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by

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ABSTRACT

Government health agencies utilize social media for public health interventions. This study examines how CDC, the national public health agency of the United States, use *Facebook* to disseminate COVID-19 vaccine messages and to get public engagement towards them over the past two years (2020-2022). Investigating the process of dialogic potentials of *Facebook* from the dialogic theory of public relations perspective, the current study analyzes 681 posts and 3,405 comments from CDC's official *Facebook* page. Thematic analysis of posts yields three dominant themes such as "Vaccine supportive", "availability of vaccine", and "up to date information". Comment analysis shows positive sentiment to vaccine promotion but negative sentiment for pregnant women's vaccine uptake. Parents of children lack of confidence to get them vaccinated. Drawing on dialogic theory, the study argues, CDC needs to escalate "usefulness of information" (e.g., audio-visual production) principle while crafting messages for vaccination. The study concludes by calling for building an active "dialogic loop" by responding to users' comments as much as possible. Practical implications and importance of findings are discussed.

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DEDICATION

I would like to dedicate this thesis to my mother, Khaleda Khanam, who passed away just six days after I successfully defended my thesis. Her affection for me was literally unconditional and her predisposition toward me both helped to make and mold my life.

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CHAPTER I – INTRODUCTION

Vaccines have long been shown useful in combating viral epidemics. Vaccination increases life expectancy, reduces parents' dread of illnesses that might cause paralysis or death of their children, overcomes epidemics, and reduces expenditures by preventing diseases and disabilities (Schuchat, 2011). However, not everyone is in favor of vaccinations in general, and the COVID-19 vaccine (Rianto & Pratama, 2021). Vaccine-related messages are increasingly appearing on social media sites, containing misinformation and disinformation that may change human behavior. For example, a big *Twitter* data analyzed by Marcec and Likic (2021) presented an alarming result that public opinion is shifting against the AstraZeneca/Oxford vaccine, since this may increase skepticism against the SARS-CoV-2 vaccine. The mood towards Pfizer and Moderna vaccines was good and constant during the 4 months, with no major changes. However, it seems that people are becoming less positive about the AstraZeneca/Oxford immunization, as seen by a significant reduction in support from December to March. Except for a limited studies that only recommended health administration contact with individuals via social networking sites, this risky fact goes unaddressed (Furini, 2021).

Social media has evolved into a primary mode of communication, and public health specialists must use it to support healthy communities. One of the hardest parts of building an interactive social media platform is posting persuasive health messages consistently, monitoring for inappropriate content, and responding to concerns (Jha et al., 2016). Health communication has gained a new dimension thanks to social media sites like *Facebook*, *Twitter*, and *YouTube* (Moorhead, 2013). More than a third of American

people have admitted to looking for health-related material on the internet, with 46 percent saying they were prompted to seek medical advice (Fox & Duggan (2013). A study conducted by the Pew Research Center in December 2012 found that *Facebook* is the social networking site that has the most users in the United States, with 67 percent of all internet users accessing it (Duggan & Brennar, 2012). In 2012, CDC issued guidelines for building a social media communication plan, stressing audience knowledge, scientifically acceptable language, and social marketing in an effort to make best use of these platforms (CDC USA, 2012a).

Previous health communication research has repeatedly and unequivocally demonstrated social media's fast proliferation among patients and healthcare professionals has created a great opportunity for academics to design health promotion programs based on social media and maybe reduce health inequities (Huo et al., 2019). For example, Kandzer et al. (2022) studied how the CDC used *Facebook* videos to contact directly with the general people regarding the COVID-19 pandemic in its early stages. Being a public body, CDC employed the organization-public relationship (OPR) strategy to connect with the general public. They noted, *Facebook* videos may be utilized to convey the value of scientific knowledge by employing conversational speech and OPR indicators.

Facebook, *Twitter*, and *YouTube*— these social media platforms are used by around 70 percent of health care institutions in the United States, according to some estimates (Househ, 2013; Ventola, 2014, as cited in Peck, 2014). *Facebook* is being used by US federal health authorities to “engage” the users in reading, spreading, promoting, and encouraging health discussions. On the other hand, different agencies and their

messages receive varying degrees of engagement. For instance, Healthcare institutions such as CDC or the Food and Drug Administration (FDA) have a fundamental obligation to warn the public of significant pandemic occurrences, such as the spread of H1N1 or Coronavirus (Ithete et al., 2013; Patient, 2009; Reynolds, 2010; as cited in Bhattacharya et al., 2017). However, being frontliners in dealing with the COVID-19 pandemic, government national public health agencies (e.g., CDC) have not received much attention to the scholars. Especially, what vaccination information are available on CDC's social media sites, how are the information being disseminated, who are the possible target audience of that and how they engage to that vaccination program. To my best knowledge, previous studies did not exactly focus this area. To fill this gap, the study has undertaken a content analysis of the CDC's official *Facebook* page to determine the government agency's social media strategy for COVID-19 immunization and to ascertain public attitude towards the COVID-19 vaccination messages.

A rising number of research have been carried out to disclose talks on social media platforms relating to COVID-19 and general public attitudes. Insights from research suggest that negative feelings (such as concerns about health safety, worry of getting vaccination compulsory, vaccination effectiveness, conspiracy theories, etc.) might be temporary and may have altered by the time public access to the COVID-19 vaccination has been established (Lappeman et al., 2021). Statistics show till April 18, 2022, 256.8 million people, or around 77.4 percent of the US population, had received at least one dosage of a COVID-19 vaccine, 218.9 million, or 65.9 percent are completely vaccinated, and over 99.5 million individuals got a booster (CDC, 2022). However, 34.1 percent of people have not fully been vaccinated, and many social media discussions

concerning COVID-19 immunizations are still unfavorable. For example, a lot of anti-vaccination comments are visible on CDC's *Facebook* page. This study is important to explain why individuals are opposed to the COVID-19 vaccine in order to urge them to acquire it.

Rianto and Pratama (2021) investigates the government accounts which posted far more positive sentiment content, received relatively homogeneous positive reactions to their *Facebook* posts in compared to the news portals about COVID-19 vaccination by the public. However, being a federal agency, CDC has been facing negative comments, reactions, attitudes towards its positive COVID-19 vaccination posts. Therefore, it necessitates more scholarly attention to reveal CDC's communication strategy and public sentiments about COVID-19 vaccination program.

Despite the availability of vaccines, the rate at which vaccinations are started and finished in a series is still below the standard for several reasons. Drawing attention from a previous study shows even though the HPV vaccination is readily available, in 2010, the National Health Interview Survey (NHIS) reported that just 25% of American women aged 21-30 had begun the process of being vaccinated and that only 13% had finished the recommended three-dose regimen (Williams et al., 2016). Scholars suggest, more research is needed into HPV vaccine knowledge and uptake among underserved populations to discover the appropriate messaging, dose, and social media platform (Paek et al., 2016). Allen et al. (2020), emphasized for future investigation to understand how spreading HPV vaccination promotion messages via *Twitter* affects HPV-related outcomes across geographically distributed individuals. These initiatives, taken together, have the potential to affect the awareness of the HPV vaccine, the risk perceptions, and

the vaccination habits of marginalized populations who have a greater risk of cervical cancer. This suggestion also encourages to take same action for the COVID-19 vaccination program.

The current research used dialogic theory to do a content analysis of the CDC's *Facebook* page in order to gain insight into the manner in which the organization employs social sites to contact various individuals in a manner resembling a dialogue. The study looked into how the CDC uses ideas from dialogue on its *Facebook* page. This study also made a connection between the organization's dialogue on its *Facebook* page and how it interacted with the public. This research would contribute to what is already known about dialogic communication through social media by illuminating the ways in which governmental entities initiate discussions via the usage of social media. It applied old ideas about how to have a conversation to the world of social media. This research also looked at how dialogic communication between an organization and the public affects public participation. This would help the dialogic theory move forward.

CHAPTER II - LITERATURE REVIEW

Public Health and Vaccine Discussion in Social Media

Digital platforms that allow users to join, connect, create, and share material are referred to as social media (Lewis, 2009), social media allow people to be participate online discussion, connection, and/or interaction (Russo et al., 2008). More specifically, Carr and Hayes (2015) elaborate on the internet, there are many social media platforms that let people talk to each other and show themselves to a wide range of people who are interested in user-generated material and social connection in real time.

