the usage “Graduation” of “Focus” to emphasize the speaker’s emotions and opinions about the COVID-19 vaccine rollout in different countries. Specifically, the speaker used “Graduation” of “Focus” to “Sharpen” their expression of jealousy towards Singapore for having already administered the vaccine, and to “Sharpen” their criticism of the Malaysian government for their perceived incompetence in delaying the vaccine rollout. By saying “I am very jealous” and “It’s just pure incompetence”, the speaker used the language that intensifies their feelings of jealousy and their criticism of the Malaysian government. In contrast, the usage of language that “Softens” the “Focus” of their statement through “nothing else” indicating that the speaker did not believe there are any other factors contributing to the delay in Malaysia’s vaccine rollout. The usage of “Graduation” in this situation conveyed a sense of frustration and disappointment with the vaccine rollout in Malaysia, and a sense of admiration and envy towards the success of Singapore’s vaccine efforts.

In addition, Malaysian Twitter users often used the language that “Softens” the “Focus” when sharing their experiences of the vaccine shot to help reassure others and avoid causing undue alarm or panic. For example:

P2-Tweet 72:

Excited we got our vaccine this morning AstraZenaca was the potion for us ... side effect **a-bit headache** [G: Focus: Soften]. The vaccination center was smooth and fast.. thanks @JKJAVMY @KKMPutrajaya @Khairykj .. will update it **any other** [G: Focus: Soften] side effects.

The “Soften” of “Focus” was conveyed through the use of words “a bit” and “any” in P2-Tweet 72 to downplay the severity of the side effects and emphasize that they were manageable and not a cause for concern. For example, the speaker mentioned “side effect a-bit headache” instead of simply saying “I have a headache” to minimize the severity of the headache and suggest that it is a minor inconvenience rather than a serious health concern. In addition, the speaker also used the phrase “any other” to “Soften” the “Focus” by implying that the speaker did not expect to experience any additional side effects, and simply provided an update as a precaution. By using language that “Softens” the “Focus”, the speaker was reassuring others that getting the vaccine is safe and manageable and was helping to create a more positive and supportive environment for discussing the vaccine topics.

Malaysian Twitter user also often used the “Focus” of “Graduation” in their tweets to make suggestions or criticisms of the government and authorities, with both “Sharpen” or “Softens” the “Focus” to emphasize the urgency and importance of the issue they were addressing, such as:

P3-Tweet 143:

It is inevitable. And I hope the government will provide **factual information** [G: Focus: Sharpen] rather than been seeing as fear-mongering the rakyat. Can’t wait to get my booster shot **soon nonetheless** [G: Focus: Soften]! Boost up your vac guys!

In the given P3-Tweet 143, “Graduation” of “Focus” was used to convey the speaker’s message in a more nuanced way. The phrase “factual information” is an example of “Sharpen” the “Focus”, as it is narrowing down the type of information that the author was seeking and emphasizing its importance. In this context, the speaker emphasizes the importance of the government providing accurate and reliable information about the COVID-19 vaccine by using the word “factual”, while highlighting the negative consequences of spreading misinformation and fear. The usage of language that “Softens” the “Focus” through the phrase “soon nonetheless” was to convey a positive sentiment despite the previous criticism, indicates that the author was optimistic about getting their booster shot soon, despite the concerns expressed about the government’s communication on the matter.

The Malaysian Twitter users often expressed balanced “Softening” and “Sharpening” of “Focus” through the positive tweets to reduce the spread of misinformation and encourage critical thinking. By presenting a balanced view of the benefits and potential risks of COVID-19 vaccination, Malaysian Twitter users were able to promote informed decision-making among their followers to build trust and credibility among the Twitter community and contribute to the public’s overall understanding of the vaccination process.

Frequency of Graduation in Positive Tweets

This section examines the frequency and percentages of appraisal aspects of “Graduation” in positive tweets posted by Malaysian Twitter users about COVID-19 vaccination during three distinct phases, as presented in Table 4.4. The “Graduation” refers

to the degree of intensity, force, or certainty in the expression of sentiment. This aspect reflects how strong or weak the sentiment is in the tweet.

Table 4.4: Frequency and Percentages of Graduation in Positive Malaysian Tweets

GRADUATION (n=52)		PHASES			Total	Per %
Aspects	Categories	Phase 1	Phase 2	Phase 3		
Force (n=29)	Quantification	8	10	6	24	46.2%
	Intensification	3	2	0	5	9.6%
Focus (n=23)	Sharpen	4	7	4	15	28.8%
	Soften	2	3	3	8	15.4%

In the positive tweets within the “Graduation” category, the analysis revealed that users conveyed more “Force” of “Graduation” (n=29) compared to “Focus” of “Graduation” (n=23) in their tweets about COVID-19 vaccination. Further analysis of the “Force” category revealed that the primary aspect of “Graduation” for most Malaysian Twitter users (n=24) was the “Quantification” of “Force”, followed by the “Intensification” of “Force” (n=5).

The “Quantification” of “Force”, which refers to the measurement or numerical expression of the strength of the vaccine’s efficacy and safety, was the aspect conveyed most frequently by users during all three phases. This indicates that consumers have a great deal of faith in the vaccine’s efficacy and safety, and they wish to convey this to others. Meanwhile, “Intensification” of “Force” refers to the expression of strong sentiments or emotions regarding the vaccine, is also indicative of a positive attitude toward vaccination.

This pattern of “Force” of “Graduation” in positive tweets indicates that users are emphasizing the significance of public health and the benefits of vaccination in their messages.

The “Sharpen” of “Focus” was utilized by Malaysian Twitter users (n=15) more frequently than “Soften” of “Focus” (n=8), according to the data. This suggests that Malaysian Twitter users emphasized the specific details or aspects of COVID-19 vaccination that they deemed crucial, such as the vaccine’s efficacy and safety. The use of “Sharpen” of “Focus” also suggests that users were attempting to persuade others to get vaccinated by emphasizing the vaccine’s benefits. In contrast, the “Soften” of “Focus” was used less frequently, indicating that Malaysian Twitter users were less likely to minimize or diminish certain aspects of COVID-19 vaccination.

The analysis of “Graduation” related aspects in positive tweets about COVID-19 vaccination reveals a consistent emphasis on the positive benefits of vaccination and the necessity of getting vaccinated, as well as a high level of confidence in the vaccine’s efficacy and safety. This is a positive indicator of the public’s attitude toward vaccination in Malaysia and demonstrates the potential for social media to be used to disseminate accurate information and promote vaccination.

iii. Engagement in Positive Tweets

This section is about the appraisal aspects of “Engagement” in Malaysian Twitter users in positive tweets related to COVID-19 vaccination. There are four sub-sections under the “Engagement” aspect which are the “Disclaim”, “Proclaim”, “Entertain” and “Attribute”.

Disclaim

“Disclaim” refers to a linguistic device used by Malaysian Twitter users to distance oneself from a particular viewpoint or claim when discussing the COVID-19 vaccination. Under the “Disclaim” aspect, the Malaysian Twitter user showed “denial” than “countering” in their positive sentiment tweet about the implementation of booster dose for the COVID-19 vaccine. This indicated that they had some reservations or concerns about the vaccine rollout plan in Malaysia despite their overall positive attitude towards it. Frequent use of “Disclaim” shows the Malaysian Twitter users had a nuanced way of expressing agreement or disagreement while also considering other factors.

“Disclaim” of “Deny” was made towards the authorities and government to express criticism, such as:

P1-Tweet 25:

*Wahai kerajaan now, Kenapa **tiada** [E: Disclaim: Deny] promosi **besar-besaran** about vaccines **yang** bakal tiba tak lama lagi? Promote *la besar-besaran*, aduiiiiii. **Tak** [E: Disclaim: Deny] macam negara luar dia punya promote.*

(Oh, government now, why is there **no promotion** [E: Disclaim: Deny] massively about vaccines that will arrive soon? Promote it massively, aduiiiiii. **Not like** [E: Disclaim: Deny] other countries the promotions.)

In P1-Tweet 25, the “Engagement” of “Disclaim” was used to express a judgement towards the government’s approach in promoting the upcoming COVID-19 vaccines. The user was expressing his/her dissatisfaction with the government’s efforts by suggesting that there was a lack of promotion or advertising on the upcoming COVID-19 vaccines, using the denying phrase of “*tiada promosi*” (no promotion) to enhance the knowledge of the

vaccine among the public. In addition, the “Engagement” of “Deny” also used when the user denies the effectiveness of the government’s promotion efforts by stating “*tak macam negara luar dia punya promote*” (not like other countries the promotions), suggesting that the user believes that the government’s promotion efforts are not up to par with other countries.

Following that, another criticism was the slow vaccination progress. For example:

P2-Tweet 66:

No [E: Disclaim: Deny], the world **does not** [E: Disclaim: Deny] need ANOTHER fast & furious movie. the world needs faster vaccination process.

The example shown in P2-Tweet 66 shows the “Engagement” of “Disclaim” was used to criticize the slow vaccination progress in Malaysia due to the limited vaccine supply. Therefore, both instances of “Deny” (“no” and “does not”) reflected the frustration experienced by the Malaysian Twitter user with the current situation of vaccine distribution and the prioritization of other non-essential matters over public health. The “Engagement” used in this tweet highlights the user’s strong stance on the issue.

The usage of both “Deny” and “Counter” is not always negative engagement. For example, P1-Tweet 8 engaged with both the positive and negative aspects of the issue.

P1-Tweet 8:

When the country is having over thousands of covid-19 cases daily and **still no** [E: Disclaim: Deny] total Lockdown, we better have a fresh election as this government failed. **Meanwhile** [E: Disclaim: Counter], stay safe ourselves by wearing masks or stay home until vaccine can to rescue.

The “Engagement” of “Disclaim” showed that P1-Tweet 8 was disappointed with the lack of strict measures (“still no total lockdown”) to control the spread of the virus. Furthermore, the phrase “government failed” emphasized the user’s negative evaluation of the government’s handling of the situation. However, the phrase “meanwhile” expressed a contrasting opinion to balance the foregoing criticism. P1-Tweet 8 suggested a more proactive approach to manage the situation rather than waiting for government action. By using the disclaiming language of both “Deny” and “Counter”, the user acknowledged the strengths and weaknesses of different arguments and may be trying to encourage a more balanced or informed discussion.

In Phase 3, the disclaiming language was used when expressing a positive emotion on the vaccination itself such as:

P3-Tweet 118:

Previously vaxxed with AstraZeneca and now waiting for my 3rd jab booster which **not** [E; Disclaim: Deny] necessary **but** [E; Disclaim: Counter] highly recommended. I’ll be thrilled when it’s my turn.

In this example shown in P3-Tweet 118, the word “not” is used to express a negative sentiment towards the necessity of getting a third booster after being previously vaccinated with AstraZeneca. The user tried to “Deny” the necessity of getting a booster shot by suggesting that it is not required. However, the word “but” was also used to express a contrasting opinion, to “Counter” the previous statement by suggesting that the booster shot is highly recommended even if it may not be strictly necessary.

In conclusion, the Malaysian Twitter users’ nuanced use of “Disclaim” in expressing their opinions about the COVID-19 vaccine shows their critical thinking and balanced

approach to the issue. Despite their positive attitude towards the vaccine, they used the “Deny” aspect of “Disclaim” to express reservations and concerns about the vaccine rollout plan in Malaysia. The language of “Disclaim” was used to criticize the government’s approach and express frustration about the slow vaccination progress, while also acknowledging the strengths and weaknesses of different arguments. Through their use of “Disclaim”, the Malaysian Twitter users were able to express their opinions in a complex and nuanced way, encouraging a more informed and balanced discussion.

Proclaim

“Proclaim” expresses conviction, passion, or enthusiasm by making clear and confident statements on COVID-19 vaccination. For positive tweets, “Endorse” was frequently used by Malaysian Twitter users, along with “Concur” and “Pronounce” to enhance engagement and appraisal of COVID-19 vaccination matters.

An example of “Proclaim” of “Concur”, where the speaker expresses the same view or belief as the person who made the statement is as follows:

P2-Tweet 78:

Agreed [E: Proclaim: concur]. 80% vaccination should be the prime objective now. #vaccine should be available to everyone! Access to vaccines should be available and information on vaccines should be shared to get more buy in. Stop politicking at all costs!

In P2-Tweet 78, the user agreed that 80% vaccination should be the prime objective then. By using the word “agreed”, the user was trying to “Concur” with this idea. In this case, the user “Endorse” the idea that increasing vaccination rates should be the top priority

and was calling for vaccines to be accessible to everyone and for more information to be shared to encourage people to get vaccinated.

Twitter users used “Proclaim” of “Pronounce” in positive tweets to express their support, belief, or affirmation towards the importance of getting vaccinated. They show their conviction that vaccination is the right thing to do, and they advocate for it in a confident and assertive way. For example:

P3-Tweet 108:

Get your facts right [E: Proclaim: Pronounce]. There are people who are contraindicated for vaccination pertaining to severe allergies etc.

P3-Tweet 108, the “Proclaim” word used is “Pronounce” as the user was making a statement or expressing their opinion on the importance of getting the facts right. By writing “get your facts right”, the user was asserting his/her viewpoint that it is important to have accurate information about vaccination, particularly for individuals who may be contraindicated for vaccination due to severe allergies or other health concerns.

On the other hand, “Endorse” was mostly used during Phase 3 and shows that Malaysian Twitter users were more actively and enthusiastically supporting or advocating for the use of vaccines. They were sharing personal experiences, positive news articles or statistics, and encouraging others to get vaccinated as well. This kind of behaviour can be influential in persuading others to get vaccinated and can help contribute to increasing vaccination rates in Malaysia. For example:

P3-Tweet 130:

My family member kena covid... **vaccinated** [E: Proclaim: Endorse]. *Alhamdulillah*
Stage 1/2. What is there to lose?

(My family member got COVID... **vaccinated** [E: Proclaim: Endorse].
Alhamdulillah Stage 1/2. What is there to lose?)

By using the word “vaccinated”, P3-Tweet 130 was trying to “Endorse” others to get vaccinated by sharing a personal experience of a family member who contracted COVID-19 but experienced only mild symptoms. By using the phrase “What is there to lose?” at the end, the user is suggesting that the potential benefits of vaccination outweigh any perceived risks or downsides.

In conclusion, Malaysian Twitter users showed a strong sense of conviction, passion, and enthusiasm towards COVID-19 vaccination, reflected in their use of “Proclaim” language. The analysis of positive tweets found that users frequently used “Endorse” to advocate for the importance of getting vaccinated. The balanced use of “Concur” and “Pronounce” also helped enhance “Engagement” and appraisal by expressing agreement and affirmation towards the effectiveness and importance of vaccination. These behaviours can be influential in persuading others to get vaccinated, contributing to increasing vaccination rates in Malaysia.

Entertain

The “Entertain” language in positive tweets was reflected in words for a sense of eagerness about the prospect of getting vaccinated or seeing others get vaccinated. The analysis showed that “Entertain” featured through all the three phases but were more frequent in Phase 2 and Phase 3. Frequent use of “Entertain” in the Appraisal Theory shows that the Malaysian Twitter were engaged in a positive way with the topic of COVID-19 vaccination. For example:

P1-Tweet 17:

Vaccine is a substance used to stimulate the production of antibodies and provide IMMUNITY against several diseases...***kalau*** [E: Entertain] *guna time dah kene virus* we call it ANTIDOTE which is to counteract virus...*ada beza disitu, kita ambil vaccine utk mengelak dijangkiti...ada paham?*

(Vaccine is a substance used to stimulate the production of antibodies and provide IMMUNITY against several diseases...***if*** [E: Entertain] used when already got the virus, we call it ANTIDOTE which is to counteract the virus...there's a difference there, we take the vaccine to avoid getting infected...got it?)

In P1-Tweet 17, the word “*kalau*” (if) indicates a conditional statement as the user was trying to “Entertain” and engage their audience by providing an explanation that is easy to understand and relatable. The user also used simple language and provided an analogy to help their audience understand the difference between vaccine and antidote. By doing so, the user was trying to create a more engaging and interesting conversation about the topic.

In addition, “so” is a word reflecting “Entertain”.

P2-Tweet 93:

Even though they had close contact with me without wearing a mask. This is the effectiveness of the vaccination. The high chances to spread is low and the high chances to be affected also very low. ***So*** [E: Entertain], go get your jab now. Together we save Malaysia. Stay Safe, Mathavan

In P2-Tweet 93, the word “so” created a sense of enthusiasm to see others get vaccinated. Furthermore, the use of “so” also serves to emphasize the point being made and encourage action, which emphasize the benefits of vaccination. P2-Tweet 93 suggested that

people should get vaccinated because the vaccination is effective in reducing the chances of spreading and being affected by the virus. The use of “so” adds a sense of urgency and conviction to the statement, which can be seen as a form of “Entertain” in the “Engagement” process.

In P3-Tweet 138, there are three words used as an “Entertain” of “Engagement” which are the words “should”, “may” and “if” to convey a message and promoting a particular viewpoint.

P3-Tweet 138:

Today is historic. It’s a day that was made possible by science. It’s a day that we **should** [E: Entertain] thank the millions of Malaysians who believe in science. Vaccines work and **may** [E: Entertain] those who oppose it realise that it could have come sooner **if** [E: entertain] ... well... believe in science lah. GET VACCINATED.

The word “should” was an engaging word that prompts the reader to take action and used to create a sense of obligation and encourage people to show gratitude towards science and those who believe in it. Following that, the word “may” was used to suggest the potential benefits of vaccines and to imply that those who oppose vaccines should reconsider their position to create a sense of possibility and encourages the reader to think positively about vaccines. Lastly, the word “if” is used to create a sense of accountability and encourages the reader to reflect on their beliefs and actions.

In conclusion, the use of the “Engagement” aspect of Appraisal Theory known as “Entertain” in positive tweets about COVID-19 vaccination in Malaysia shows that users found the topic engaging and enjoyable. The high frequency of “Entertain” throughout all three phases suggests that the users were motivated to discuss and share information about

vaccination. The use of simple language, analogies, and humor helped to make the conversation more interesting and engaging, while also highlighting the effectiveness of the vaccine. Additionally, “Entertain” was used to encourage action and emphasize the benefits of vaccination, such as achieving herd immunity and saving Malaysia.

Attribute

The “Attribute” of “Engagement” aspects in Appraisal Theory posted by Malaysian Twitter users when discussing COVID-19 vaccination in their positive tweets was a form of indirect speech, which the user reports what someone else said or wrote without using their exact words. The analysis found that the language features used by Malaysian Twitter users with “Attribute” primarily focused on the vaccine administration by mentioning other countries, such as:

P2-Tweet 84:

Mcm negara luar [E: Attribute], mostly *bila* 50% vaccinated, *dah boleh mula* back to normal life, no mask, no social distance m. Hopefully.

(**Like other countries** [E: Attribute], mostly when 50% vaccinated, you can start back to normal life, no mask, no social distance m. Hopefully.)

In P2-Tweet 84, the “Attribute” of “Engagement” was used when the author uses the Malay language phrase “*mcm negara luar*” (like other countries) to “Attribute” the proposition to an external source rather than their own internal authorial voice. Therefore, the author is not taking credit for the idea that when a country reaches a 50% vaccination rate, they can start returning to normal life without masks or social distancing. Instead, the user was suggesting that Malaysia should follow other countries.

In addition, to highlight the importance of getting vaccinated against COVID-19, the Malaysian Twitter user warned about the risks of not getting vaccinated. For example:

P3-Tweet 130:

*Dengar sendiri **space yg Borak Santai** [E: Attribute]. Korang dengar lah sendiri... orang yg tak nak vaccinate... meninggal. **He urged** [E: Attribute] people to take vaccine.*

(Listen yourself the **Borak Santai space** [E: Attribute]. You heard it yourself... people who don't want to get vaccinate... die. **He urged** [E: Attribute] people to take the vaccine.)

P3-Tweet 130 shows two example of “Attribute” used in “*space yg Borak Santai*” (*Borak Santai Space*) and “He urged”. In the first part of the sentence, P3-Tweet 130 used the phrase “*Borak Santai*” (“casual talk” or “chit-chat”) to “Attribute” the proposition to an external source rather than their own internal authorial voice. Therefore, P3-Tweet 130 is not taking credit for the idea that people who do not want to get vaccinated are dying. In the second part of the sentence, the phrase “He urged” was used to indicate that they were reporting on someone else’s words or actions as a form of indirect speech.

In conclusion, the “Attribute” of positive tweets on COVID-19 vaccination by Malaysian Twitter users primarily focused on vaccine administration and emphasized the importance of getting vaccinated. Tweets that used “Attribute” used external sources, such as other countries or casual conversations, to convey their messages rather than taking credit for the ideas themselves. By doing so, the users were able to reinforce their arguments by providing evidence or opinions from other sources. The use of indirect speech in the form of “Attribute” also added a layer of credibility and authenticity to the messages being conveyed.

Frequency of Engagement in Positive Tweets

This section discussed the frequency and percentages of appraisal aspects of “Engagement” of “Disclaim”, “Proclaim”, “Entertain”, and “Attribute” in positive tweets posted by Malaysian Twitter users about COVID-19 vaccination during three distinct phases, as presented in Table 4.5.

Table 4.5: Frequency and Percentages of Engagement in Positive Malaysian Tweets

ENGAGEMENT (n=93)		PHASES			Total	Per %
Aspects	Categories	Phase 1	Phase 2	Phase 3		
Entertain (n=40)		7	16	17	40	43.0%
Disclaim (n=46)	Deny	6	14	8	28	30.1%
	Counter	4	8	6	18	19.4%
Attribute (n=5)		1	2	2	5	5.4%
Proclaim (n=2)	Concur	0	1	0	1	1.05%
	Pronounce	0	0	1	1	1.05%
	Endorse	0	0	0	0	0

The analysis of “Engagement” in positive tweets related to COVID-19 vaccination in Malaysia shows that Malaysian Twitter users engaged more in “Entertain” tweets (n=40), followed by “Disclaim” tweets (n=46), and “Attribute” tweets (n=5). The lowest frequency of “Engagement” was found in the “Proclaim” tweets (n=2), which had only one instance of “Concur” and one instance of “Pronounce”.

“Disclaim” tweets were further categorized into “Deny” (n=28) and “Counter” (n=18). The “Deny” was the most frequent type of “Disclaim” tweets, with the majority of instances appearing in Phase 2 (n=14). The “Counter” was also prevalent, with the majority appearing in Phase 2 (n=8). The frequent use of “Disclaim” in Phase 2 could be because this phase coincided with the initial rollout of the vaccination program in Malaysia, which may have generated a higher level of public interest and scrutiny. As such, Twitter users may have felt the need to be more cautious in expressing their opinions and to include disclaimers to avoid any potential negative consequences.

Next, the “Entertain” tweets were the most frequent type of “Engagement” tweets, with the majority appearing in Phase 3 (n=17). Phase 3 of the COVID-19 pandemic in Malaysia coincides with the ongoing vaccination rollout and gradual easing of restrictions, leading to a greater inclination to use language that is lively, interesting, or amusing, with the goal of entertaining the audience. Furthermore, Phase 3 at the end of 2021 coincides with the festive seasons in Malaysia such as *Eid al-Adha*, *Deepavali* and Christmas which are typically associated with social gatherings, feasting. This is why there is frequent use of “Entertain” in positive tweets which go beyond conveying information and aims to create a positive affective response among Twitter users.

Following that, the low frequency of “Attribute” tweets (n=5) indicates that Malaysian Twitter users were less likely to “Attribute” positive outcomes to the COVID-19 vaccination, perhaps because they were focusing more on personal experiences and emotions rather than statistical or factual evidence.

Lastly, the usage of “Proclaim” was minimal, with only two tweets found in this category. Malaysian Twitter users might have been more focused on expressing their

personal opinions and experiences with the vaccine rather than making strong public declarations about it. Additionally, the use of “Proclaim” may require a higher level of confidence and authority than what the Twitter users had.

Overall, the analysis of “Engagement” in positive tweets related to COVID-19 vaccination in Malaysia suggests that Malaysian Twitter users were actively engaged in sharing their experiences, emotions, and opinions related to the vaccination, with a higher focus on “Entertain” and “Disclaim” tweets.

4.3.2 Negative Sentiments

The study on Malaysian Twitter users’ sentiment towards COVID-19 vaccination shows a moderate number of negative sentiments among the tweets about COVID-19 vaccination. Table 4.12 shows that 23.3% of 150 were negative, with Phase 1 (n=13), Phase 2 (n=9), and Phase 3 (n=13). This suggests that Malaysian Twitter users were generally receptive to the idea of getting vaccinated against COVID-19, and that there are relatively few concerns or criticisms about the vaccine. Most of the tweets categorized under the negative sentiments were about vaccine hesitant behavior.

The negative sentiment expressed towards COVID-19 vaccination was slightly higher during Phase 1 as limited information on the vaccination had been spread, suggesting that there was a sense of frustration, anxiety, and uncertainty among the public. The lack of access to the vaccine could have led to concerns about the effectiveness and safety of the vaccine, such as:

P1- Tweet 1:

Adakah vaksin Covid19 yang akan diwajibkan semua terima itu nanti selamat? Atau ini hanya propaganda supaya kita terima cecair yg dikatakan vaksin masuk kebadan kita? Jadi cecair itu cecair apa?

(Is the Covid19 vaccine that everyone will be required to receive safe? Or is this just propaganda so that we accept the liquid that is said to be a vaccine into our bodies? So what kind of liquid is that liquid?)

P1-Tweet 1 shows the scepticism about the safety and efficacy of the COVID-19 vaccine. The user appears to be questioning whether the vaccine was safe as it used the “weakened” virus. This negative sentiment may reflect the lack of trust and uncertainty among some individuals in Malaysia towards the COVID-19 vaccine.

The efficacy of vaccines was questioned by the public as a result of the rapid development of vaccines. Although information about vaccination has been widely disseminated, anti-vaccination groups continue to raise doubts about vaccination. In addition, the efficacy and purpose of the vaccine shot has been the subject of social media rumours. For instance:

P2- Tweet 89:

Omg..vaccination is not a guarantee to a life of safety. So why do we vaccinate then?

P2-Tweet 89 questioned the effectiveness of vaccination in providing a safe life. This negative sentiment may reflect a lack of understanding or misinformation about the benefits of vaccination and may contribute to vaccine hesitancy among some individuals in Malaysia. Correspondingly, the WHO has announced that the purpose of the vaccine is to

provide naturalising antibodies to develop higher immunity to the virus, which can help reduce the risk of infection or reduce the risk by alleviating symptoms. Nonetheless, a number of anti-vaccination groups continue to raise the problem at hand, as vaccination is not a virus-killing cure.

The negative sentiments recorded the highest frequency during Phase 3, compared to the earlier phases. Phase 3 was when the booster dose was implemented. This was the time when the public were facing issues or concerns related to the effectiveness, safety, or availability of the booster dose. Example of the negative sentiment expressed during this phase was:

P3- Tweet 137:

Nothing hypocritical abt saying I'm not in favour of boosters for all at the moment.

The data doesn't justify it. Malaysia is administering boosters to the high risk and those with sinovac first so its still very much a correct move.

P3-Tweet 137 was not in favour of boosters shot for everyone and believed that there were insufficient data to justify the need for a booster dose. This implies that they were worried about the effectiveness and safety of booster doses for the general population and felt that the booster shot should be given to only high-risk groups and those who have received the Sinovac vaccine. The tweet suggests a lack of trust in the decision-making process and highlights concerns about the potential risks and benefits of the booster dose.

In conclusion, the dissemination of the false rumors affected the vaccination uptake rates, while attitudes regarding the safety of vaccines are a major contributor to vaccine reluctance.

a) Appraisal Aspects of Negative Sentiments

This section presents the results of negative sentiments of appraisal aspects expressed by Malaysian Twitter users regarding COVID-19 vaccination focusing on the appraisal aspects of “Attitude”, “Graduation”, and “Engagement”.

i. Attitude in Negative Tweets

The appraisal aspects of “Attitude” in Malaysian Twitter users’ negative tweets related to COVID-19 vaccination are divided into “Affect”, “Judgement”, and the “Appreciation”. Negative sentiments related to “Attitude” of Appraisal Theory mostly included frustration, fear, and scepticism, and the potential negative impact of the spread of these sentiments on vaccination efforts.

Affect

In terms of “Affect” in negative tweets, the users conveyed both positive and negative emotional responses through either adjective, noun phrases or verb phrases. Based on the analysis, the Malaysian Twitter users commonly expressed negative “Affect” such as disappointment with the vaccination rollout plan. For example:

P2-Tweet 79:

So **sad** [A: Affect: Negative] like this, even if you want a vaccine, you have been discriminated.