Social media networks enable health organizations to engage with people through the sharing of photographs and videos, *Facebook* comments, and Twitter retweets. Even though it's important for Internet advertising, interaction on social media sites hasn't gotten much attention (Downes and McMillan, 2000). According to the findings of a content analysis of 1,760 wall comments posted on the *Facebook* pages of various health organizations, it appears that nonprofit healthcare institutions are more engaged than any other health organization that was reviewed in posting to *Facebook* utilizing interactive features (Park et al., 2011).

Most people who use social media for health purposes go to *Facebook* for health information (Dolan, 2011, as cited in Park et al., 2011). More doctors, community clinics, and government organizations should use social media to raise public awareness and educate the public, as argued by Eysenbach (2008). This is due to the ease of sharing information on social media, as well as the fact that many individuals choose to ask health-related issues on social media before seeing a doctor. Increasing emphasis is being paid to the use of social media in recent public health initiatives (Korda & Itani, 2013).

According to Jang et al. (2021), people's responses to societal issues can be gleaned via social media. Documenting people's reactions to public health programs is essential since their lives have been changed because of COVID-19. The scholars also mentioned, “Public health campaigns and interventions like physical distance, border restrictions, handwashing, staying home, and face coverings” are a big part of the interpretation and timeline analysis of the topics that were found and how they changed over time during COVID-19 pandemic (p. 5). Hung et al. (2020) also identified five dominant themes among COVID-19–related tweets: “health care environment, emotional support, business economy, social change, and psychological stress” (p. 1).

Abd-Alrazaq et al. (2020) reports, individuals, organizations, and governments are utilizing social media to discuss the COVID-19 outbreak. The current research seeks to determine key COVID-19 pandemic-related topics on *Twitter* such as viral genesis, sources, impact on individuals, countries, and economies, and measures to reduce infection risk. Not only, COVID-19 patients, but also other patients seek health information through social media throughout the pandemic. For instance, Berkovic et al. (2020) mention arthritis patients use *Twitter* to connect with others and stay informed about new medicines and management approaches. Seven themes emerged: health care experiences, personal tales, blog connections, arthritis-related symptoms, advice sharing, positive messages, and stay-at-home messages. In a similar manner, Karmegam and Mapillairaju (2020) sorted tweets on public health into five categories, based on topics i.e., basic information, health records, feelings, humor, and other related topics. The majority of tweets, 57.42 percent, are composed of basic information, accompanied by 24.12 percent of emoticons. The most liked tweets were humorous, while the most

retweeted were health related. However, the usage of social cites for disseminating health data have decreased, whereas the interchange of health records with medical stuff has increased, according to Huo et al. (2019). The researchers advise further study on ways to engage individuals in social platform-based health treatments, especially elderly adults.

Research finds, the way people use language through social media posts can leverage their concern about vaccination. In order to get insights into views about childhood vaccination, the language of social media (i.e., *Facebook*) posts regarding vaccination were assessed and identified several types of themes by Faasse et al. (2016) such as pro-vaccination, anti-vaccination, and irrelevant (control) remarks. Similar trend found in mothers' comments on *Facebook* posts expressing concerns related to HPV vaccination of their daughters. Buller et al. (2019) categorized such comments on HPV vaccination as favorable (e.g., HPV vaccine helps reduce parent's worries), unfavorable (e.g., parents are not sure about the efficacy of the HPV vaccine, mothers are concerned about what effects their daughters may face in the long run due to vaccination), and irrelevant (e.g., not related to HPV vaccines but in general all types of vaccines).

Apart from public comments and posts on social media regarding vaccination, government health organizations also use social media (e.g., *Facebook*, *Twitter*) to disseminate important information about vaccination. For example, Park et al. (2011) mentioned several types of social media posts such as "up-to-date-information, flu clinic schedules, availability of vaccines, and mortality reports made by National Association of County & City Health Officials" in response to H1N1 outbreak in 2009, p. 65. However, in the Buchanan and Beckett (2014) study, it was identified that, 43 percent of vaccination-focused *Facebook* pages, groups, and venues as anti-vaccination, 7 percent

neutral, and 50 percent pro-vaccination. They also found that *Facebook* vaccination information contradicts CDC and FDA (Food and Drug Administration) recommendations.

While several previous studies focused on individuals' vaccination attitudes on the internet simply mentioned the terms "pro-vaccine" and "anti-vaccine" (e.g., Ache & Wallace, 2008), Elkin et al. (2020) developed a range of vaccine attitudes and features on the google, *Facebook*, and *YouTube* such as "pro-vaccine", "vaccine promoting", "vaccine supportive", "neutral", "vaccine skeptical", "vaccine discouraging", and "anti-vaccine" (p. 4).

The CDC is determined to protect public health for more than 70 years. CDC has its official *Facebook* page (www.*Facebook*.com/cdc) with 4.9M followers. According to its *Facebook* page, CDC is responsible for 24/7 for protecting America from health and safety concerns (CDC, n.d.). On January 21, 2020, CDC initiated its response dealing with the COVID-19 pandemic, and it is the most extensive effort ever mounted in the agency's history (CDC, n.d.). On December 14, the first patient in the United States to receive the COVID-19 vaccine was given, 2020 (BBC, 2020) and children aged from 5-11 were began to be vaccinated from November 3, 2021 (Neergaard & Stobbe, 2021). However, till April 18, 2022, 34.1 percent people are remaining fully unvaccinated against COVID-19. As a national public health agency CDC has been continuously posting COVID-19 vaccine-related information on the official *Facebook* page to encourage public to take vaccines and it is significant to observe the types of COVID-19 vaccine information and news are available in CDC's social media (*Facebook*) posts. Therefore, the following research question is formulated:

Research question 1: Which themes were most prevalent in CDC's COVID-19 vaccine-related Facebook posts?

Target Audience of COVID-19 Vaccine and Strategies to Reach Them

Previous studies found, specific ethnic group shows particular response to health messages or interventions. Media could be successfully used for dissemination of health intervention or messages crafted for specific group of people. According to Hall et al. (2015), a culturally relevant multi-component campaign employing Black radio and print media on low-income Black or African American women in Savannah results in increased mammography uptake. The scholars suggest more such campaigns using various media platforms to sustain increased mammography uptake. National data show that while vaccine initiation doesn't vary by race or ethnicity, vaccine completion is significantly lower for black women than for white women, even after socioeconomic factors are considered (Agénor, 2020) Regardless, low levels of vaccine completion are worrying, especially because low-income women and women of color are more likely to get cervical cancer and die from it. (USCS, 2019, as cited in Allen et al., 2020).

Although just 14 percent of COVID-19 patients were African American, health professionals in the USA felt that African Americans were responsible for roughly a third of the deaths caused by COVID-19. According to the media, the death rate of African Americans in New York was twice as high as the death rate of their white counterparts. Additionally, the death rate of Latinos in the city was significantly higher than the death rate of white or Asian New Yorkers. People of the same race or ethnicity are more likely to feel involved and conscious of the severity of the pandemic, as well as the necessity of preventative strategies and government initiatives, as a result of this. Governments and

public authorities should utilize health communication campaigns to highlight the inadequacy of healthcare facilities and services for specific communities to support new health policies (Aleem, 2020; Yancy, 2020).

A study by Noar (2006) suggests effective campaign design to achieve desired impact on specific audience pertaining to health-related issues and Busselle and Bilandzic (2009) did not incorporate relevance as one of the four dimensions of experiential engagement in narratives. Conversely, Frank et al. (2015) argue, relevance of the legend to an audience's life seems more important to achieve expected effects which may be accelerated by Larkey and Hectht's (2010) opinion that is culture specific narratives should be a voluntary choice for identifying and designing health messages for culture specific audience. For example, according to Los Angeles County Department of Public Health Latin American women may be more likely to get cervical cancer than white women. They are also less likely to be educated about the disease or to be screened for it (ScienceDaily, 2015). These kinds of health disparities may be reduced by telling stories, claimed Frank et al. (2015) The scholars of this study use a fictional film ("Tamale Lesson") crafted to circulate certain knowledge about human papillomavirus (HPV) and cervical cancer prevention toward a Mexican American group and 83 percent of Mexican-American women who watched the narrative were in line six months later than 73 percent of those who watched a nonnarrative.