The vaccination distribution in Malaysia unfolded in three stages. The first stage prioritized frontliners, encompassing approximately half a million individuals, followed by the second stage for high-risk groups, and the third stage for all adults aged 18 and above. Tweets like P2-Tweet 79 reflect grievances concerning discrimination in implementation of the vaccination program. Certain political figures and their associates were alleged to circumvent the established vaccination queue. Based on a *Malay Mail* article (2021, March 01), politicians, particularly ministers, were reportedly authorized to escort up to five of their officers for vaccination, contingent upon the approval of the district health officer. This is because each vial of Pfizer vaccine, comprising six doses, necessitated immediate administration upon unsealing. Nonetheless, there were reported instances of ministers requisitioning additional doses and introducing extra individuals without prior notification, leading to the depletion of surplus vaccine doses. In response to these concerns, the Minister of Science and Technology Khairy Jamaluddin, overseeing vaccine access through the Special Committee for Ensuring Access to COVID-19 Vaccine Supply (JKJAV), announced that these occurrences would be investigated. The outcome of the public expressing their dissatisfaction and sadness at being “discriminated” seemed to have a good impact.

As the vaccination started, the Malaysian Twitter users frequently expressed their negative opinions on the side effects they felt after the vaccination. Thus, to describe the side effects, they used the negative “Affect” words. For example:

P3-Tweet 124:

The booster dose felt the **worst** [A: Affect: Negative] for me, my whole body was just **weak** [A: Affect: Negative], and I had fever. Then I went to the KK, they didn’t wanna accept me, said I had covid-like symptoms.

The experience of side effects faced by individuals were different from one another. P3-Tweet 124 said the side effects of booster dose was “worst” and he/she felt “weak” after receiving the injection. The side effects were similar to COVID-19 symptoms. For example, vaccine after-effects usually only last for a short period of time and disappear within a day or two. In addition, loss of smell (anosmia) and persistent cough are not vaccine after-effects but are two of the most common signs of COVID-19.

In contrast, the Malaysian Twitter users also expressed positive “Affect” in the context of negative views on vaccination. For example:

P1-Tweet 3:

Shall we take the vaccine even if we never ever getting in contact with the virus? what’s your opinion? it’s not that I’m an antivac. it’s just I **trust** [A: Affect: Positive] my antibody more.

In P1-Tweet 3, the user employed the positive term “trust” while expressing scepticism or rejection towards the COVID-19 vaccine. He/she was talking about whether to trust their own antibody or the vaccination. Here, the use of the word “trust” imparts a positive connotation within the context of a negative sentiment conveyed in the tweet. Trust is a fundamental element of acceptance of public health interventions by the targeted population which can help facilitate efforts to control the spread of the virus. “Trust” here is attributed to negative “Affect” because it reflects vaccine hesitance and doubts.

In conclusion, Malaysian Twitter users expressed a nuanced range of emotions in negative tweets related to COVID-19 vaccination. Disappointment with the vaccination rollout, concerns about preferential treatment for political figures, and adverse side effects

contribute to the negative “Affect”. However, amidst scepticism, some users conveyed positive “Affect” by emphasizing trust in their own antibodies.

Judgement

The “Judgement” aspects of negative tweets reveal the underlying reasons for the Malaysian Twitter users’ attitudes and perceptions on COVID-19 vaccination, which are conveyed through positive or negative words. Within the negative tweets, the analysis found more negative “Judgement” than positive “Judgement” indicating the public have more negative “Attitudes” towards the vaccine. In addition, the aspects of “Judgement” also were used to evaluate the authorities through their personal experiences. For example:

P2-Tweet 86:

It was a drive-through vaccination center and can be seen the jab was not pumped at all. If this did happen in Malaysia, those involved must really face the music to upkeep the image of our **saluted** [A: Judgement: Positive] frontliners!

Personal “Judgement” was used in P2-Tweet 86 by including a praising word (“saluted”) to express admiration publicly for a person or an achievement. As Malaysia navigates the challenges brought about by the global pandemic, the recovery momentum achieved by the country would not have been possible without the contributions and sacrifices of our everyday “heroes” on the frontlines. However, the actions of some irresponsible frontliners giving an empty jab have given rise to public concern. In this tweet, the inclusion of the positive term “saluted” initially suggests a positive “Judgement”, but the overall tone of the tweet is negative as it expresses disapproval and negative sentiment about frontliners. This negative expression can potentially influence other people’s decisions

regarding the vaccine, reflecting the user's disapproval despite the positive language initially used.

In Phase 3, negative “Judgement” was commonly used to evaluate the behaviour of the public. P3-Tweet 140 is an example of anti-vaccination tweets that labelled people who accepted the vaccine shot as “*bodoh* (foolish)” and “*ketamakan* (greed)”. The word “greed” referred to the companies that benefitted from the manufacture and sale of vaccines.

P3-Tweet 140:

*Lambakan kematian akan berterusan hanya disebabkan pilihan **bodoh** [A: Judgement: Negative] dari **ketamakan** [A: Judgement: Negative] urusniaga vaksin.*

(Tons of deaths will continue solely due to the **foolish** [A: Judgement: Negative] choices from the **greed** [A: Judgement: Negative] of the vaccine business.)

The vaccine hesitancy has been expressed by the Malaysian Twitter users by including judgement words to evaluate those pro-vaccination public and the authorities. In reality, the spike in death were not all caused by the vaccine but potentially due to chronic diseases that the people had.

In conclusion, the analysis of negative tweets among Malaysian users revealed prevalent negative “Judgement” toward COVID-19 vaccination. While positive terms may be used initially, the overall sentiment often turns negative, impacting public attitudes. Negative “Judgement” extends to evaluating frontliners and public behaviour, with some tweets expressing vaccine hesitancy. It is crucial to address and understand these concerns to enhance public trust in vaccination efforts.

Appreciation

In the Appraisal Theory, “Appreciation” in negative tweets refers to the recognition and expression of negative emotions or sentiments related to an object or event, based on the individual’s appraisal or evaluation of the object or event. The positive “Appreciation” was mainly used to express sarcasm towards the vaccination process in Malaysia by mentioning something positive first. For example:

P1-Tweet 12:

Vaccination plans, while might looks **good** [A: Appreciation: Positive] on paper, it will be **messy** [A: Appreciation: Negative] during implementation stages. Of that no doubt ady.

In P1-Tweet 12, the word “good” refers to the vaccination plan but negative “Appreciation” of the plan is shown through the word “messy”. P1-Tweet 12 states that the vaccination plans only looks good on paper but was actually confusing and chaotic when implemented.

The long waiting period due to the shortage of vaccine had upset the Malaysian public during the vaccine distribution phase. To evaluate the vaccination progress, attitudinal expression of “Appreciation” also was used, such as:

P2-Tweet 94:

Let’s also set our expectation **better** [A: Appreciation: Positive]. Even with 30k cases a day, and potential new variants etc., The UK will always have first dib on vaccine stocks and access to any vaccine updates. We in Malaysia will always be 5-6 months behind, and the impact is **devastating** [A: Appreciation: Negative].

P2-Tweet 94 shows the usage of positive “Appreciation” via the word “better” to refer to their expectation to get vaccinated quickly so that they could lead their normal life. However, the worldwide demand of the vaccine and the inadequate stock caused the slow progress of the vaccine distribution among the countries, and the more “influential” countries were given the vaccine first compared to other small countries. The word “devastating” refers to the impacts of the slow progress of the vaccination in Malaysia, that is, the spread of more dangerous variants, the increase in positive cases, and the prolonged closure of restaurants and shops to minimise the public gatherings.

In conclusion, the negative tweets about COVID-19 vaccination by Malaysian Twitter users revealed a dual-toned “Appreciation”. The sarcasm had two points: the initial part acknowledged positive aspects, but the later part highlighted negative perspectives on the vaccination process such as implementation challenges, delayed vaccine distribution, and concerns about the impact on daily life.

Frequency of Attitude in Negative Tweets

The appraisal aspect of “Attitude” in negative tweets can provide insights into how people are responding to and coping with the pandemic. This section presents the frequency of “Attitude” used in negative tweets by Malaysian Twitter users when discussing COVID-19 vaccination, as presented in Table 4.6.

Table 4.6: Frequency and Percentages of Attitude in Negative Malaysian Tweets

ATTITUDE (n=33)		PHASES			Total	Per %
Aspects	Categories	Phase 1	Phase 2	Phase 3		
Appreciation (n=18)	Positive	4	2	6	12	36.4%
	Negative	2	1	3	6	18.2%
Judgement (n=9)	Negative	1	1	5	7	21.2%
	Positive	0	1	1	2	6.0%
Affect (n=6)	Negative	0	1	4	5	15.2%
	Positive	1	0	0	1	3.0%

The analysis of the appraisal aspects of “Attitude” in the negative tweets shows that Malaysian Twitter users expressed more “Appreciation” (n=18) in their tweets related to COVID-19 vaccination compared to “Affect” (n=6) and “Judgement” (n=9).

In terms of “Appreciation”, the majority of the tweets expressed positive “Appreciation” (n=12), particularly in Phase 1 (n=4) and Phase 3 (n=6). This suggests that despite some negative sentiment towards vaccination, users still appreciate the efforts made to distribute and administer vaccines in the country. The negative “Appreciation” tweets (n=6) were more evenly distributed across the phases, indicating that concerns and criticisms were consistently expressed throughout the period of the study.

For “Affect”, most of the tweets expressed negative “Affect” (n=5) in Phase 3, which could be due to the surge of COVID-19 cases after the interstate travel allowed for fully

vaccinated citizen, and the public expressed their emotions on the need of booster dose. This indicates that negative emotions were heightened during the third phase of the study, possibly as a result of the increase in the number of cases.

In terms of “Judgement”, the negative “Judgement” (n=7) was more common compared to positive “Judgement” (n=2) in negative tweets. The negative “Judgement” tweets were mostly expressed in Phase 3 (n=5), which suggests that the increasing number of cases and deaths during this period may have led to more criticism towards the vaccination effort. The positive “Judgement” tweets were only found in Phase 2 (n=1) and Phase 3 (n=1), which indicates that while some users had positive opinions about the vaccination effort, it was not as prevalent as the negative opinions.

In conclusion the patterns suggest that while there were some positive sentiments expressed towards the vaccination effort, there were also consistent concerns and criticisms throughout the study period. The negative “Affect” and “Judgement” tweets in Phase 3 could be attributed to the worsening situation and the government’s response to it.

ii. Graduation in Negative Tweets

This section presents the results on the appraisal aspect of “Graduation” in Malaysian Twitter users’ negative tweets related to COVID-19 vaccination based on analysis of the “Force” and “Focus”. The negative sentiments related to “Graduation” include disappointment, frustration, and anger, and the potential impact of these sentiments on vaccination efforts.

Force

In the context of negative tweets related to COVID-19 vaccination, the “Force” of “Graduation” refers to the strength or intensity of negative emotions or sentiments related to the perceived delay or inability to graduate from the pandemic situation. Analysis of “Force” in negative tweets reveals that “Graduation” of “Intensification” of “Force” was dominant in their tweets related to COVID-19 vaccination compared to the “Graduation” of “Quantification” of “Force”, suggesting that they are using language that emphasizes strong emotions and opinions about the topic. This may indicate that they have strong convictions or beliefs about the issue and are trying to express their views in a forceful manner. For example:

P1-Tweet 3:

it's not that im an antivac. its just i trust my antibody **more** [G: Force: Intensification]. i have been contact with positive cases. i even share drink n food through the same spoon n sources.

As shown in P1-Tweet 3, by using the word “more” to describe their trust in their own antibodies over vaccines, the speaker used “Intensification” of the “Force” of their statement. The use of “more” emphasizes the speaker’s conviction that their own immune system is superior to vaccination in providing protection against disease. “Force” of “Intensification” can be used to make a statement more emphatic or to emphasize the speaker’s conviction or passion about a particular topic. In this case, the use of “more” intensifies the “Force” of the speaker’s statement by emphasizing their confidence in their own immune system over vaccination.

In addition, the “Intensification” of “Force” persuades others by evoking an emotional response. For example:

P2-Tweet 86:

I have received this. I don't know where and when this happened! It was a drive-through vaccination centre and can be seen the jab was not pumped **at all** [G: Force: Intensification].

The use of “Intensification” of “at all” shown in P2-Tweet 86 emphasizes the speaker’s belief that the jab was not administered properly and that there was a complete absence of pumping during the vaccination process. In addition, the use of “at all” intensifies the appraisal of the situation, highlighting the speaker’s frustration and dissatisfaction with the experience. The strong negative evaluation shows that the vaccination process was not given due attention or care, which could lead to negative consequences such as a lack of immunity or potential side effects.

In the context of negative tweets related to COVID-19 vaccination, the use of “Quantification” of “Force” can help to show the degree of hesitancy or resistance towards vaccination. For example:

P3-Tweet 145:

We Asians find it difficult to accept change because our family has lived a healthy life without a vaccine for **hundreds of years** [G: Force: Quantification]. We think it is a very logical fact that a vaccine is a for-profit.

By using the word “hundreds” in the phrase “for hundreds of years” suggests that the family has been living this way for a significant amount of time, which may make it difficult for them to accept the changes to prevent the disease spread. The “Quantification” used to

strengthen the argument that vaccines are not necessary for their family's health and well-being, as they have been living without them for centuries. The usage of "Quantification" of "Force" in P3-Tweet 145 was to provide a numerical value to emphasize the length of time that the family has lived without vaccines. This adds weight to the speaker's argument that vaccines were not necessary for a healthy life and reinforces their reluctance to accept the idea of vaccination.

In conclusion, Malaysian Twitter users expressed deep scepticism and dissatisfaction through "Force" of "Graduation" in negative tweets with prominent use of "Intensification", reflecting strong emotional sentiments and convictions. On the other hand, "Quantification" is utilized to underscore hesitancy, with numerical values emphasizing a longstanding resistance to vaccination, highlighting the challenge of embracing change within certain cultural contexts.

Focus

The "Focus" of "Graduation" in negative tweets related to COVID-19 vaccination refers to the specific aspects of the "Graduation" experience that individuals were expressing negative sentiments towards specific aspects of the vaccination issue that they believe are important or worth discussing. These are to voice a problem of the vaccination or to criticize the vaccination process. For example:

P2-Tweet 49:

Small kids [G: Focus: Sharpen] are pushed front to school by **old folks** [G: Focus: Sharpen] are stood behind for the Parliament session. The best part is, those at behind getting the vaccine first not the school kids or teachers.

P1-Tweet 49 criticized the vaccination plan made by the government by “Sharpen” the “Focus” through the terms “small kids” and “old folks”. By using the term “small kids” to describe the group of children, and “old folks” to describe the group of adults of politicians, the speaker emphasized the vulnerability of both groups to COVID-19 infection. The speaker highlighted the discrepancy between the government’s stated priorities and the actual distribution of vaccines, which implied that the government was not effectively prioritizing vulnerable populations.