Telling an engaging, culturally relevant tale is the best way to connect with Mexican American women, according to Lourdes Baezconde-Garbanati, one of the authors of the study. Murphy, a co-author of the study said, facts alone won't be enough to sway individuals to alter their conduct. Public health officials must convey a tale that

their audience finds interesting if they hope to keep their attention (ScienceDaily, 2015). In this approach, the narrative and the viewers could work together to achieve the intended health effect.

A study by Allen et al. (2020) found that there was very little information about another popular social media such as *Twitter*-based HPV vaccine promotion interventions, especially for "women from lower socioeconomic backgrounds and women of color" (p. 2). The scholars suggest, *Twitter* may be a good way to spread information about the vaccine, but further research is required to figure out how to reach "low-income women" who don't get the vaccine (p. 5). Similarly, Huo et al. (2019) indicates, there is a need for more study to develop techniques for including patients in social platform-based medical treatments and how to encourage the distribution of current, accurate, high-quality and evidence-based medical knowledge, particularly among older persons.

Social media vaccine sentiment research is quickly evolving. Its uses range from better understanding attitudes towards certain vaccinations, such as HPV, to immunization of sensitive groups, including pregnant women (Du et al., 2017; Martin et al., 2020) who belong to the target audiences of CDC's social media posts regarding COVID-19 vaccines.

Among the target audiences, school and college going students are greatly focused on CDC's social media posts. Schools, universities, and institutions throughout the world have experienced severe delays in their operations due to the COVID-19 pandemic (Duong et al., 2020). Because of the COVID-19, 13 percent of students have put off graduating, 40 percent have lost a job, an apprenticeship, or hiring process, and 29 percent think their income would be reduced at age 35, according to an Aucejo et al.

(2020) research of 1,500 pupils at one of the major public universities in the US. Loades et al. (2020) find children, teenagers, and college students especially endure stress during quarantines since they are physically isolated from their peers, friends, teachers, and extended family.

In light of what has been discussed so far, it really should realize that, every post or tweet releases by CDC about COVID-19 vaccine-related information has its specific target groups (e.g., general public, pregnant women, school going students such as kindergartener/high school/college/university going, tribal/native people etc.) Hence, it is critical to explore the target group of CDC's vaccination program. On the other hand, perhaps CDC presents all the COVID-19 vaccine-related (*Facebook* posts and tweets) messages targeting wide range of audiences in various ways. On the other hand, CDC strategically crafted texts, images, graphics, and videos while disseminating COVID-19 vaccine posts and tweets to its target audiences. Therefore, the following two research questions are formed:

Research question 2a: Which groups appeared mostly as the target audience of CDC's COVID-19 vaccine-related Facebook posts?

Research question 2b: Does any relationship exist between the major themes and target audience of CDC's COVID-19 vaccination posts?

Public Responses Towards COVID-19 Vaccine Discussion on Social Platforms

In many countries, vaccine hesitancy and misinformation about vaccination have made it difficult to get enough people vaccinated to achieve herd immunity (Lane et al., 2018; Lazarus et al., 2021). Because of this, governments, public health experts, and

policymakers need to be aware of the various factors that influence public perception of COVID-19 vaccinations (Cornwall, 2020).

When it comes to sentiment analysis (SA), the aim of a study is to elicit and investigate individuals' feelings and thoughts on a variety of different subjects, goods, and services, among other things. Sentiment analysis extracts and analyzes views, feelings, attitudes, and impressions of products, services, or events that are happening somewhere (Birjali et al., 2021).

Worldwide data from social networking sites may be exploited to gauge public opinion about vaccination and locate high-priority areas for vaccine uptake campaigns (Lappeman et al., 2021). Social media sentiment analysis collects, and analyses uploaded information to acquire extensive insights into people's vaccination decision making process (Salathé & Khandelwal, 2011; Wilson & Wiysonge, 2020).

A study finds the dominant community had a positive response with the percentage of tweets reaching 48 percent with a total of 471 tweets, then for the percentage of negative tweets by 23 percent with a total of 224 tweets and neutral by 29 percent with a total of 281 tweets regarding COVID-19 vaccinations (Rakhmawati et al., 2020, cited in Rianto & Pratama, 2021).

However, Garcia (2020) identified Twitter users expressing negative thoughts, emotions, and the psychological consequences such as impatience, emotional disturbance, and despair while witnessing community quarantine during the early COVID-19 epidemic in the Philippines. Conversely, public also expressed mixed sentiments of COVID-19 vaccines as Hu et al. (2021) claimed *Twitter* users exhibited a rising pattern of positive sentiment with a declining pattern of negative sentiment towards COVID-19 vaccinations

in most of the states of United States, reflecting “8 types of emotion, including joy, trust, anticipation, trust, surprise, disgust, sadness, and fear” (p. 9).

The media has a crucial influence in how the public reacts to a pandemic since it connects governments, health systems, and individuals. Health professionals and others publicized and discussed health advice and government orders online, in journals, periodicals, and on *Facebook*, Instagram, and *Twitter* (Mheidly & Fares, 2020). Heldman et al. (2013), and Merchant et al. (2011) suggest, social media should be used strategically to complement traditional systems in order to maximize information transmission and user engagement. For example, according to Luo et al. (2020), due to inadequate medical resources and a sluggish reaction to the early COVID-19 outbreak, a significant number of suspected and diagnosed patients have sought assistance through social media. Social media posts that express anger, ask aid, expose self-illness, explain suspected instances, and disclose personal information are more likely to be shared. Equally, public shows their reactions against interprofessional team through social media posts. For example, El-Awaisi et al. (2020) discover public sentiments of dissatisfaction and alienation expressed in posts on *Facebook*, *Twitter*, and LinkedIn focused on the interprofessional team. According to the researchers, this kind of reaction to the post on social media is extremely important and must not be disregarded. They suggest healthcare workers must increase their interprofessional teamwork to provide safe, effective, and high-quality patient care.

Health rules and guidelines during the COVID-19 have significant effects on students. Hence, it is important to observe how students show different reactions to COVID-19 health protocols in order to understand their response to COVID-19 vaccines.

According to Karasmanaki and Tsantopoulos (2021), initiatives taken to prevent the spread of COVID-19 have dramatically altered academic life. In their study, they found that students are greatly influenced by the closing of colleges and the transfer to online education. According to the authors, respondents are enraged and concerned about the epidemic. The degree to which female respondents experience intensely negative emotions such as dread, anxiety, and depression is significantly higher than the degree to which male students, who are more upbeat towards the pandemic. Aside from these unpleasant feelings, quarantined persons might also acquire PTSD and sleeplessness (Brooks et al., 2020, Hossain et al., 2020). It has been suggested that practical decisions and ethical responses to contentious activities pertaining to the COVID-19 dilemma, such as relaxing data protection standards and prohibiting public meetings, denigrating an old friend who breeched COVID-19 guidelines, favoring patients over older ones when clinical supply is limited, and lessening animal rights to expedite vaccine development, have a strong correlation with each other. Individuals reacted differently to the COVID-19 health rules prescribed by the health authorities. Park et al. (2020) did a national survey on social isolation at the beginning of April 2020. They asked about the stresses people faced, how they dealt with them, and how well they followed CDC guidelines at the time. They reported the most prominent stressors as being ambiguity over isolation and social distance limitation, as well as shifts in personal and social care practices. The most worrisome aspect was money. Anxiety levels rose with age, gender, and caregiver status. Techniques for reducing stress included distracting oneself, engaging in constructive coping behaviors, and looking to others for emotional support. Although CDC's guidelines were mostly followed, several critical social distancing and hygiene

habits were not, particularly among males and young adults. However, Fridman et al. (2020) argue, individual's trust and confidence regarding COVID-19 health rules are associated with sources of information as they found, social distancing and correct information about COVID-19 knowledge were both linked with credibility in government sources, while confidence in private sources and social media platforms was associated with the opposite.

A study by Hung et al. (2020) discovered five common topics of COVID-19 debate with positive and negative attitudes. Negative feeling was expressed in Alaska, Wyoming, New Mexico, Pennsylvania, and Florida, whilst good emotion was shown in the following states: Vermont; North Dakota; Utah; Colorado; Tennessee; and North Carolina. These themes, feelings and geographical locations can assist policymakers understand the people's reaction to COVID-19 pandemic. Berkovic et al. (2020) found, fear of pharmaceutical shortages, increased symptom load, and high demand for trustworthy information and emotional connection emerged through sentiment analysis of tweets during the COVID-19 outbreak.

If the mass people's sentiment regarding COVID-19 vaccines is negative or ambiguous, it might prevent a large uptake throughout the rollout, resulting in a less vaccination impact than anticipated. As a result, it is a continuous public health priority to characterize attitudes on COVID-19 vaccinations (Lappeman et al., 2021). Likewise, Kandzer et al. (2022) also suggest, future study should strive to realize the general people's reactions to the CDC's technical communication to the public during the COVID-19 pandemic. Hence, the third research question wants to investigate:

Research Question 3a: To what extent did followers of CDC's Facebook page respond to its COVID-19 vaccine related posts in regards to the amount of comments, shares, and emotive reactions such as like, love, care, ha ha, wow, sad, and angry?

Research Question 3b: To what extent post themes and target audience affect comment sentiment?

Application of Dialogic Theory in Social Media

Any interactive way to talk that allows for participation and feedback from both sides, is what Kent (2010) calls "social media" in the field of public relations (p. 645). In a database search using the phrases "public relations" and "social media," approximately 12,000 peer-reviewed journal papers were returned, most of which focused on the way how organizations employ social platform to engage directly with consumers in a wide range of circumstances (Duhé, 2015; Ye & Ki, 2012, as cited in White & Boatwright, 2020). Nonprofits and government agencies have seen more people join their campaigns when they use social media. This is so because they tapped into the social media platforms frequented by their intended audience (Campbell et al., 2014; Cockerill, 2013, Graham & Avery, 2013; Maibach et al., 2007; Wukich & Mergel, 2016). Technologies related to social media have the potential to improve interactions between governments and their constituents, and they also have the capacity to communicate with populations who do not typically use traditional media (Bertot et al., 2010). It is social media that leverages governments to engage directly with the constituents without intervention of mainstream media (Smith, 2011) though historically government depended largely on conventional media (Dixon, 2010).

Twitter was used by the Korean and US governments to share links to pertinent material such as news websites, blog posts, and so on, in order to raise public knowledge of public policies and influence policy making, according to Khan et al. (2014). Several prior research that addressed the usage of social sites in the government sector concur with their findings. (Brainard & McNutt, 2010; Sandoval-Almazan & Gil-Garcia, 2012). Khan et al. (2014) recommend that future research should look into how social media can be used for more than just getting information (e.g., for transactions). Social networks could be used to facilitate interactions between citizens and government, for example. That is, social media may make government services more accessible to citizens. On the other hand, Graham and Avery (2013) asserted that American city governments rarely use social media to spread information to their constituents.

In addition to the federal or central governments, local governments are taking advantage of the growing popularity of social media as a means of enhancing public participation in political and social concerns and researchers (e.g., Haro-de-Rosario et al., 2018) attempted to reveal factors that affect citizens' engagement in social and political affairs. When it comes to local government concerns, Spaniards prefer *Facebook* over *Twitter*. Other characteristics that affect public involvement include online transparency, mood, social media activity, and the local government website's interactivity.

With this inclusion of virtual media, over the past two decades, a theoretical shift in the process of public relations has been observed. Practitioners of public relations are now more inclined to build relationships with their public through dialogue rather than just having a one-way communication with them (Archer & Harrigan, 2016; Waters et al., 2011). Previous studies suggest that diverse organizations utilize social media in

order to build dialogic partnerships with the stakeholders (Lovejoy & Saxton, 2012; Manetti & Bellucci, 2016; Men & Tsai, 2012; Pang et al., 2018; Waters et al., 2011). Understanding how consumers see and debate health issues helps businesses, non-profits, and governments better educate and serve the public (Waters, et al., 2011). Dialogic communication has garnered attention in public relations discussions because scholars feel it can foster trust, mutuality, and empathy (Baxter & Montgomery, 1996; Kent & Taylor, 2002; Wang & Yang, 2020; Yang et al., 2015) between the parties.

Philosophers, rhetoricians, psychologists, and relational communication scholars traditionally have long regarded dialogue as an influential framework for characterizing moral and practical relationships and public relations practitioners define dialogue as dealing publics with issues. (Kent & Taylor, 2002). For example, dealing issues among tobacco industry and its stakeholders e.g., smoking, and non-smoking groups or anti-smokers (Grunig & White, 1992). Heath (2000) argues that dialogue is all about arguments and counter arguments. The concept of dialogue has many intellectual origins, including but not limited to philosophy and relational communication theory (Kent & Taylor, 2002). Stewart (1978) has seen it as a form of relationship building. From the context of public relations, Heath (2000) states, “dialogue consists of statement and counterstatement” (p. 74). In their explanation, Kent and Taylor (1998) defined it as any mediated discussion of thoughts and perspectives. According to the researchers, dialogues have five features – mutuality, propinquity, empathy, risk, and commitment (Kent & Taylor, 2002; Soon & Soh, 2014; Wang & Yang, 2020).

With a primary emphasis on these basic ideologies of dialogue, the Dialogic Theory of Public Relations was formulated by Kent and Taylor (1998). The researchers

came up with a list of five principles to help them study how organizations use dialogue to build two-way, dialogic relationships with their publics (Wang & Yang, 2020).

Five principles of the dialogic theory

Dialogic loop. As a kind of feedback, the establishment of a dialogic loop is advocated by this theoretical framework. Because it provides organizations with the opportunity to communicate with their audience on a more profound level, the dialogic loop has the potential to be beneficial to organizations. These feedback loops allow members of the public to voice their concerns about the groups to the authorities, and the organizations, in turn, are given the ability to reply with answers to the questions or queries that have been posed by the public. To effectively apply this approach, Kent and Taylor (1998) suggested to train the organizational members who will perform the dialogic connection with the public and to monitor the loops thoroughly.

The dialogic loops can be established and measured through various items. For instance, Arturo et al. (2017) utilized six criteria to assess how Facebook may be used by local governments in Europe as a dialectic strategic management tool. These items are: the option for followers to remark on a post that was published by the institution, the ability for the organization to react to the audience's comment that was published under a post, and the possibility for people to comment even if there is no post to comment on, possibility for the organization to respond to a user's remark even when there is no post currently available, the ability to vote on problems affecting the municipality, as well as the provision of surveys via which users may express their thoughts on topics affecting the municipality (p. 82). To investigate how college health services use dialogic theory to spread wellness messages on social media (i.e., Facebook) applying the dialogic

theory, Waters et al., (2011) estimated the usage of e-mail address, social networking cites, vote in polls, reply to comments, RSS feeds, and request information as their scale items. Through these items, they have measured the dialogic loops used by the university health centers (p. 217)

Kim et al. (2014) demonstrated how environmental nonprofits use *Facebook*, *Twitter*, and their websites to use dialogic principles. For Facebook, the researchers used seven items—- option for user-reaction (text and multimedia), chance to voting (poll) and survey on concerns, having constant information via email, scope for taking action on concerns, and institution's reactions as well.

The usefulness of information. It is important to provide all necessary generic and specific information to the stakeholders of an organization. The two theorists have seen this as the first step of developing relationship between the public and the organization. While providing these kinds of contents, concerns pertaining to ranking and structure need to be taken into consideration (Waters et al., 2011). The second principle also implies that the goal of establishing this relationship is to ensure the public's concerns, values and interests rather than just meeting the organizational goals.

By giving the names, postal and e-mail addresses, and phone numbers of members of the organization, as well as the names and contact information of outside specialists or other shareholders, an organization can provide useful information to its audience. In addition, unique information about any service or product can also be made available to clients or users. This information might include explanations of how products are manufactured or services are provided, lists of ingredients, and

explanations of why and how particular ingredients or elements are the perfect suited for the intended audience of that organization (Kent & Taylor, 1998).

For *Facebook* pages, researchers have measured the number of press release, speeches (text, audio-video format), audio-visual posts, statement of an organizations' philosophy or mission or goals, information on how to participate in activities or services, logo or emblem of the organization, summaries of activities of an organization, e-mail address, telephone number, and the title or Facebook account of the webpage supervisor (Arturo et al., 2017). Kim et al. (2014) have focused on organizations' usage of news releases or references to news releases, public speaking (short message service or video content), printable visual effects, audio and video enabled messages, mainstream press contact information, latest report, president's information, statement of philosophy or mission, procedure to be attached with the institution, and the way to donate money or gifts– to facilitate *Facebook* followers with useful information. Link to news, organizational material, calendar, mission statement, program descriptions etc. have been used by Waters et al. (2011) for measuring usefulness of information by *Facebook* pages (p. 217).