The “Sharpen” of “Focus” is a cognitive bias in which the focus or emphasis on certain aspects of a situation or event is increased, while others are minimized or ignored. Following that, the Malaysian Twitter users also often expressed the seriousness of the symptoms and the side effects of the vaccination by “Sharpen” the “Focus”, such as:

P3-Tweet 101:

My dad got a **mild stroke** [G: Focus: Sharpen] and weakness in leg 2 days after his 2nd dose AstraZeneca vaccine. On the 6th day in HKL, my dad passed away. He was in **perfect condition** [G: Focus: Sharpen] before this.

The “Sharpen” of “Focus” expressed in P3-Tweet 101 is achieved using the words “mild stroke” and “perfect condition”. The term “mild stroke” downplayed the severity of the stroke, shifting the “Focus” away from the stroke as a significant health event and towards the vaccine as the cause of the stroke. Conversely, the phrase “perfect condition” emphasized the health of the speaker’s father that was previously in good shape, and this shift “Focus” towards the vaccine as the cause of their father’s sudden decline in health and eventual death. The usage of “Sharpen” of “Focus” in this statement could potentially impact their attitudes towards the AstraZeneca vaccine.

The “Soften” of “Focus” was quite high among individuals who were sceptical about vaccines. For example:

P1-Tweet 36:

Hmm, I still have **a lot of doubts** [G: Focus: Soften] on this covid 19 vaccine. If it is available, I dont think I'll get the injection.

The “Soften” of “Focus” shown in P1-Tweet 36 was seen in the term “a lot of doubts”. P1-Tweet 36 justified their decision not to get vaccinated based on a complex set of concerns. The “Soften” of “Focus” in this tweet made the speaker’s message less confrontational and could potentially open up a dialogue about the reasons behind vaccine hesitancy and how to address them.

In conclusion, the “Graduation” of “Focus” in negative tweets in negative sentiments are divided into “Sharpen” of “Focus” to intensify criticism and emphasize specific issues and “Soften” of “Focus” to express scepticism less confrontationally, framing doubts as questions for discussion rather than outright rejection.

Frequency of Graduation in Negative Tweets

In this section, the frequency of “Graduation” in negative tweets were discussed as shown in Table 4.7 based on the “Force” and “Focus” of “Graduation”. The analysis provides insights into the sentiment of Malaysian Twitter users during the pandemic and how it has evolved over time. The negative sentiments related to “Graduation” include disappointment, frustration, and anger, and the potential impact of these sentiments on vaccination efforts.

Table 4.7: Frequency and Percentages of Graduation in Negative Malaysian Tweets

GRADUATION (n=28)		PHASES			Total	Per %
Aspects	Categories	Phase 1	Phase 2	Phase 3		
Focus (n=18)	Sharpen	5	3	5	13	46.4%
	Soften	2	0	3	5	17.9%
Force (n=10)	Intensification	1	1	4	6	21.4%
	Quantification	2	0	2	4	14.3%

The appraisal aspect of “Graduation” in the negative tweets shows that Malaysian Twitter users expressed more “Graduation” of “Force” (n=28) compared to “Graduation” of “Focus” (n=18) in their tweets related to COVID-19 vaccination. The highest frequency of “Graduation” aspects was the “Quantification” of “Force” (n=10), followed by “Sharpen” of “Focus” (n=13), “Soften” of “Focus” (n=5), and the “Intensification” of “Force” (n=6).

The “Sharpen” of “Focus” was more frequent in all three phases (n=13), indicating a tendency among users to highlight specific aspects of the vaccine, such as its side effects or efficacy, and to express strong opinions about them. The “Soften” of “Focus” was less frequent (n=5), indicating that they seldom downplay or minimize vaccine-related issues.

Following that, the frequent use of the “Quantification” of “Force” in Phase 1 (n=2) suggest due to the early stages of the vaccination rollout when there was still uncertainty about the effectiveness and safety of the vaccine. The users were expressing their doubts and concerns through the “Quantification” of “Force”, indicating a lack of confidence in the vaccine.

In Phase 3, however, the “Intensification” of “Force” was used more frequently (n=4), indicating a heightened sense of urgency and concern among users regarding the effectiveness and safety of the vaccines. This also might be influenced by the emergence of new COVID-19 variants and the continued spread of the virus although most of the public had received their vaccine shot.

This finding suggests that negative tweets regarding COVID-19 vaccination often expressed strong concern and frustration about the effectiveness and safety of the vaccine. Overall, the negative tweets showed a lack of confidence in the vaccination process and a need for more effective communication and education efforts to address concerns and improve public trust in the vaccine.

iii. Engagement in Negative Tweets

This section describes the results on the appraisal aspects of “Engagement” in Malaysian Twitter users’ negative tweets related to COVID-19 vaccination for “Disclaim”, “Proclaim”, “Entertain” and “Attribute”. The focus is on the negative sentiments related to “Engagement”, including avoidance, disengagement, and resistance, and their potential impact on vaccination efforts.

Disclaim

The “Disclaim” of “Engagement” system of Appraisal Theory in negative tweets by Malaysian Twitter users refers to the use of language to “Deny” or “Counter” a certain idea or belief about the COVID-19 vaccination, as a way for Malaysian Twitter users to express their dissatisfaction and concerns about the COVID-19 vaccination process. In these tweets,

Malaysian Twitter users expressed their doubt, uncertainty, or scepticism about the safety or efficacy of the vaccines by using the disclaimers of “Deny” or “Counter” to express their reservations or to challenge claims made by others.

The “Disclaim” of “Engagement” is evident in Malaysian Twitter users’ negative tweets on COVID-19 vaccination, as seen in their scepticism towards the safety and effectiveness of the vaccine, as well as their counter-arguments against government propaganda, as illustrated in tweets such as:

P1-Tweet 1:

*Adakah vaksin Covid19 yang akan diwajibkan semua terima itu nanti selamat? **Atau** [E: Disclaim: Counter] ini hanya propaganda supaya kita terima cecair yg dikatakan vaksin masuk kebadan kita? Jadi cecair itu cecair apa?*

(Is the Covid19 vaccine that everyone will be required to receive safe? **Or** [E: Disclaim: Counter] is this just propaganda so that we accept the liquid that is said to be a vaccine into our bodies? So what kind of liquid is that liquid?)

P1-Tweet 1 shows the Malaysian Twitter user expressed the doubt about the safety of the COVID-19 vaccine that would be made mandatory for everyone. The word “*atau*” (or) functions as a “Counter” to the idea that the vaccine is safe. The user was suggesting that perhaps the idea of mandatory vaccination is just propaganda to convince people to receive an unknown liquid into their bodies. This use of the “Counter” of “Engagement” of the Appraisal Theory highlights the user’s critical stance towards the vaccination program and their reluctance to trust the authorities promoting the vaccine.

Furthermore, the “Disclaim” of “Engagement” system of Appraisal Theory in negative tweets includes expressions of doubt and hesitancy. For example:

P1-Tweet 36:

Hmm, I **still** [E: Disclaim: Counter] have a lot of doubts on this covid 19 vaccine. If it is available, I **dont** [E: Disclaim: Deny] think I'll get the injection.

The appraisal of “Engagement” of “Disclaim” in P1-Tweet 36 with the word “still” is a “Counter” to the idea that the vaccine is safe and effective, which reflects concerns about the vaccine despite some progress being made in vaccine development and distribution. Nonetheless, the “Disclaim” of “Deny” in the word “don’t” shows a clear denial of the idea of getting the vaccine in the future. Overall, the tweet expresses a negative sentiment towards the COVID-19 vaccine and reflects the user’s doubts and concerns about its safety and efficacy.

The “Disclaim” of “Engagement” system in negative tweets by Malaysian Twitter users regarding the safety of COVID-19 vaccination is still prevalent even after the distribution of the vaccine and implementation of booster doses, as seen in tweets such as:

P3-Tweet 120:

A close family friend passed away today morning. Stroke n diabetic patient was forced to take Pfizer vaccination **if not** [E: Disclaim: Deny] **no** [E: Disclaim: Deny] **salary**. He was unconscious at 5am today, called 999 for emergency assistance, took 40min to reach. Pronounced dead.

In P3-Tweet 120, the appraisals of “Disclaim” of “Deny” were used in the words “not” and “no”. The word “not” implied that the patient might not have wanted to take the

vaccine but was compelled to do so because of the circumstances. Meanwhile, the word “no” was used to send the message that the patient would not get his/her salary without vaccination. This tweet highlights the use of “Disclaim” language to express scepticism and distrust towards the methods used to force people to be vaccinated.

In conclusion, the present study finds that the “Disclaim” of “Engagement” system of Appraisal Theory was widely employed by Malaysian Twitter users in their negative tweets about the COVID-19 vaccination. These disclaimers were employed to express doubt, uncertainty, scepticism, and distrust towards the vaccine’s safety and efficacy and the authorities promoting it. The “Disclaim” of “Engagement” system is evidenced through the use of language to “Deny” or “Counter” certain ideas or beliefs about the vaccine. In short, the “Disclaim” of “Engagement” language articulates the reservations and concerns of Twitter users regarding the COVID-19 vaccination process.

Proclaim

The “Proclaiming” of “Engagement” in negative tweets by Malaysian Twitter users refers to the use of language in their tweets to assert their dissatisfaction about the COVID-19 vaccination.

Malaysian Twitter users engaged in the “Proclaiming” of “Endorsement” to express their negative views about the COVID-19 vaccination. P3-Tweet 121 is an example of a tweet that “Endorses” certain claims or facts regarding the adverse effects of vaccines on people.

P3-Tweet 121:

The simple answer is **5 million people** [E: Proclaim: Endorse] have died due to vaccines, infections to families also come from individuals who have been vaccinated. That is **the fact** [E: Proclaim: Endorse] of every country.

In P3-Tweet 121, the user used words “5 million people” and “the fact” to “Endorse” the truth of a claim. Here, the claim was false, that is, “5 million people” have died due to vaccines. They “Endorse” the false claim using the word “the fact” which is presented in a declarative manner, as if it is an indisputable truth as an endorsement of the idea that vaccines are hazardous and can result in extensive harm. In other words, they disapproved or condemned the use of vaccines.

Furthermore, the debate over the necessity and efficacy of COVID-19 booster shots has intensified with the use of “Endorse” by Malaysian Twitter users, for example:

P3-Tweet 137:

Nothing hypocritical abt saying I'm not in favour of boosters for all at the moment.
The data [E: Proclaim: Endorse] doesn't justify it.

P3-Tweet 137 used the word “data” to “Endorse” the opinion as it implies a scientific basis for the statement. P3-Tweet 137 said that the decision to not support boosters was based on factual evidence and not just personal opinion. This action can be seen as a way of presenting a logical and reasoned argument against the use of boosters. The scientific “Endorse” in this tweet adds weight to the user’s argument and positions them as someone who is informed and rational in their opinions.

In conclusion, by endorsing certain claims or facts, users were their concerns and scepticism around the COVID-19 vaccination process. Overall, the use of “Proclaim” of

“Endorse” in negative tweets highlights the need for better communication and education around the COVID-19 vaccination process to ensure that individuals can make informed decisions about their health.

Entertain

The “Entertain” component of “Engagement” in the negative tweets by Malaysian Twitter users pertains to the level of interest generated by messages that propagate conspiracy theories regarding the pandemic, cast doubts on the severity of the virus or propagate the idea that it is a hoax.

The use of “Entertain” of “Engagement” was often seen in concerns related to the safety and effectiveness of vaccines, circulation of misinformation and rumours about vaccine composition and potential adverse reactions, lack of trust in the government’s vaccination strategy, and dissatisfaction with the sluggish progress of the vaccination program. For example:

P1-Tweet 34:

*“Vaksin mengandungi bakteria/virus yg dilemahkan” **Maksudnya** [E: Entertain], menyuntik vaksin ke dlm badan bermaksud, menyuntik bakteria/virus! **Mcm mana** [E: Entertain] suntikan bakteria/virus ke dlm badan boleh menjadi imunisasi, sedangkan suntikan tersebut mengandungi bakteria?*

(“Vaccine contains weakened bacteria/virus.” **Meaning** [E: Entertain], injecting the vaccine into the body means injecting bacteria/virus! **How** [E: Entertain] can injecting bacteria/virus into the body be immunization whereas the injection contains bacteria?)

The use of “Entertain” in negative tweets related to COVID-19 vaccination in Malaysia can be seen as a means for users to express “Engagement” with the content and to grab the audience’s attention using a rhetorical question. This can make their negative sentiments more approachable and engaging, thereby attracting more attention and responses from other users. For instance, in P1-Tweet 34, the phrase “*maksudnya*” (meaning) and “*mcm mana*” (how) express a critical and doubtful stance towards the information being presented. The inclusion of “*maksudnya*” (meaning) suggests that the user was trying to engage the audience by providing an explanation or clarification of a statement and highlighting the apparent contradiction or surprise in the information provided about the vaccine contents. Similarly, “*mcm mana*” (how) introduces a rhetorical question, inviting the audience to ponder and consider the apparent paradox in the information presented. By asking “*Mcm mana suntikan bakteria/virus ke dlm badan boleh menjadi imunisasi*” (How can injecting bacteria/virus into the body be immunization), he/she was not seeking a literal answer. This rhetorical question adds a layer of intrigue and provokes the audience to think critically about the information.

Following that, the use of “Entertain” in negative tweets related to COVID-19 vaccination can be observed through phrases that evoke emotion and engagement, such as:

P2-Tweet 52:

When [E: Entertain] I'm reading about vaccination on the news, something triggered my brain. 'Painkiller' jab. :(

In P2-Tweet 52, the word “when” sets up the context for the emotional reaction that follows. The word “when” serves to create a sense of anticipation or suspense, which can be considered a type of entertainment that engages the reader’s attention and draws them into

the speaker's emotional experience. Overall, the use of the "Entertain" word "when" in this tweet helps to create a sense of drama or tension, which can make the message more engaging and memorable for the reader. The negative emotion was emphasized by the word "painkiller" and the sad face emoji.

There are instances where Malaysian Twitter users used language that aims to "Entertain" and engage readers instead of conveying a serious message or argument to express their personal beliefs or opinions that lead them to reject vaccines, for example:

P3-Tweet 145:

We Asians find it difficult to accept change **because** [E: Entertain] our family has lived a healthy life without a vaccine for hundreds of years. We think it is a very logical fact that a vaccine is a for-profit.

In the context of the negative tweet in P3-Tweet 145, the use of "because" reflects the aspect of "Entertain" in the Appraisal Theory. Here, P3-Tweet 145 serves the function of providing a reason or justification. P3-Tweet 145 suggests that the reason behind the reluctance to accept vaccination is the belief that their family has lived a healthy life without vaccines for generations. The use of "because" here "Entertain" or introduces a reason that supports the speaker's viewpoint to engage with the audience. This "Engagement" is an essential aspect of negative tweets to express their opinions, share their concerns, and connect with others who share similar views. Additionally, it allows the users to participate in a larger public discourse on the topic of vaccination and its effectiveness.

To sum up, Malaysian Twitter users often use "Entertain" language in negative tweets about COVID-19 vaccines. This type of "Engagement" was common when they express concerns about vaccine safety, government strategies, and slow progress, and they

sought to use language that makes their negative sentiments more appealing and attract more attention and responses from others. This approach allows users to share their opinions, connect with like-minded people, and participate in a wider discussion about the effectiveness of vaccines.

Attribute

The “Attribute” component of “Engagement” in negative tweets refers to the specific characteristics or qualities of the “Engagement” that individuals were expressing negative sentiments towards to “Entertain” and engage their audience.

Specifically, these tweets often express details of the concerns related to vaccine safety and effectiveness, such as:

P1-Tweet 38:

What if you already had the virus and show immunity? Why would you risk the “vaccine” which **actually** [E: Attribute] isn’t a vaccine at all. Its untested gene therapy.

In the negative tweet shown in P1-Tweet 38, the word “actually” serves as an “Attribute” of “Engagement” to emphasize the speaker’s belief and to challenge the audience’s assumptions about the vaccine. It is used to indicate the speaker’s opinion and to create a sense of contrast between what the speaker believes is the truth and what others may believe. The use of “actually” implies that the speaker is correcting a misconception or

providing a more accurate representation of the situation, creating an “Engagement” with the audience by encouraging them to question their own beliefs and consider the speaker’s perspective. In this case, the speaker is suggesting that the vaccine is not a vaccine at all, but rather an untested form of gene therapy.

Following the vaccine distribution in Malaysia, the Malaysian Twitter user also used “Attribute” of “Engagement” to share details of their own negative experiences as a way to engage the audience, such as:

P2-Tweet 86:

I have [E: Attribute] received this. I don't know where and when this happened! It was a drive-through vaccination centre and can be seen the jab was not pumped at all.

In P2-Tweet 86, the “Attribute” of “Engagement” of Appraisal Theory associated with the phrase “I have” is personalization. Personalization refers to the degree to which an individual perceives an event as relevant to their personal goals and values. In this context, the speaker was emphasizing that they themselves have had a negative experience with the COVID-19 vaccine, which makes the message more personally relevant and engaging to their audience. This personalization is likely to increase the emotional impact of the message and enhance the likelihood that it will be shared and discussed among others who may share similar concerns.

As majority of the Malaysian citizen was *Muslim*, Twitter users employed language related to Islam to express their doubts and scepticism. For example:

P3-Tweet 123:

Halal vaccines involve ensuring the raw materials, production method, production facility etc are *syariah* compliant. **Ada virus** [E: Attribute] (main component of vaccines) they grow *dalam babi untuk dapatkan* the vaccine raw mat in quantity. **Ada guna** [E: Attribute] pork based gelatin as stabilizer.

(Halal vaccines involve ensuring the raw materials, production method, production facility etc are *syariah* compliant. **There are viruses** [E: Attribute] (the main component of vaccines) that are grown in pigs to obtain the vaccine raw material in quantity. **There also use** [E: Attribute] pork-based gelatine as a stabilizer.)

P3-Tweet 123 utilized “Engagement” of “Attribute” of Appraisal Theory through the phrases “*ada virus*” (there are viruses) and “*ada guna*” (there also use) to evoke concern about the use of halal vaccines in Malaysia. These phrases were used to appeal to the readers’ emotions and religious values. The phrase “*ada virus*” was used to emphasize the presence of components in vaccines that are grown in pigs, which are considered unclean in Islamic teachings, while “*ada guna*” highlighted the use of pork-based gelatine as a stabilizer in some vaccines.

In conclusion, negative tweets about COVID-19 vaccination in Malaysia utilize the “Attribute” of “Engagement” to engage their audience. This is achieved by using language that provides details to evoke emotion and draw readers in. The details make their negative sentiments more engaging and attracting more attention and responses from other users. Overall, the “Attribute” of “Engagement” in negative tweets about COVID-19 vaccination in Malaysia can be a powerful tool for expressing dissent and shaping public opinion on this important issue.

Frequency of Engagement in Negative Tweets

This section presents results on the frequency of “Engagement” in negative tweets for “Disclaim”, “Proclaim”, “Entertain”, and “Attribute” for the three phases of the COVID-19 vaccination (Table 4.8).

Table 4.8: Frequency and Percentages of Engagement in Positive Malaysian Tweets

ENGAGEMENT (n=55)		PHASES			Total	Per %
Aspects	Categories	Phase 1	Phase 2	Phase 3		
Disclaim (n=33)	Counter	14	2	1	17	30.9%
	Deny	10	1	5	16	29.0%
Entertain (n=14)		7	2	5	14	25.5%
Attribute (n=5)		1	1	3	5	9.10%
Proclaim (n=3)	Endorse	0	0	2	2	3.6%
	Concur	1	0	0	1	1.8%
	Pronounce	0	0	0	0	0

The analysis of “Engagement” in negative tweets related to COVID-19 vaccination in Malaysia shows that Malaysian Twitter users engaged more in “Disclaim” tweets (n=33), followed by “Entertain” tweets (n=14) and “Proclaim” tweets (n=3). The lowest frequency of engagement was found in “Attribute” tweets (n=0).

“Disclaim” tweets were further categorized into “Deny” (n=16) and “Counter” (n=17). The “Deny” was the most frequent type of “Disclaim” tweets, with the majority of

instances appearing in Phase 1 (n=10), which coincided with the waiting period for the vaccine arrival in Malaysia. During this phase, Malaysian Twitter users expressed their doubts and concerns about the effectiveness and safety of the vaccine. The “Countering” of “Disclaim” tweets was also prevalent, with the majority appearing in Phase 1 (n=14), when there was uncertainty and speculation about the vaccine, leading to a greater need for individuals to provide counter arguments and opposing viewpoints.

Next, “Entertain” tweets were the second most frequent type of “Engagement” tweets, with the majority appearing in Phase 1 (n=7). During this phase, Malaysian Twitter users may have used humour and sarcasm to cope with the uncertainty and anxiety surrounding the vaccine. In Phase 3, “Entertain” tweets remained prevalent (n=5), indicating that individuals may have continued to use social media as a platform to share their humorous experiences related to the vaccine.

There was minimal use of “Attribute” of “Engagement” found in negative tweets, which was more common in Phase 3. This suggests that Malaysian Twitter users were less likely to directly “Attribute” adverse effects to the vaccine in the earlier stages and during the vaccination distribution period. The subtle change in “Engagement” of “Attribute” during Phase 3 suggest that Malaysian Twitter users were more concerned with expressing their questions and blaming the vaccine for undesirable outcomes.

Lastly, the “Proclaim” tweets were the least frequent type of “Engagement”, with only two tweets found in this category. Both tweets were “Endorse” and appeared in Phase 3, which may suggest that Malaysian Twitter users were more willing to express their support for the vaccine as the vaccination program progressed and the benefits of vaccination became more apparent.

Overall, the analysis of “Engagement” in negative tweets related to COVID-19 vaccination in Malaysia suggests that Malaysian Twitter users were actively engaged in expressing their doubts and concerns about the vaccine, reflected in the high frequency of “Disclaim” and “Entertain” tweets.

4.3.3 Neutral Sentiments

The neutral sentiment of Malaysian Twitter users on COVID-19 vaccination refers to tweets that do not express a positive or negative sentiment towards the vaccination process as they simply provide factual information. These tweets express a neutral or ambivalent attitude towards vaccination. Table 4.12 shows that 16.0% of 150 were neutral, with Phase 1 (n=11), Phase 2 (n=6), and Phase 3 (n=7).

The neutral sentiment was more apparent during Phase 1 and Phase 3 as Twitter users were considering a range of factors that might be influencing their sentiments towards the vaccine. During the phase of waiting for the vaccine to arrive in Malaysia, the neutral sentiment could be due to the uncertainty surrounding the vaccine’s arrival and distribution in Malaysia, as well as questions about the efficacy and safety of the vaccine. For example:

P1-Tweet 18:

Vaccine Covid-19... *nak amek ke taknak ehh*

(COVID-19 vaccine... want to take or not *ehh*)

In P1-Tweet 18, the use of ellipsis and colloquial language “*ehh*” suggests that the speaker was pondering whether to take the vaccine or not. Factors considered may include the vaccine efficacy and safety, personal beliefs or values, or concerns about side effects or access to the vaccine.

Following that, the Malaysian Twitter users also often expressed neutral sentiment when looking for more information on the vaccination. For example:

P1-Tweet 14:

Wajibul ghunnah ke ambil vaccine tu?

(Is it compulsory to take the vaccine?)

P1-Tweet 14 implies that he/she was questioning the vaccine's necessity or ramifications from a religious or personal standpoint, rather than expressing strong positive or negative feelings about it. The phrase "*Wajibul ghunnah*" is an Arabic term that translates to "obligatory sin" in English and is frequently used to refer to evil or forbidden behaviors in Islam. However, this term in P1-Tweet 14 was coded as expressing neutral sentiment because it appeared in the context of a question on whether the COVID-19 vaccination was required or not. The inclusion of a question mark at the end of the phrase suggests that no stance was taken.

During the implementation of the booster dose in Malaysia (Phase 3), the neutral sentiment could be due to a number of factors, including mixed messages about the need for boosters, concerns about the effectiveness of the vaccine against new variants, and uncertainty about the timing and availability of the booster dose. The use of colloquial language in P3-Tweet 141 such as "*nak tanya*" (I want to ask) and "*ghisauuu*" (worried) suggests that mild concern or uncertainty about the vaccine. P3-Tweet 141 questioned whether it was okay to receive mixed vaccine shot. This shows that the user was seeking clarification or information about vaccine protocols.

Additionally, the use of a question and the lack of any overtly positive or negative comments shows the neutral tone of the statement. For example:

P3-Tweet 141:

Aku nak tanya, takpe ke 1st n 2nd vaksin sinovac. Tetibe booster Pfizer? Ghisauuu aku ttbe jadi zombie plak nt.

(I want to ask, is it okay for the 1st and 2nd sinovac vaccines? Suddenly Pfizer for booster? Worried I will become a zombie.)

Finally, tweets with neutral sentiment had factual information when Twitter users tried to educate others about the vaccine. For example:

P3- Tweet 126:

Vaccine alone don't prevent the spread of infections. Combining them with other measures/SOPs do i.e ventilation, mask usage, avoid crowd, TRIIS, reduce risk factors (for those have other disease), boosters vax, etc)

P3-Tweet 126 emphasizes the importance of combining vaccines with other measures to control the spread of COVID-19. Technical phrases like “TRIIS” were used to show that he/she was knowledgeable about the issue and may be giving advice to other users. P3-Tweet 126 urged other Twitter users to follow and maintain SOP such as avoiding crowded situations, maintaining a physical distance, washing their hands, and wearing a mask as a strategy to boost protection against the deadly virus. The Malaysian government has emphasized this information. The Health Director General Tan Sri Dr Noor Hisham Abdullah stated that it is important to monitor the vaccine efficacy because they do not render the body immune to the virus but rather serve as a preventative measure against its spread (The Malaysian Reserve, 2023). The appraisal aspects of the neutral sentiments are described next.

a) Appraisal Aspects of Neutral Sentiments

This section describes results on the appraisal aspects of “Attitude”, “Graduation”, and “Engagement” in neutral tweets on the COVID-19 vaccination.

i. Attitude in Neutral Tweets

This section describes how the attitude in neutral tweets are expressed in the form of “Affect”, “Judgement”, and “Appreciation”.

Affect

The “Affect” of “Attitude” in neutral tweets related to COVID-19 vaccination refers to the evaluative aspect of the tweets towards the vaccination process. In neutral tweets, minimal use of “Affect” was found, that is, only one tweet during Phase 1, and no tweets found for Phase 2 and Phase 3.

During the waiting period of vaccine arrival, the highly contagious Delta and Beta variants of COVID-19 began to spread, thereby bringing the pandemic to a perilous level. Following that, the news on lower effectiveness rate of AstraZeneca vaccine against this variant raised concern among Malaysian Twitter users and the usage of “Affect” has been found. For example:

P1-Tweet 39:

AstraZeneca-Oxford vaccine cannot protect patients with this type of variant. We **hope** [A: Affect: Positive] that such variant will not appear in Malaysia.

P1-Tweet 39 expresses concern about the negative situation. The word “hope” denotes positive “Affect”. The AstraZeneca is believed to be not effective for the Beta variant (also known as the B.1.351 variant), which was first identified in South Africa. Despite the negative news about the vaccine’s effectiveness, P1-Tweet 39 was optimistic and expressed a hopeful outlook for the situation in Malaysia. The usage of positive “Affect” in the negative situation as shown in P1-Tweet 39 reflects. The Twitter user was aware of the challenges posed by the new variants but still desired a positive outcome in the context of the pandemic.

In conclusion, the analysis of “Affect” in neutral tweets related to COVID-19 vaccination reveals a balance of positive and negative viewpoint to maintain the neutral tone. The usage of positive “Affect” reflects a positive outlook in the negative situation.

Judgement

The analysis showed that there were no neutral tweets in the category of “Judgement” for “Attitude”. The Malaysian Twitter users often conveyed their “Judgement” of “Attitude” using emotion-related words.

Appreciation

The Malaysian Twitter users mostly expressed positive “Appreciation” compared to negative “Appreciation” to talk about vaccination.

As the public was waiting for the announcement of the vaccine arrival, the news on the government’s decision to use the Chinese-produced vaccine, Sinovac caused concern as

Sinovac was still not approved by National Pharmaceutical Regulatory Agency (NPRA). For example:

P1-Tweet 22:

*Sinovac masih belum dilesen NPRA. Pfizer dilesen di 60 negara termasuk Msia. **Keberkesanan** [A: Appreciation: Positive] Sinovac 50-91%. Pfizer-95%. Pfizer-diterbit di jurnal Sinovac-tiada terbitan. Pfizer-**Selamat** [A: Appreciation: Positive] & Halalan Tayyiban.*

(Sinovac is still not licensed by NPRA. Pfizer is licensed in 60 countries including Malaysia. The **effectiveness** [A: Appreciation: Positive] of Sinovac is 50-91%. Pfizer is 95%. Pfizer has been published in journals, while Sinovac has not. Pfizer is **safe** [A: Appreciation: Positive] and halal.)