The Generation of Return Visits (RV). It is essential for an organization to have a website that is not only aesthetically pleasing but also dynamic in order to encourage repeat visits. Interested website visitors can find a wide range of resources, including up-to-date material, shifting topics, dedicated discussion boards, fresh commentary, live Q&A sessions, and access to online "experts" (Kent & Taylor, 1998, p. 329). The goal of these features is to increase the percentage of repeat visitors to the website. Despite the fact that this principle is usually challenging to put into practice, according to the findings

of some researchers, the implementation of this principle on a number of websites, blogs, and social networking sites scored very poorly (Seltzer and Mitrook, 2007; Waters et al., 2011).

Arturo et al. (2017) figured out how often people come back to an organization's Facebook page by looking at things like links to websites with more information, links to a number of events throughout the year, links to news from outside sources and discussion forums, news coverage of the organization over the last one month, links to frequently asked questions on the local government website, information that can be downloaded, the ability to ask for information by mail or email, and the use of other tools (p. 82). Waters et al., (2011) searched for explicit appeal to return, frequently asked questions, become friend statement and updated in 30 days etc. as their scales to measure the *Facebook* pages' capacity to ensure return visits (p. 217). Kim et al. (2014) examined how organizations apply the third principle of dialogic theory by measuring how frequently news forums, frequently asked questions or frequently asked and answered questions, links towards other webpages, reminders of events, and Facebook posts of news within the past one month were used (p. 602).

The Intuitiveness/Ease of the Interface. The ease or intuitiveness of the interface should be prioritized by organizations, as part of an effective public relations strategy. The public should provide a facilitating navigation procedure in the websites or social media sites, which should not have any slow graphic features or material that is jumbled. Comparatively, organizations find it simple and easy to put this dialogic principle into practice across all online platforms (Waters et al., 2011). It is crucial to give visitors the choice to switch between a standard text-only site and a more advanced one with

graphical elements and audio (Kent & Taylor, 1998). Additionally, the focus of sites should be given on the products, services or on the activities of an organization, rather than making the platform more complex with several lucrative items on it. According to Kent and Taylor (1998), instead of making online platforms engaging, user-friendly, instructive, and helpful to publics, generating special effects like spinning, burning, and logos, among other things, might provide "gratuitous" special effects which might bring harmful consequences for an organization (p. 330). Waters et al., (2011) estimated the use of tab, picture, video and special search option in *Facebook* pages to facilitate public during navigating in an interface.

Conservation of visitors. Organizations need to make an attempt to convince site visitors to remain on their website rather than to navigate to the websites of other organizations (Taylor et al., 2001). It can be a good strategy to conserve visitors if organizations can limit the number of needless links that lead outside the site and provide a direct roadmap to their clients (waters et al, 2011).Through the use of this principle, an organization's website can have a well-organized and facilitating platform for the audience, and it can also urge users to a greater instant to remain on its page (Kent & Taylor, 1998). In addition to an organizations' official websites, their *Facebook*, *Twitter*, *YouTube* or other social media sites and blogs may be regarded part of their overall existence in social media networking. According to Rybalko and Seltzer (2010), a company's website should have links to social media platforms (e.g., *Facebook*) in order to retain followers as part of conservation of visitors.

Researchers used a variety of parameters, such as “linking page”, which includes a detail of a company's goods and services; “last tweet”, which was spotlighted on the

profile's front page; “recent update”, which indicated that tweet had been posted within the past 24 hours, etc., to analyze Conservation of visitors (Rybalko & Seltzer, 2010, p. 338). For their study, Arturo et al. (2017) referred their readers to the city's official website and other social media platforms (*Twitter*, Flickr, *YouTube*, blogs, Instagram) where the municipal authority is active and recent update that came within 24 hours (p. 82). Waters et al. (2011), examined link to a university’s site, on topic comments, news catchy titles, cartoons and mascot in their research to study this principle applied by a university’s health center’s *Facebook* page (p. 217). Link to the self-website and organizational SNS(s) and recent update within 24 hours – these three subscales were used by Kim et al. (2014) in their research to measure the conservation of visitors (p. 601).

Several scholars have used this set of dialogical principals as a framework in order to investigate how different organizations use a variety of online websites or social media platforms as dialogic instruments in order to connect and create relationships with their respective publics (Gordon & Berhow, 2009; Hickerson & Thompson, 2009; Wang & Yang, 2020; Waters et al., 2011). These concepts were applied to health wikis by Hickerson and Thompson (2009). Their study demonstrated that after the wiki included dialogic contents, the subscribers of that health wiki were more committed and encouraged in future interactions. Analyzing these dialogic strategies and public engagement, Wang & Yang (2020) reported the varied patterns of employing dialogic principles on the *Twitter* pages of various profit-based and non-profit organizations. While evaluating the adoption of dialogic approaches on *Facebook* by nonprofit, environmental advocacy organizations, Bortree and Seltzer (2009) concluded

with the notion that adopting dialogic principles increase the extent to which organization and their stakeholders engage with each other. In light of the dialogic theory discussion, this study asks the following question:

Research question 4: To what extent does CDC employ the dialogic principles on its Facebook page while posting COVID-19 vaccination messages?

CHAPTER III - METHOD

In order to investigate the CDC's total use of *Facebook* for COVID-19 immunization efforts, a quantitative content analysis was carried out. To accomplish this objective, the CDC's *Facebook* posts that were generated between March 11, 2020 and March 10, 2022 were analyzed as part of this study. In addition, to investigate user engagement, comment sentiment was also examined. Since World Health Organization's (WHO) director general, Tedros Adhanom Ghebreyesus declared COVID-19 as pandemic on March 11, 2020, hence, the day was taken as the starting date for collecting *Facebook* posts. During these two years, CDC made 681 *Facebook* posts regarding COVID-19 vaccination messages and all these posts were assessed by the evolving themes found in the posts. Each theme was created on the basis of previous literatures, which are – "Vaccine supportive", (Elkin et al., 2020); "Availability of vaccine", "Up to date information", (Park et al., 2011) and "Other themes".

Furthermore, CDC's *Facebook* posts were examined to see which groups were most listed as the intended audience for the COVID-19 vaccination campaign. The groups that had been been established from prior research were assessed: "African American" (Hall et al., 2015); "White American", (Frank et al., 2015); "Older persons" (Huo et al., 2019); "Pregnant women" (Du et al., 2017; Martin et al., 2020); "Children" (Loades et al., 2020); "Everyone", and "Other target audience".

This research measured the ways in which people who followed the CDC's *Facebook* page responded to the organization's COVID-19 vaccination-related posts by measuring social media interactions (i.e., number of comments, shares, like, love, care, ha ha, wow, sad, and angry). In addition, it also provided insight from the five principles of

Dialogic theory of public relations (i.e., Dialogic loop, Usefulness of information, Generation of return visits, Ease of the interface, and Conservation of visitors), proposed by Kent and Taylor (1998) that leveraged to demonstrate the usage of social networking site (i.e., Facebook) by CDC in order to build a two-way, dialogic relationship with its public on COVID-19 vaccine information. The method part of this very study explained how to extract the data, how to sample it, how to code it, what the proposed measures are, and then how to analyze the data.

Unit of Analysis

Due to the fact that the primary focus of the present investigation is on the organizational utilization of social media, each one of the CDC's one-of-a-kind posts on *Facebook* relating to the COVID-19 vaccination has been regarded as its own separate unit of analysis. This study aims to evaluate aspects of user engagement that are closely related to gathered posts. Every action (e.g., “like”, “love”, “wow”, “haha”, “sad”, “angry”, and “care” emotion, along with the total amount of replying comments and shares) across every single post was regarded as a component of the post unit in order to reveal how followers reacted to such postings.