In P1-Tweet 22, there were two “Appreciation” words: “*keberkesanan* (effectiveness)” and “*selamat* (safe)”. These words highlighted the positive aspects of the Pfizer vaccine. The word “effectiveness” highlighted the positive value of Pfizer’s vaccine, praising its 95% effectiveness, while “safe” strengthened the argument on Pfizer’s safety. Although positive portrayal was made towards Pfizer vaccine, P1-Tweet 22 contains a negative portrayal of the Sinovac vaccine by bringing up the lack of NPRA licensure, lower effectiveness. Neutrality is maintained in P1-Tweet 22 through a combination of positive and negative portrayal. The information given was factual for both vaccine types.

In conclusion, the “Appreciation” aspect of “Attitude” in neutral tweets was mostly positive. No negative “Appreciation” was identified. The usage of positive “Appreciation” was to highlight a positive and encouraging tone in neutral tweets in the face of doubts about the COVID-19 vaccine.

Frequency of Attitude in Neutral Tweets

Table 4.9 presents the frequency of “Attitude” in neutral tweets for “Affect”, “Judgement”, and “Appreciation”. There were only four neutral tweets in the “Attitude” category: “Appreciation” (n=3) and positive “Affect” (n=1).

Table 4.9: Frequency and Percentages of Attitude in Neutral Malaysian Tweets

ATTITUDE (n=4)		PHASES			Total	Per %
Aspects	Categories	Phase 1	Phase 2	Phase 3		
Appreciation (n=3)	Positive	2	0	1	3	75.0%
	Negative	0	0	0	0	0.0%
Affect (n=1)	Positive	1	0	0	1	25.0%
	Negative	0	0	0	0	0.0%
Judgement (n=0)	Negative	0	0	0	0	0.0%
	Positive	0	0	0	0	0.0%

During Phase 1, positive “Appreciation” was more prevalent indicating that the Malaysian Twitter users were optimistic towards the COVID-19 vaccination and waiting for the vaccine to arrive. The positive “Appreciation” started to increase in Phase 3 as the Malaysian Twitter users. Positive “Appreciation” in the neutral tweets conveys favourable views on COVID-19 vaccination. This approach as one of the ways for Malaysian Twitter users to maintain a balanced and informative discourse.

The single tweet with positive “Affect” during Phase 1 shows hopeful anticipation that the vaccine would help Malaysia in the ongoing battle against COVID-19.

In conclusion, there were only four neutral tweets in the “Attitudes” category, showing that Malaysian Twitter users were generally cautious yet optimistic about the COVID-19 vaccination. This cautious optimism highlights awareness of the importance of vaccination while also acknowledging the uncertainties and challenges of the ongoing pandemic.

ii. Graduation in Neutral Tweets

This section describes the results on “Graduation” in neutral tweets related to COVID-19 vaccination for “Force” and “Focus”.

Force

The usage of “Force” of “Graduation” in neutral tweets consist of tweets that expressed a sense of urgency or importance regarding the need for vaccination. The analysis showed that there was more “Quantification” of “Force” than “Intensification” of “Force”. This shows emphasis on the numerical aspects of the situation. For example, they might be providing statistics or figures related to vaccination rates, or the percentage of the population that has been vaccinated, such as:

P1-Tweet 23:

True. Even with vaccine is expected to be available by end of Q1 but is going to take **at least** [G: Force: Quantification] a year to cover **more than half** [G: Force: Quantification] of the population.

The “Force” of “Quantification” in P1-Tweet 23 shows certainty regarding the timeline of the COVID-19 vaccination. The phrase “at least” indicates a minimum time frame, implying that it might take even longer than a year to vaccinate more than half of the population. The words “more than half” is a quantitative estimate of the proportion of the population that needs to be vaccinated to achieve herd immunity.

Following that, Malaysian Twitter users also often conveyed “Intensification” of “Force” to provide a stronger and more emphatic evaluation of a particular event or situation. For example:

P2-Tweet 53:

If I understand **correctly** [G: Force: Intensification]: - Sinovac produce vaccine & Pharmaniaga process & put into vials **locally** [G: Force: Intensification].

In P2-Tweet 53, the words “correctly” and “locally” emphasize the importance of the information. The word “correctly” intensifies the “Force” of the confidence in the accuracy of the statement. Similarly, the word “locally” intensifies the “Force” of the production process. The “Intensification” of “Force” highlights the potential risks associated with the local production of the vaccine.

Sometimes both “Quantification” of “Force” and “Intensification” of “Force” appear in a neutral tweet on COVID-19 vaccination, as shown in P1-Tweet 39.

P1-Tweet 39:

Covid-19 virus mutates. There are **many** [G: Force: Quantification] variants. **Some** [G: Force: Quantification] such as South African variant are **more contagious** [G: Force: Intensification].

P1-Tweet 39 used words such as “many”, “some” and “more” to emphasize the information. The words “many” and “some” are examples of the “Force” of “Quantification” which quantifies the number of variants that exist due to the virus mutation. On the other hand, the word “more” describes the adjective “contagious”. This is an example of the “Force” of “Intensification” that allows for a more precise appraisal of the South African variant, rather than making a generalization that all variants are equally contagious.

In summary, Malaysian Twitter users used both “Quantification” and “Intensification” of “Force”. The prevalence of “Quantification” emphasizes statistical aspects, such as vaccination rates and population coverage, reflecting a data-driven perspective. Meanwhile, the “Intensification” was to draw attention to key points in a factual and objective manner.

Focus

The “Focus” of neutral tweets refers to the specific aspect of the vaccination process that the tweet was centred around. For example:

P1-Tweet 42:

YB @Khairykj can we have **crystal clear policy** [G: Focus: Sharpen] on the vaccination process and after-effects? *Negara jiran* [G: Focus: Soften] *dah perjelaskan hak / pampasan kpd rakyat yg ambil #COVID19 vaccines*. Please clarify.

(YB @Khairykj can we have **crystal clear policy** [G: Focus: Sharpen] on the vaccination process and after-effects? **Neighbouring countries** [G: Focus: Soften] have explained the rights / compensation to citizens who have taken #COVID19 vaccines. Please clarify.)

P1-Tweet 42 employs both “Sharpen” and “Soften” of “Focus” to voice the opinions as well as seeking information from the government about the policy regarding COVID-19 vaccination. The phrase “crystal clear policy” is an example Sharpening of “Focus” as it narrows down the evaluation to a specific aspect of the vaccination process. On the other hand, he/she “Soften” the “Focus” when mentioning “*negara jiran*” (neighbouring countries) by broadening the evaluation. More general or less specific information were added on the policies and practices of neighbouring countries. The “Soften” of “Focus” invites a broader perspective on the issue and encourages the audience to consider alternative viewpoints.

In conclusion, the use of “Focus” in the neutral tweets reflects a desire for clarity, frustrations, urgency, and diverse perspectives.

Frequency of Graduation in Neutral Tweets

Table 4.10 shows the frequency of “Graduation” on “Force” and “Focus” in neutral tweets. There were 17 neutral tweets in the graduation category.

Table 4.10: Frequency and Percentages of Graduation in Neutral Malaysian Tweets

GRADUATION (n=17)		PHASES			Total	Per %
Aspects	Categories	Phase 1	Phase 2	Phase 3		
Focus (n=9)	Sharpen	3	0	3	6	35.4%
	Soften	3	0	0	3	17.6%

Table 4.10 continued

Force (n=8)	Intensification	3	1	1	5	29.4%
	Quantification	2	0	1	3	17.6%

In Phase 1, there was a balance in the frequency of “Sharpen” (n=3) and “Soften” (n=3) of “Focus”, and “Intensification” of “Force” (n=3). The tweets expressed the intensity of evaluation and specific details about certain aspects of the vaccination process. During Phase 1, the vaccination rollout was still in its early stages and there may have been more focus on expressing specific details and intensity of evaluations.

In Phase 2, there was only one tweet with “Intensification” of “Force” and none for “Quantification”, “Sharpen” and “Soften”. This indicates there was a shift towards expressing a more generalized evaluation of the vaccination experience with less specific details. The emergence of new variants and changes in vaccination guidelines may have affected users’ perspectives and led to changes in their views.

In Phase 3, there was a return to specific details and intensity of evaluation: “Sharpen” of “Focus” (n=3) and “Quantification” of “Force” (n=1).

Overall, the usage of “Graduation” in neutral tweets can provide subtle shades of meaning and emphasis for a comprehensive and nuanced expression of attitudes and evaluations, even when the sentiment expressed in the tweet is neutral.

iii. Engagement in Neutral Tweets

This section describes the results on “Engagement” in neutral tweets show that “Disclaim”, “Proclaim”, “Entertain” and the “Attribution” were distributed across the three vaccination phases.

Disclaim

“Engagement” with other Twitter users was disclaimed to avoid an emotional response or bias towards a particular viewpoint.

“Disclaim” is sub-divided into “Deny” and “Counter”. In P1-Tweet 5, the “Disclaim” words is the act of distancing themselves from a specific viewpoint.

P1-Tweet 5:

Aku takde masalah [E: Disclaim: Deny] *nak berbincang dgn warga ig isu vaccine, tp* [E: Disclaim: Counter] *once die reply “WHO ni milik yahudi dan sebenarnya kes dkt msia tk banyak* [E: Disclaim: Deny] *and huge figure just for media purposes” aku malas nk argue.*

(I have **no problem** [E: Disclaim: Deny] to discuss with the Instagram users about the vaccine issue, **but** [E: Disclaim: Counter] once they reply “WHO belongs to Jewish and actually there are **not many** [E: Disclaim: Deny] cases in Malaysia and huge figure just for media purposes” I’m lazy to argue.)

“Disclaim” words used P1-Tweet 5 were “*takde masalah*”, “*tp*” and “*tk banyak*”. The phrase “*takde masalah*” (no problem) is used as a “Disclaim: Deny”, meaning that he/she did not have any issues talking to people about the vaccine issue. Similarly, the phrase “*tk banyak*” (not many) suggested that the number of cases related to the vaccine issue in

Malaysia is not significant. In addition to these denials, P1-Tweet 5 also used “Disclaim: Counter” in the form of “*tp*” (but) to shift the focus of the tweet and acknowledge the opposing viewpoint without necessarily agreeing with it or adopting a specific emotional tone.

In conclusion, the use of “Disclaim” allows for a more objective and neutral presentation of information, allowing readers to form their own opinions based on the presented information rather than being influenced by emotional language or bias. The use of these “Disclaim” words enables the authors to maintain credibility and impartiality in their tweets and express different perspectives, opinions, and emotions related to a specific topic or issue.

Proclaim

Tweets in the category “Proclaim” under “Engagement” are more likely to elicit “Engagement” are those that present information that is novel, surprising, or practically useful to other users. For example:

P1-Tweet 23:

True [E: Proclaim: Concur]. Even with vaccine is expected to be available by end of Q1 but is going to take at least a year to cover more than half of the population.

In P1-Tweet 23, the word “true” shows the use of the “Proclaim” of “Concur”, indicating agreement with the preceding statement and expressing the speaker’s belief in its accuracy. P1-Tweet 23 supported the notion that vaccinating over half of the population would take at least a year, despite the COVID-19 vaccine’s anticipated availability by the end of Q1 of 2021. The use of “Proclaim: Concur” signals their support for ideas.

In conclusion, the use of “Proclaim” play a crucial role in fostering interaction by affirming or asserting specific viewpoints. It is also used to signal the speaker’s agreement of a particular idea, contributing to the richness and diversity of conversations on various topics.

Entertain

Neutral tweets related to COVID-19 vaccination by Malaysian Twitter users in the “Entertain” category of “Engagement” capture attention and encourage them to engage with the topic.

These tweets posed questions or challenges related to vaccination, share personal stories or anecdotes, or use humour or satire to discuss vaccine-related concerns. For example, P1-Tweet 50 used humor in his/her tweet to make the discussion more amusing.

P1-Tweet 50:

Kalau [E: Entertain] *apply utk vaccination programme tu. Bleh pilih ke nk brand Pfizer je. Hahahaha*

(**If** [E: Entertain] *apply for that vaccination programme. Can choose whether want to get Pfizer brand only? Hahahaha.*)

The “Entertain” word of “*kalau*” (if) in P1-Tweet 50 introduced the hypothetical situation while inserting satire in the message about being able to choose only the Pfizer brand of vaccine in a vaccination program. The tweet aimed to foster discussion and interaction with other users using a question.

In conclusion, neutral sentiment tweets related to COVID-19 vaccination by Malaysian Twitter users that include the “Entertain” element of “Engagement” aim to

encourage discussion around the topic of vaccination. These tweets use elements such as rhetorical questions, personal anecdotes, humor, and analogies to make the topic more approachable and relatable to other users, inviting them to participate in the conversation.

Attribute

Neutral tweets with the “Attribute” category of “Engagement” acknowledge or distance themselves from the topic without taking a clear stance. For example:

P2-Tweet 62:

935,865 individuals completed two-dose vaccination up to May 25, **says Dr Adham**
[E: Attribute].

P2-Tweet 62 conveyed a message from Dr. Adham, a Malaysian government official, regarding the efficacy and safety of different types of COVID-19 vaccines approved by the Ministry of Health. The “Attribute” words are “says Dr Adham”, showing the source of the information. “Attribute” words give credibility to the information stated in the tweet.

In conclusion, the use of the “Attribute” of “Engagement” in neutral tweets about COVID-19 vaccination by Malaysian Twitter users serves to acknowledge or distance individuals from the topic without taking a definitive stance. These tweets often present factual information or relay news-related content, utilizing attributions to sources like government officials or governing bodies.

Frequency of Engagement in Neutral Tweets

Table 4.11 presented the frequency and percentages of “Engagement” aspects in neutral tweets, that is, “Entertain”, “Disclaim”, “Attribute” and “Proclaim”, There were 45 tweets with “Engagement” words.

Table 4.11: Frequency and Percentages of Engagement in Neutral Malaysian Tweets

ENGAGEMENT (n=45)		PHASES			Total	Per %
Aspects	Categories	Phase 1	Phase 2	Phase 3		
Entertain (n=18)		9	4	5	18	40.0
Disclaim (n=16)	Deny	5	0	5	10	22.2
	Counter	5	0	1	6	13.3
Attribute (n=6)		2	2	2	6	13.3
Proclaim (n=5)	Endorse	0	3	0	3	6.8
	Concur	1	0	0	1	2.2
	Pronounce	0	0	1	1	2.2

The analysis of “Engagement” in the neutral tweets shows that Malaysian Twitter users expressed more “Entertain” (n=18) and “Disclaim” (n=16) compared to “Attribute” (n=6) and “Proclaim” (n=5) across all three phases of the study.

For “Disclaim”, Malaysian Twitter users mostly “Deny” (n=10) the claims made in the tweets, particularly in Phase 1 (n=5) and Phase 3 (n=5). This suggests that Malaysian

Twitter users were more sceptical towards the information shared about COVID-19 vaccination in the later phase of the study. On the other hand, some tweets “Counter” (n=6) claims made by others throughout the three phases of vaccination. This could be responses to misinformation and fake news circulating on social media during the pandemic, causing users to question and refute unverified claims.

In terms of “Proclaim”, Malaysian Twitter users mostly “Endorse” (n=3) the information shared about COVID-19 vaccination effort. This indicates that while there were some positive opinions shared by users, it was not as prevalent as the sceptical and questioning attitude seen in “Disclaim” tweets.

For “Entertain”, it was found in all the three phases with the highest number was in Phase 1 (n=9). The high use of “Entertain” during Phase 1 reflects an openness to different perspectives and a willingness to consider alternative viewpoints, as individuals sought to understand and navigate the evolving situation.

Malaysian Twitter users sometimes quoted information or opinion sources the vaccination effort to various individuals and organisations. Table 4.11 shows some use of “Attribute” (n=6) words.

In conclusion, the patterns suggest that Malaysian Twitter users were more sceptical and questioning towards the information shared about COVID-19 vaccination, with a higher frequency of “Disclaim” and lower frequency of “Proclaim” tweets. The consistent use of “Entertain” indicates an openness to diverse perspectives and a willingness to consider various possibilities, enriching the discourse surrounding vaccination efforts.

4.3.4 Frequency of Sentiment Categories Expressed by Malaysian Twitter Users

In this section, the quantitative measure of analysis on the frequency of sentiment categories such as positive, negative and neutral sentiment expressed by Malaysian Twitter users in relation to COVID-19 vaccination were explained. The frequency and percentages of sentiments in tweets during the three phases of COVID-19 disease spread and control are shown in Table 4.12.

Table 4.12: Frequency and Percentages of Sentiments in Tweets during the Three Phases of COVID-19 Vaccination

n=150					
Sentiment categories	Phases			Total	Per %
	Phase 1	Phase 2	Phase 3		
Positive	26	35	30	91	60.7%
Negative	13	9	13	35	23.3%
Neutral	11	6	7	24	16.0%

The analysis of sentiment categories of tweets posted on COVID-19 vaccination shows that most of the Malaysian Twitter users have a positive view on COVID-19 vaccination. Positive sentiment was the most frequently expressed sentiment category (n=90) in all the three phases (Phase 1, n=26; Phase 2, n=35; Phase 3, n=30). The dominance of positive sentiment indicates that the general public of Malaysian Twitter users were supportive of the COVID-19 vaccination efforts in Malaysia. Positive sentiment was the highest during vaccine distribution phase (Phase 2) because the public saw the vaccination

being rolled out to a wider group of people, including those who are at high risk of contracting the virus. In addition, the positive sentiments also have been contributed by the active promotion and encouragement made by the Malaysian Twitter users to influence others in the vaccination campaign.

Negative sentiment, on the other hand, was expressed at a moderate frequency during all the three phases (Phase 1, n=13; Phase 2, n=9; Phase 3, n=13), with the highest frequency during the period of waiting for the announcement on the vaccine arrival (Phase 1). This might be due to uncertainty and anxiety that has been caused as the public were waiting to hear about the availability of vaccines. The increased number of negative tweets in Phase 3 (n=13) also might be the result from the public that started to question the effectiveness of the vaccines as another shot was required. In addition, the misinformation on the vaccines has been frequently spread by the anti-vaccination group during Phase 1 and Phase 3 which might influenced the public's views on the vaccination effort.

Conversely, the neutral sentiment was expressed the least during all the three phases (Phase 1, n=11; Phase 2, n=6; Phase 3, n=7). However, the frequency of neutral sentiment mirrored the negative sentiment, with neutral expressions being particularly common during Phases 1 and 3. This suggests that despite the high levels of misinformation spread by anti-vaccination groups during Phase 1 and Phase 3, there were individuals who maintained a neutral stance towards the issues. This also suggest that the Malaysian Twitter users possibly signifying a need to seek more information before forming a definitive opinion.

In conclusion, Malaysian Twitter users' views on COVID-19 vaccination reveals a generally positive viewpoint throughout all three phases, with a slight negative sentiment due to underlying doubts and uncertainty among the public. Despite the negativity, some of the public remained a neutral stance due to information-seeking nature. The findings

highlight the complex dynamics of public opinion and the necessity of continuous education to promote trust in vaccination efforts in the future.

4.3.5 Frequency of Appraisal Aspects Expressed by Malaysian Twitter Users

This section describes the results on the frequency of appraisal aspects expressed by Malaysian Twitter users in their tweets related to COVID-19 vaccination. The Appraisal Theory is used to evaluate the emotions and attitudes expressed in the tweets. Table 4.13 shows the frequency of appraisal aspects in tweets during the three phases of COVID-19 vaccination. The selected data has been analysed through Appraisal Theory by Martin and White (2005), divided into three aspects, “Attitude”, “Engagement” and “Graduation”.

Table 4.13: Frequency of Appraisal Aspects in Tweets during the Three Phases of COVID-19 Vaccination

n=490							
Appraisals	Aspects		Phase 1	Phase 2	Phase 3	Total	Per %
Engagement (n= 223)	Entertain		26	25	36	87	17.8%
	Disclaim	Deny	22	17	26	65	13.3%
		Counter	22	11	11	44	8.9%
	Attribute		4	5	7	16	3.3%
	Proclaim	Concur	2	3	1	6	1.2%
		Pronounce	1	1	1	3	0.6%

Table 4.13 continued

		Endorse	0	0	2	2	0.4%
Attitude (n= 139)	Appreciation	Positive	25	12	20	57	11.6%
		Negative	3	2	4	9	1.8%
	Affect	Positive	6	7	8	21	4.3%
		Negative	4	5	8	17	3.5%
	Judgement	Negative	6	4	8	18	3.7%
		Positive	2	7	8	17	3.5%
Graduation (n= 128)	Force	Quantification	15	13	24	52	10.6%
		Intensification	10	5	5	20	4.1%
	Focus	Sharpen	14	12	12	38	7.8%
		Soften	7	4	7	18	3.7%

The analysis shows that these appraisal aspects are expressed in varying frequencies in the tweets. The appraisal aspect of “Engagement” (n=223) was the highest compared to “Attitude” (n=139) and “Graduation” (n=128). The high of “Engagement” shows that the Malaysian Twitter users were paying more attention to the evaluation of events and situations, rather than expressing their own opinions or focusing on the level of intensity or focus on their language.

The frequency of the appraisal aspect of “Attitude” (n=139) shows more data compared to “Graduation” (n=128) indicating a strong emotional response towards the topic.

The “Attitude” in Appraisal Theory refers to the evaluative stance that individuals take towards something, whether it is positive or negative. Therefore, the low frequency of “Attitude” in these discussions suggests that Twitter users have an overall muted emotional reaction towards the vaccine, neither strongly in support nor in opposition.

On the other hand, less frequent use of “Graduation” (n=128) in these discussions reflects that Malaysian Twitter users were not focusing as much on the specific details and nuances of the topic, suggesting that they were not as concerned with the specific details or were not expressing nuanced evaluations of the vaccine.

In conclusion, the analysis reveals that Malaysian Twitter users primarily engage in evaluating events and situations, with less emphasis on expressing strong emotional reactions or delving into nuanced details. This suggests a balanced, measured approach in discussing the topic of vaccination.

4.4 Discussion

This section highlights three key findings for the discussion in relation to the literature and the context of Malaysian Twitter users’ sentiment on COVID-19 vaccination. The result was based on the analysis on 150 tweets of Malaysian Twitter users.

Firstly, the Thematic Analysis revealed that Twitter messages related to COVID-19 vaccination in Malaysia can be categorized under three main themes, which are Vaccine Administration (Theme 1), Impact of Vaccine (Theme 2) and Vaccination and COVID-19 Control (Theme 3) that were divided into 17 sub-themes reflecting the interest and concerns of Malaysian Twitter users during the study period. Based on the analysis, there were some changing patterns of the discussion on Twitter throughout the different phases showing the

public interest changed depended on the important events that occurred. For example, the discussion related to “doubts on vaccination” was more frequent during the phase of waiting for the vaccine arrival (Phase 1) and the phase of implementation of booster dose (Phase 3). In Phase 1, there was uncertainty and anticipation of the vaccine’s arrival, leading to doubts and questions about its safety and efficacy. In Phase 3, there was a need for a booster dose, which raised concerns about the effectiveness and safety of receiving an additional shot. Additionally, the spread of misinformation regarding vaccines, particularly on social media, could have also contributed to the doubts and concerns discussed among Malaysian Twitter users. This finding supports Funk and Tyson’s (2021) findings that effectiveness and side effects were the main factors affecting decision to be vaccinated. In addition, similar patterns of sentiments and topics also found in another research using natural language processing and deep learning techniques on Facebook and Twitter posts (Hussain et al., 2021) showing that the patterns are similar across social media platforms.

Secondly, the analysis of emotional response based on Appraisal Theory in Malaysian Twitter users’ sentiment on COVID-19 vaccination showed more positive than negative responses. Positive appraisals of the vaccine, such as perceiving it as a way to protect oneself and others from COVID-19, were associated with more positive sentiments towards the vaccine, while negative appraisals, such as concerns about side effects and efficacy, were associated with more negative sentiments. Moreover, the Appraisal Theory suggests that people can change their appraisals of a situation through cognitive reappraisal techniques, such as changing their focus of attention or reframing the situation in a more positive light. This suggests that interventions that help people reappraise the benefits of COVID-19 vaccination may help to increase vaccine acceptance and uptake among Malaysian Twitter users.

The current findings supported the studies that have examined the role of Appraisal Theory in the context of health behaviours, including COVID-19 vaccination. Wong et al. (2021) found that positive appraisals of the vaccine's benefits, such as protection from COVID-19, were positively associated with vaccine acceptance, while negative appraisals, such as concerns about side effects, were negatively associated with vaccine acceptance among healthcare workers in Malaysia. Wong et al. (2021) also reported that negative appraisals of the vaccine, including concerns about safety and efficacy, were associated with vaccine hesitancy among healthcare workers. These findings are consistent with the Appraisal Theory, which suggests that people's emotional responses and subsequent behaviour are influenced by their cognitive evaluations of a situation.

Lastly, the sentiment categories shows that the Malaysian Twitter users' discussion toward COVID-19 vaccination became more positive over time, reflecting good perception and attitudes displayed around COVID-19 vaccination progress. It is worth noting that the positive trend in sentiment categories towards COVID-19 vaccination among Malaysian Twitter users is consistent with the findings of previous studies conducted in Malaysia. For instance, Nor et al. (2020) reported that the Malaysian population had good knowledge, attitudes, and practices towards COVID-19 prevention measures, while Elnaem et al. (2021) found that Malaysians had a positive perception towards the COVID-19 vaccine. Similarly, Hassim et al. (2021) highlighted that the Malaysian population had a high level of vaccine acceptance and willingness to be vaccinated against COVID-19. These studies employed questionnaires and the findings of the present study obtained from analysis of naturally occurring data in Twitter confirmed these findings obtained using a different data collection technique.

This consistency in findings across different studies highlights the positive attitude and perception among Malaysians towards COVID-19 vaccination. It suggests that the positive sentiment observed in the sentiment categories analysis is not just limited to Twitter users but is reflective of the overall public opinion towards COVID-19 vaccination in Malaysia. Moreover, this positive perception towards COVID-19 vaccination is crucial in ensuring the success of vaccination programs in the country, as it promotes vaccine uptake and reduces vaccine hesitancy among the public.

CHAPTER 5

CONCLUSION

5.1 Introduction

Chapter 5 includes a summary, implications of findings, recommendations for future research and conclusion.

5.2 Summary

The current study aims to investigate the sentiments expressed by Malaysian Twitter users related to COVID-19 vaccination during the different phases of disease spread and control. The specific objectives examined in this study are:

- (1) To identify themes on COVID-19 vaccination that were discussed in tweets; and
- (1) To identify the patterns of sentiments on COVID-19 based on the Appraisal Theory.

This descriptive study has made use of three analysis frameworks to analyse the views expressed by Malaysian Twitter users, which are: (1) the analysis framework of bottom-up Thematic Analysis (Braun & Clarke, 2006) to identify the common themes and sub-themes, (2) the sentiment categories proposed by Nuzhath et al. (2021) to identify the attitude expressed, and (3) the Appraisal Theory (Martin & White, 2005) to identify the sentiments expressed by Malaysian Twitter users. The data were categorised according to the phases of the disease spread and control in Malaysia. Phase 1 from January 1, 2021, to February 23, 2021, is the phase when vaccine was still unavailable and Malaysians were waiting for the arrival of the first vaccine shot. Phase 2 from February 24, 2021, to September 24, 2021, is the phase when Malaysians receive their first and second doses of vaccination.

Phase 3 from September 25, 2021, to December 31, 2021, is the phase when Malaysians experienced loosening of restrictions and received their booster shots. The tweets from Malaysia were collected through the third-party app connected to Twitter API, known as TweetDeck using the keyword search on vaccines related keywords. In total 150 tweets (5200 words) were systematically selected for analysis out of 5,766 tweets (199,900 words).

The results for objective 1 of the study shows that there are three main themes and 17 sub-themes. The three main themes are interest and concerns of Malaysian Twitter users during this period on the “Vaccine administration”, “Impact of vaccination”, and “Vaccination and the COVID-19 control”. Analysis based on the three phases of disease spread and control in Malaysia showed that before COVID-19 vaccination began in Malaysia (Phase 1), the Malaysian Twitter users frequently criticised the vaccine administration in Malaysia while comparing it to other country that began the vaccination earlier. In Phase 1, the prevalence of themes related to “anti-vaccination views” was notably higher compared to the subsequent phases, indicating that Malaysian Twitter users received less information and were frequently swayed by negative rumors regarding vaccination. On the other hand, when vaccine distribution was underway in Malaysia (Phase 2), there was balance in positive and negative views from Malaysian Twitter users. Some criticized the slow progress of vaccine distribution to the public, while others voiced their suggestions on how to handle the vaccination in more appropriate ways. During the phase of booster dose administration (Phase 3), the public started to focus more on the travel and health precautionary restrictions that were implemented along with COVID-19 vaccination. There was also an increase in the number of tweets that “refute anti-vaccination view” showing that the Twitter community has a self-corrective mechanism to handle dissemination of misleading information on COVID-19 vaccination. The better-informed Twitter users gave

legitimate information on the vaccination process during Phase 2 and Phase 3 and helped to educate other Malaysian Twitter users.