Sampling

To investigate how the CDC utilize social media for COVID-19 vaccination efforts, this study focused primarily on the *Facebook* because it is the most widely used social networking site in the entire globe. First quarter of 2022, *Facebook* had 2.93 billion monthly active members, making it the most popular social network in the world (Published by Statista, 2022). With around 240 million, the United States holds the second-most *Facebook* users globally. This indicates that more than 71 percent of

individuals in the United States, which translates to roughly three out of every four people, are active *Facebook* users (*Facebook* users by, 2022). The U.S. government health agency, CDC has an official *Facebook* page with 4.2 million of followers.

The current study used CrowdTangle application for data extraction. CrowdTangle is a *Facebook*-provided application that makes it simpler to access, track, analyze, and report on data pertaining to social media public content. CrowdTangle specifies on its website what data can be collected, including the type of post, the account that produced the post, and the amount of conversations or comments (CrowdTangle, 2021, as cited in Rianto & Pratama, 2021).

In recent times, CrowdTangle is commonly used tool to extract *Facebook* data for conducting research. For example, CrowdTangle facilitates scholars for data collection (Larsson, 2020;) and data retrieval (Berriche & Altay, 2020). Using CrowdTangle, this study gathered CDC's COVID-19 vaccination-related posts from *Facebook*, *Facebook* Pages, Custom Timeline, English language posts, and Page Admin Country-United States. Other options stayed at default.

When only using the term “COVID-19 Vaccine” as the search term, a total of 681 relevant posts were found. The CDC’s *Facebook* page published each and every one of these entries between the dates of March 11, 2020 and March 10, 2022. During the time period, very first five comments from each post ($N = 681$) thread were collected. Therefore, 3,405 total sampled comments were taken for analysis.

On December 14, 2020, the first dose of the COVID-19 vaccine was released in the United States (BBC, 2020) and children aged from 5-11 were began to be vaccinated from November 3, 2021 (Neergaard & Stobbe, 2021). The booster can be received from

five months after the final dose and the second booster (if applicable) can be taken from four months after the first booster (CDC, 2022). Therefore, two-year timeline is sufficient for getting COVID-19 vaccine-related information and public response towards the CDC's posts. Followers' interactions with sampling COVID-19 vaccine postings totaled 3,562,437, including 13,91,878 "likes"; 5,74,822 "shares"; 10,27,436 "comments"; and 1,19,934 "love"; 21,647 "wow"; 2,77,040 "haha"; 33,979 "sad"; 87,260 "angry"; and 28,441 "care" reactions.

Coding Procedure

A codebook is made to keep track of evolving themes from COVID-19 vaccination posts (i.e., "Vaccine supportive", "Availability of vaccine", "Up to date information", and "Other themes"); CDC's target audience for those vaccine related posts (i.e., "African American", "White American", "Older persons", "Pregnant women", "Children", "Everyone", and "Other target audience"); and the five principles of Dialogic theory (i.e., Dialogic loop, Usefulness of information, Generation of return visits, Ease of the interface, and Conservation of visitors).

This coding system was constantly being improved to increase its precision and intercoder reliability. This study's coders were two *Facebook*-savvy grad students including the author. Coders were trained by coding a subsample of gathered posts. This random subsample included 140 posts (20.56% of the entire sample). After coder training, 70 postings (10.28% of the total sample) were tested for intercoder reliability using Krippendorff's alpha. In the next section, the alphas for each category are given. The first training subsample of 70 posts (10.28%) was not used to figure out Krippendorff's alpha. Instead, it was used to teach coders how to use the codebook, re-

define categories as needed, talk about differences, and improve reliability as a whole (this subsample was recoded after completing of the training set, however). Once there was enough trust between the two coders, the full sample set of 681 posts was split between the two coders. The first coder coded 340 posts, and the second coder coded the other 341 posts. *Facebook* postings were imported into an Excel file for coding, where they were then sorted. The coders identified problematic scenarios and discussed them as a group.

Measures

Appendix A has a comprehensive codebook for further reference. In the first phase of categorizing, there are four categories in order to measure the developing themes of the COVID-19 Vaccination-related postings.

These categories have been originated from previous literatures: "Vaccine supportive" ($\alpha = 0.873$) (e.g., "Vaccination against COVID-19 could protect you and your family members", "I have taken COVID-19 vaccine during my pregnancy, and it is completely safe". This category will stress on motivational and advocating factors for taking COVID-19 vaccine (e.g., "Vaccination against COVID-19 protects you from contracting the disease."), "Availability of vaccine" ($\alpha = 1$) (e.g., "Get a vaccine when it's available to you", "visit vaccines.gov to find vaccination providers near you", "Up to date information" ($\alpha = 0.851$) (e.g., new vaccine brand, number of vaccinated individuals, booster doses, novel side effects, etc., "Approximately 75% of the U.S. population, have taken at least one dose of COVID-19 vaccine") and "Other themes" ($\alpha = 0.796$) (e.g., vaccine ingredients, how COVID-19 vaccine works, COVID-19 health rules).

Another set of seven categories comprise the second phase of categorization: “African American” (α = 0.851) (e.g., African Americans are greatly encouraged to take COVID-19 vaccines and booster), “White American” (α = 1) (e.g., White Americans are ahead in vaccine uptakes), “Older persons” (α = 1) (e.g., Senior citizens are among the first groups who would receive COVID-19 vaccines), “Pregnant women” (α = 1) (e.g., COVID-19 shots are safe for women who are pregnant, COVID-19 vaccines help keep pregnant women away from getting severe illness), “Children” (α = 0.843) (e.g., Every child age 5 to above should receive COVID-19 vaccine), “Everyone” (α = 0.801) (when people from all walks of life are addressed) and “Other target audience” (α = 0.882) (e.g., native American or ethnic minorities are responding greatly to take COVID-19 vaccines). These seven groups are based on existing work on various organizations' target audiences for vaccination or health-related social media initiatives.

Later, posts were also be coded according to the five principles that Kent and Taylor’s (1998) Dialogic theory of public relations outlines— “Dialogic loop”, (α = 1) “Usefulness of information” (α = 0.843), “Generation of return visits” (α = 0.819), “Ease of the interface” (α = 0.843), and “Conservation of visitors” (α = 0.923).

To measure the first principle, “Dialogic loop”, posts were coded under four items. These are “opportunity for users to comment” (e.g., post that offers visitors to comment on it), “chance for the organization to respond to the feedback provided by the user” (e.g., CDC is allowed to respond to users’ comments), “opportunity to vote” (e.g., CDC provides online poll to participate in), and “provision of surveys” (e.g., post that has link for any official survey). For “Usefulness of information” there would be four items— “speeches” (e.g., from physicians, patients, experts etc.), “audio-visual posts”

(e.g., post that carry audio/video files, links, graphics, etc.), and "links to press release" (e.g., post that provides CDC's press release about new vaccines or boosters). "Generation of return visit" will be measured by three items— "links to other websites" (e.g., other useful websites regarding COVID-19 vaccination), "links to news" (e.g., post that include news reports related to vaccine information in print, electronic, and online media), and "FAQs" (e.g., post that reply to common vaccine related questions of users). Three items will be used to measure "Ease of the interface" principle. The items are "logo" (e.g., post that carries CDC's logo), and "picture" (e.g., post that has one or more images). And for the last principle, "Conservation of visitors" will be measured by four items— "catchy titles" (e.g., if the post has an attractive headline), "cartoons" (e.g., if the post is adorned with cartoons), "link to the self-website" (e.g., if the post links CDC's official website), and "recent update within 24 hours" (e.g., updating number of vaccinated individuals within 24 hours in a certain county).

And finally, the responses of the followers to the posts that were chosen for study were gathered, including the amount of comments and shares, along with the percentage of "like", "love", "wow", "haha", "sad", "angry" and "care" reactions. This information was used throughout the analysis and the whole number of interactions was compiled for the purpose of analysis. Comment sentiment of the followers were measured [i.e., Comment sentiment 1 ($\alpha = 0.860$), Comment sentiment 2 ($\alpha = 0.798$), Comment sentiment 3 ($\alpha = 0.911$), Comment sentiment 4 ($\alpha = 0.824$), Comment sentiment 5 ($\alpha = 0.826$)] this way: code "1" for positive comment (pro-vax), code "-1" for negative comment (anti-vax), and code "0" for neutral comment (e.g., ambiguous, irrelevant etc.).