Overall, it can be concluded that the discussion on Twitter was primarily centred around the vaccine and its administration. There were also discussions about other COVID-19 control measures in conjunction with the vaccine to reduce the spread of the virus. However, these discussions were less frequent compared to those related to the vaccine. The Malaysian Twitter users also showed a good understanding of COVID-19 prevention measures and were receptive towards COVID-19 vaccination. In addition, the analysis revealed that Malaysian Twitter users were interested in the logistics of the vaccine rollout, including the availability of the vaccines and the vaccination process. This indicates an eagerness to be informed about what was happening in the country about the vaccine rollout.

Moreover, the results for objective 2 of the study on the patterns of the sentiment in sentiment categories were based on the codebook adapted from Nuzhath et al. (2021). Overall, the analysis found that the positive sentiments (52.0%) dominated the overall sentiment categories followed by neutral sentiments (31.3%) and negative sentiments (16.7%) towards the vaccination efforts in Malaysia. The highest frequency of positive tweets was observed during Phase 2, when the vaccine distribution was taking place. The public saw the vaccination being rolled out to a wider group of people. Conversely, there were the fewest tweets with negative sentiments throughout the three phases, indicating that a minimal number of users opposed the idea of vaccination. There was a moderate proportion of neutral tweets during each phase. This suggests that Twitter users only shared factual information about the vaccination process without expressing any strong opinion or emotions towards it. These results show that although tweets with positive sentiments were far more frequent than tweets with negative sentiments, but it is the negative sentiments

which get blown out of proportion and attract the attention of the social media community. The combination of sentiments portrayed suggests a generally supportive attitude towards vaccination among Malaysian Twitter users, with some room for continued education and engagement efforts to address any remaining concerns or misconceptions.

Additionally, the analysis of emotional response using the Appraisal Theory (Martin & White, 2005) showed that the highest usage of appraisal aspects was Engagement (51.0%; n=330) was the most frequent, followed by Attitude (26.1%; n=169), and Graduation (22.9%; n=148). During Phase 1 and Phase 3, there was frequent “Engagement” with the COVID-19 issue in the form of frustration, anxiety, or scepticism about the vaccine rollout process. Malaysian Twitter users also were more likely to share and participate in conversations on COVID-19 vaccination, which can help increase awareness and promote vaccination efforts. During Phase 2, tweets with “Attitude” were frequent, indicating that personal feelings, beliefs, and opinions towards the vaccine are important factors in their decision-making process. Malaysian Twitter also expressed their concerns about the safety and efficacy of the vaccines and shared misinformation or conspiracy theories. “Graduation” was the least used, indicating that Malaysian Twitter users were prioritizing public health benefits of vaccination over individual benefits.

The analysis suggest that the Malaysian Twitter users had a strong emotional response towards the COVID-19 vaccine, whether they favored it or were against it. This is reflected in the frequent tweets in the “Attitude”. However, users were not as concerned with the specific details or nuances of the vaccine, shown by the lower frequency of tweets with Graduation features. The high frequency of the “Engagement” category suggests that users were evaluating events and situations related to the vaccine rather than expressing their attitudes about it. The use of “Engagement” is considered an interpersonal strategy to involve

other Twitter users in the conversation about COVID-19 vaccination. Overall, the pattern of sentiments of Malaysian Twitter users suggests that they were actively engaged in discussing and evaluating the COVID-19 vaccine, and they were invested emotionally in these discussions.

5.3 Implications of findings

This study shed new light on how Malaysian Twitter users reacted during the three phases of vaccination, offering valuable insights into the intricate dynamics of online discourse. The present study showed that a segment of Twitter users is inclined to spread misinformation but there were others who support the government to correct the misconceptions arising from religious beliefs, conspiracy theories, and a lack of knowledge. The diverse narratives within the online discourse provides a nuanced understanding of public reactions to a critical health issue that affects the whole Malaysian population. The findings indicate that the health authorities need to keep up with the information dissemination through newspapers, television, radio and social media, and the educated segment of the public would pick it up and do their part to educate the other members of the public. The findings underscore the important role of the social media in propagating information and mitigating misinformation. However, the study shows that misinformation cannot be ignored because it might spread out of control. Therefore, health authorities need to be proactive to use social media to promote and disseminate accurate information on a big scale to prevent irresponsible users from propagating false information. For future infectious disease outbreaks, it is important to monitor talk on Twitter and other social media platforms

to identify the target topics of anger and misinformation. Through real-time updates and online tracking capabilities health authorities can potentially leverage the findings of other control measures to restrict the spread when disseminating information on Twitter.

In addition, the findings have significant theoretical implications for social media research on health, particularly in understanding the persuasive language and sentiments expressed in health-related discussions. Malaysian Twitter users aiming to refute anti-vaccination views and educate the public often employed persuasive techniques such as emotional appeals, storytelling, or logical explanations of the benefits of vaccination. In achieving their goal, these users often combined these persuasive strategies to foster trust and credibility, aiding in overcoming vaccine hesitancy. The study shows that while medical terms may be new to the public, they can gain knowledge of it over time and use them to explain the COVID-19 disease and vaccination to other social media users.

Furthermore, the findings on Thematic Analysis and Appraisal Theory in this study also shed light on the psychological factors contributing to vaccine hesitancy and acceptance. One crucial finding is that Malaysian Twitter users often expressed their emotional concerns, particularly “fear”, regarding potential side effects of the vaccine, conspiracy theories. In addition, Malaysian Twitter users wrongly believed that having the vaccine was against their religion as it indicated their lack of trust in divine protection against the disease. On the other hand, vaccine acceptance among Malaysian Twitter users was found to be influenced by two key factors. Firstly, the desire to return to a sense of normalcy, free from the restrictions and disruptions caused by the pandemic, motivated vaccine acceptance. Secondly, the awareness of the contagious nature of the virus played a crucial role in vaccine acceptance. They understood that vaccination is a means to safeguard against the virus and prevent its transmission, leading to a collective sense of responsibility in accepting the vaccine. By

understanding the psychological factors influencing vaccine hesitancy and acceptance, interventions can be designed to effectively address concerns, dispel misconceptions, and promote vaccine acceptance among the population, ultimately contributing to public health outcomes.

Overall, this study provides crucial insights into how Twitter users discuss health and disease and how they use and link to other social media platforms during outbreak scenarios, contributing to better public health communication and education. The findings can be used to develop language teaching materials that address common misunderstandings and concerns about the vaccine expressed by individuals, ultimately helping to increase vaccination rates and promote public health.

5.4 Recommendations for Future Research

This study was conducted on a sample of 150 tweets posted by Twitter users in Malaysia regarding the COVID-19 vaccine debate. With this sample size, the findings may not represent the ideas and feelings of the entire Malaysian population. Therefore, additional research should be conducted on a wider scale beyond the social media community because people who engage in social media discussions on health may differ in characteristics from those who are not in social media. Studies involving face-to-face contact with other sectors of the Malaysian population who are not in social media can produce findings that are different and add to a better understanding of responses to health crisis.

Future scholars could, for instance, do a comparable study on other social media platforms, such as Facebook, Instagram, and Tiktok, to provide a broader sense of Malaysians' sentiments about COVID-19. This will aid in increasing the authenticity and

dependability of the outcomes. A comparative study across these platforms would enable researchers to investigate whether public opinions on COVID-19 and vaccination differ across age groups, geographical locations, and other demographic factors. This is because Facebook users tend to be older while Instagram and Tiktok users tend to be younger. Additionally, researchers can examine whether different social media platforms exhibit similar patterns of discussion on the topic or whether specific platforms foster certain types of sentiments. This is because Twitter users have been found to be more critical and sarcastic than Facebook users when making comments on COVID-19 patients and people who accidentally spread the disease to others (Ting & Shamsul, 2022).

In addition, this study was conducted using meta-data such as location information on data submitted by Malaysian Twitter users, without separating the data by Malaysian state. Future studies can set the location of the data according to the states to observe a clearer picture of the sentiments expressed, and to investigate whether specific locations influenced tweets, such as whether those living in the most affected states expressed different sentiments or discussions than those living in states with a lower rate of occurrence. For example, it is possible that Malaysians in cities and remote areas respond differently to the COVID-19 vaccination issue. By doing so, a clearer understanding of how different regions in Malaysia may have different attitudes and opinions towards the vaccination program can be obtained. It can also provide insights into ways of managing public sentiments by region.

Finally, future research can investigate significant topics or those shared by influential Twitter users using the influence scores of Twitter users and network analysis. This can provide a more nuanced understanding of how information about vaccines spreads on social media and who are the key influencers in shaping public opinion on vaccination. By identifying these influential Twitter users, future studies can also explore the reasons

behind their influence and how their messages might be amplified by other users. The recommendations of this study can provide a roadmap for future research in social media analysis and public health communication that can lead to more effective strategies for addressing vaccine hesitancy and promoting public health.

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APPENDICES

Appendix 1: The research ethics approval letter

Deputy Vice Chancellor's Office (Research and Innovation) Human Research Ethics Committee (Non Medical) Tel: 082 581222/1223 Fax: 082 665115	UNIVERSITI MALAYSIA SARAWAK 94300 Kota Samarahan
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MEMORANDUM

Reference	:	UNIMAS/TNC(PI)/09 – 65/02 (15)
To	:	Assoc Prof Dr Ting Su Hie Faculty of Language and Communication
From	:	Chair Human Research Ethics Committee (Non Medical)
Date	:	21 September 2022
Subject	:	Research Ethics Approval - No. Ethics Approval: HREC (NM)/2022 (1)/18.

With all due respect the above is referred to.

We are pleased to inform that the ethics for the research entitled **Malaysian Twitter Users' Sentiment on Covid-19 Vaccination** has been **APPROVED**. The researchers involved are as follows:

Principal Researcher:

- Assoc Prof Dr Ting Su Hie
(Universiti Malaysia Sarawak)

Co-Researcher

- Nor Eisya Shabila
(Universiti Malaysia Sarawak)

All subject records and data are **CONFIDENTIAL** and used for research purposes only and all issues and procedures regarding data confidentiality must be adhered to. Permission from the Head of the Responsibility Center in which the study area is involved must be obtained in advance before the research is commenced.



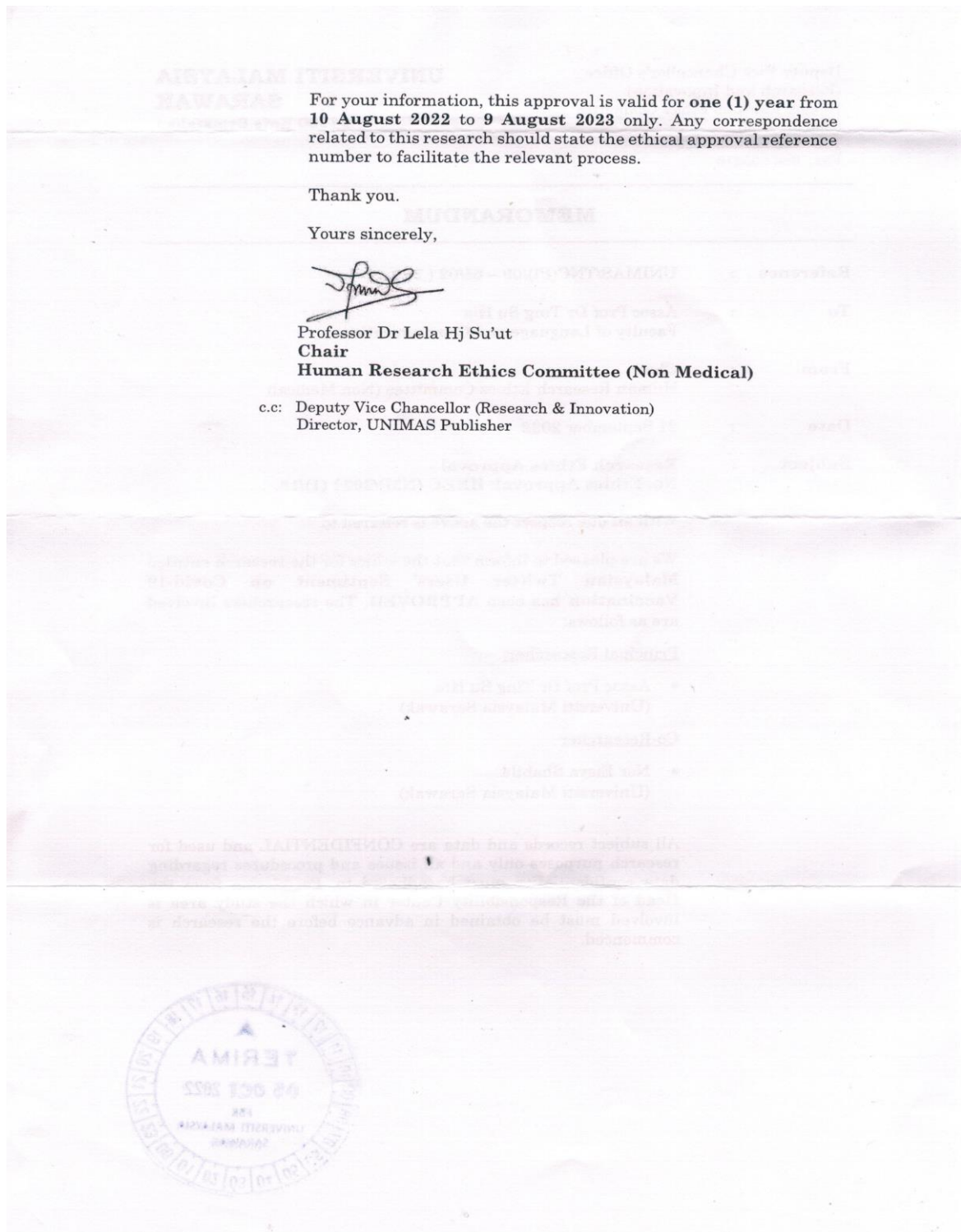


Figure 1: The Research Ethics Approval letter by Human Research Ethics Committee

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