Data Analysis

This study intended to carry out a variety of statistical tests after the coding operations got finished to offer answers to the research questions posed by this investigation. RQ1 is connected with developing themes of COVID-19 vaccination programs, RQ2a is necessary to understand the most prevalent groups as the CDC's target audience for COVID-19 vaccine postings. RQ1 and RQ2a are related to vaccination messages. In order to answer these two study objectives, descriptive statistics have been done to determine the frequency with which the topics and groups were mentioned in CDC *Facebook* postings that were associated with COVID-19 immunization campaigns. RQ2b is associated to reveal relationship between major themes and target audience of CDC's COVID-19 vaccination posts. To investigate the relation between the themes and target audience of CDC's COVID-19 vaccination messages, chi-square test was applied. For RQ3a, several T-tests were conducted in order to investigate the variations in user reactions among the various post categories. To answer RQ3b, series of chi-square test were run in order to determine affects associated with themes and target audience of CDC's COVID-19 vaccination posts. And lastly, in order to evaluate how well the CDC's *Facebook* page applied the five dialogic principles, this study conducted descriptive analysis and chi-square tests.

CHAPTER IV – RESULTS

This study's first research question (RQ1) asks about which themes were most prevalent in CDC's COVID-19 vaccine-related *Facebook* posts. Table 1 presents a summary of the prevalence of each theme, along with the percentage of occurrences in the postings.

According to the data show in Table 1, the bulk of the CDC's *Facebook* postings appear to have had "Vaccine supportive" as their primary focus. CDC displays COVID-19 vaccination promoting posts in 398 (58.44%) of 681 *Facebook* posts over two years. The national public health agency of the United States was concerned in delivering COVID-19 vaccination messages through "Up to date information" theme that appeared in 295 (43.31%) out of total posts. The least frequent theme, "Availability of vaccine," has 222 posts (32.6%) out of 681 posts. However, the "Other themes" category, which has 297 posts and accounts for 43.61% of all posts, has the second-highest number.

Table 1

Primary themes used by CDC in its Facebook posts

Themes	Number of instances	(%)
Vaccine supportive	398	58.44%
Other themes	297	43.61%
Up to date information	295	43.31%
Availability of vaccine	222	32.60%

RQ2a asks about which groups appeared mostly as the target audience of CDC's COVID-19 vaccine-related *Facebook* posts. Table 2 presents a summary of the

prevalence of each target audience, along with the percentage of occurrences in the postings.

Table 2 shows, “Everyone” has got most attention in 453 posts with 66.52%. “Children” has been mentioned in 65 posts (9.54%). “Pregnant women” was focused in 16 posts (2.34%), “Older persons” got cited in eight posts (1.17%), “African American” was mentioned in four posts (0.59%), and “White American” was named once as target group of audience in CDC’s COVID-19 vaccination messages delivered on its *Facebook* page. However, according to the descriptive statistics, “Other target audience” has been found as the second highest group of audience in 178 COVID-19 vaccination messages (26.14%).

Table 2

Major audience mentioned by CDC’s Facebook posts

Major target audience	Number of instances	(%)
Everyone	453	66.52%
Other target audience	178	26.14%
Children	65	9.54%
Pregnant women	16	2.34%
Older persons	8	1.17%
African American	4	0.59%
White American	1	0.15%

RQ2b asks about does any relationship exist between the major themes and target audience of CDC's COVID-19 vaccination posts. A series of Chi-square tests have been done to investigate the relation between themes and target audience. 49 posts were found as COVID-19 Vaccine supportive that were targeted to children. This finding is also significant as per Pearson's chi-square test [X^2 (1, N = 681) = 7.4, p = .005]. However, "Vaccine supportive" theme does not show significant relations with "Pregnant women", "Everyone", and "Other target audience". The chi-square test does not find any significant relationship with "Availability of vaccine" theme and "Children", "Pregnant women", "Everyone", and "Other target audience".

Significant relation has been found between "Up to date information" and "Everyone [X^2 (1, N = 681) = 21.46, p < .001], "Up to date information" and "Pregnant women" [X^2 (1, N = 681) = 10.78, p = .001], and "Up to date information" and "Other target audience" [X^2 (1, N = 681) = 10.72, p = .001]. However, no significant relation has been revealed between "Up to date information" and "Children".

"Other themes" is significantly related with "Children" [X^2 (1, N = 681) = 9.70, p = .001] and "Everyone" [X^2 (1, N = 681) = 20.92, p < .001]. However, no significant relations have been revealed with "Other themes and 'Pregnant women" and "Other target audience".

RQ3a asks to what extent did followers of CDC's *Facebook* page respond to its COVID-19 vaccine related posts in regard to the amount of comments, shares, and emotive reactions such as like, love, care, haha, wow, sad, and angry. Table 3 summarizes the mean (M) and standard deviation (SD) values for every reaction associated with a post. Concerning the number of likes (M = 2044, SD = 2519.13), posts

received a high degree of engagement/reaction from their followers. Comments (*M* = 1509, *SD* = 3303.24), shares (*M* = 844.1, *SD* = 2017.03) and haha (*M* = 406.8, *SD* = 965.11) have also received reasonable number of responses by the followers on those posts. The mean value for love and angry is (*M = 176.1*) and (*M = 128.1*) respectively and their standard deviation values are (SD = 272.41) and (SD = 878.70) accordingly. It was quite evident that sad (*M* = 49.9, *SD* = 192.72) care (*M* = 41.76, *SD* = 48.78) and wow (*M* = 31.79, *SD* = 159.53) received the least number of reactions on the posts compared to the other types of reactions.

Table 3

Follower's response toward the posts

Type of the reaction	Mean (M)	Standard Deviation (SD)
Likes	2044	2519.13
Comments	1509	3303.24
Shares	844.1	2017.03
Haha	406.8	965.11
Love	176.1	272.41

Table 3 (continued).

Angry	128.1	878.70
Sad	49.9	192.72
Care	41.76	48.78
Wow	31.79	159.53

A significant effect of post themes (e.g., Vaccine supportive, availability of vaccine, up to date information etc.) with receiving post reactions (e.g., likes, love, haha, angry, etc.) on the posts made by the CDC in regard to the COVID-19 vaccination messages has been found. T-test results indicate a significant preference in getting higher likes for the posts having "Vaccine supportive" theme (M = 2636.77) over the posts that do not have "Vaccine supportive" theme (M= 1210.05), t-(680) = -21.17, p < .001. Similar trend is found for the posts with "Up to date information" theme (M = 2221.87) over the posts without "Up to date information" theme (M = 1907.84), t-(680) = -21.17, p < .001. Conversely, a significant preference in getting fewer likes for the posts having "Availability of vaccine" theme (M = 1691.61) over the posts which do not have it (M = 2214.25), t-(680) = -21.17, p < .001 is found.

The number of love reactions has been increased on the posts with "Vaccine supportive" theme (M = 241.26) compared to the posts without "Vaccine supportive" (M = 84.50) and this result is significant, t-(680) = -16.81, p < .001. Almost similar trend is found for the theme having "Up to date information" (M = 198.01) compared to the theme without "Up to date information" (M = 159.38) and the result is also significant, t-(680) = -16.83, p < .001. However, the number of love reactions increased on the posts without "Availability of vaccine" theme (M = 191.54) compared to the posts with "Availability of vaccine" (M = 144.21) and this result was significant, t-(680) = -16.84, p < .001.

The number of angry reactions has been increased on the posts with "Vaccine supportive" theme (M = 179.84) compared to the posts without "Vaccine supportive" (M = 55.41) and this result is significant, t-(680) = -3.79, p < .001. Conversely, the number

of angry reactions has been reduced having the "Availability of vaccine" theme (M = 78.74) compared to the posts without the theme "Availability of vaccine", and the result is significant, t-(680) = -3.80, $p < .001$. Similarly, reduced angry reaction has been revealed on the posts having "Up to date information" theme (M = 96.90) compared to the posts without the theme "Up to date information" (M = 152.01), and the result is also significant, t-(680) = -3.80, $p < .001$.

The number of haha reactions has been increased on the posts with "Vaccine supportive" theme (M = 524.60) compared to the posts without "Vaccine supportive" (M = 241.16) and this result is significant, t-(680) = -10.98, $p < .001$. Similarly, increased haha reaction has been revealed on the posts having "Up to date information" theme (M =457.85) compared to the posts without the theme "Up to date information" (M = 367.81), and the result is also significant, t-(680) = -10.99, $p < .001$. Conversely, the number of haha reactions has been reduced having the "Availability of vaccine" theme (M = 380.59) compared to the posts without the theme "Availability of vaccine" (M = 419.49), and the result is significant, t-(680) = -10.99, $p < .001$.

RQ3b asks about to what extent post themes and target audience affect comment sentiment? Descriptive statistics show from Table 4, 31.28% (N = 213) comment sentiment is positive, 27.61% (N = 188) is neutral, 22.61% (N = 154) is negative, 13.21% (N = 90) very positive, and 5.29% (N = 36) comment sentiment is very negative out of total 681 posts.

Table 4

Comment sentiments

Sentiment type	Number of instances	(%)
Positive	213	31.28%
Neutral	188	27.61%
Negative	154	22.61%
Very positive	90	13.21%
Very negative	36	5.29%

Descriptive statistics show, out of 398 "Vaccine supportive" posts, 30.65% (N = 122) is positive, 25.38% (N = 101) is negative, 23.87% (N = 95) is neutral, 13.32% (N = 53) is very positive, and 6.78% (N = 27) is very negative. 295 posts are found with "Up to date information" theme where 37.63% (N = 111) comment sentiment is positive, 24.07% (N = 71) is neutral, 19.32% (N = 57) is negative, 15.93% (N = 47) is very positive, and 3.05% (N = 9) of the comment sentiment is found very negative. There are 222 posts having "Availability of vaccine" theme where 35.58% (N = 79) comment sentiment is positive, 25.22% (N = 56) is neutral, 20.72% (N = 46) is negative, 12.61% (N = 28) is very positive, and 5.85% (N = 13) is very negative. Among 297 posts having the "Other themes", 38.38% (N = 114) comment sentiment is found positive, 34.68% (N = 103) is neutral, 29.29% (N = 87) is negative, 18.18% (N = 54) is very positive, 8.75% (N = 26) is very negative.

Series of chi-square tests have been conducted to know relation between the major themes and comment sentiment. The results suggest that Vaccine supportive posts were positively related to comment sentiment [X^2 (4, N = 681) = 12.27, p = .01].

Similarly, posts having up to date information about vaccination, were positively associated with comment sentiment [X^2 (4, N = 681) = 19.39, p < .001]. However, relationship between "Availability of vaccine" theme and comment sentiment are not found significant [X^2 (4, N = 681) = 3.44, p = .49]. Similarly, "Other themes" and comment sentiment do not show significant relationship between them [X^2 (4, N = 681) = 5.06, p = .28].

Regarding comment sentiment of posts (N = 16) targeting "pregnant women", 50% (N = 8) is negative, 25% (N = 4) is neutral, 12.5% (N = 2) is very negative, 6.25% (N = 1) is positive, and 6.25% (N = 1) is very positive. Chi-square test shows, posts targeted pregnant women were negatively associated with public comment sentiment [X^2 (4, N = 681) = 10.97, p = .02]. Out of 65 posts targeting "Children" theme, 30.77% (N = 20) is neutral, 27.69% (N = 18) is positive, 26.15% (N = 17) is negative 12.31% (N = 8) is very positive, and 3.08% (N = 2) is very negative. However, the result of relationship between "Children" theme and comment sentiment is not significant [X^2 (4, N = 681) = 1.66, p = .80]. Similarly, no significant relation has been revealed between the posts targeting "Everyone" audience and comment sentiment [X^2 (4, N = 681) = 8.71, p = .07].

There are 453 posts found with the theme "Everyone", where 32.23% (N = 146) comment sentiment is positive, 24.28% (N = 110) is neutral, 23.40% (N = 106) is negative, 14.79% (N = 67) is very positive, 5.30% (N = 24) is very negative. On the other hand, no significant relationship has been occurred between the posts targeting "Everyone" as target audience and comment sentiment [[X^2 (4, N = 681) = 8.71, p = .06].

RQ4 asks about to what extent does CDC use the dialogic principles on its *Facebook* page while posting COVID-19 vaccination messages. Descriptive statistics

from Table 5 shows, out of the total 681 sampled posts, CDC mostly applied "Dialogic loop" 97.36% ($N = 663$), and "Generation of return visit" 97.21% ($N = 662$). "Ease of the interface" was prevalent in 606 posts (88.99%) followed by "Conservation of visitors" in 473 posts (69.46%). On the other hand, "Usefulness of information" was discovered to be the principle that received the fewest posts (320, or 46.99%).

Table 5

Dialogic principles

Principle type	Number of instances	(%)
Dialogic loop	663	97.36%
Generation of return visit	662	97.21%
Ease of the interface	606	88.99%
Conservation of visitors	473	69.46%
Usefulness of information	320	46.99%

Chi-square tests have been conducted to reveal existing association between the principles of dialogic theory and the major themes emerged from the posts. Findings indicate that the first principle "Dialogic loop" has statistically significant relation with "Vaccine supportive" [X^2 (1, $N = 681$) = 23.59, $p < .001$], "Up to date information" [X^2 (1, $N = 681$) = 12.38, $p < .001$], "Other themes [X^2 (1, $N = 681$) = 12.53, $p < .001$]. But no considerable association was observed between "Availability of vaccine" and "Dialogic loop" [X^2 (1, $N = 681$) = 7.48, $p = .006$]. The third principle "Generation of return visit" suggests statistically significant relation with "Vaccine supportive" [X^2 (1, $N = 681$) = 25.07, $p < .001$], "Availability of vaccine" [X^2 (1, $N = 681$) = 7.99, $p = .004$], "Up to date

information" [X^2 (1, N = 681) = 9.99, p = .001], and "Other themes" [X^2 (1, N = 681) = 13.35, p < .001]. The second principle "Usefulness of information" shows statistically significant association with "Vaccine supportive" [X^2 (1, N = 681) = 48.02, p < .001], "Availability of vaccine" [X^2 (1, N = 681) = 8.87, p = .002], "Up to date information" [X^2 (1, N = 681) = 17.35, p < .001], and "Other themes [X^2 (1, N = 681) = 9.64, p = .001] . Significant relations have been found between "Ease of the interface" principle and "Vaccine supportive" theme [X^2 (1, N = 681) = 16.46, p < .001]. However, no significant relations have been revealed between "Ease of the interface" principle and two major themes i.e., "Availability of vaccine" [X^2 (1, N = 681) = 1.06, p = .302] and "Up to date information" [X^2 (1, N = 681) = 2.98, p = .084]. "Conservation of visitors", the fifth and last principle of dialogic theory shows significant relation with "Vaccine supportive" [X^2 (1, N = 681) = 4.06, p = .04] and "Up to date information" [X^2 (1, N = 681) = 27.79, p < .001]. However, no significant relation found between "Conservation of visitors" and "Availability of vaccine" [X^2 (1, N = 681) = .01, p = .902].

Series of chi-square tests have been conducted to know relation between the principles of dialogic theory and major target audience found in CDC's COVID-19 vaccination posts. Results indicate that there is meaningful relationship between "Dialogic loop" and "Everyone" [X^2 (1, N = 681) = 33.73, p < .001]. However, "Children", "Pregnant women", and "Other target audience" do not have significant relations with "Dialogic loop". The second principle of dialogic theory "Usefulness of information" shows significant association with "Children" [X^2 (1, N = 681) = 5.58, p = .01], "Everyone" [X^2 (1, N = 681) = 21.70, p < .001], and "Other target audience" [X^2 (1, N = 681) = 12.39, p < .001] though no significant relation is found between "Usefulness

of information" and "Pregnant women". The third principle of dialogic theory "Generation of return visit" shows significant relationship with "Everyone" [X^2 (1, N = 681) = 30.16, p < .001], and "Other target audience" [X^2 (1, N = 681) = 5.59, p = .01]. However, it does not show significant association with "Children" and "Pregnant women". The fourth principle "Ease of the interface" shows significant relation with "Children" [X^2 (1, N = 681) = 7.69, p = .005]. However, it does not show significant relations with "Pregnant women", "Everyone", and "Other target audience". The last principle "Conservation of visitors" shows significant relation with "Children" [X^2 (1, N = 681) = 12.23, p < .001] and "Other target audience" [X^2 (1, N = 681) = 5.05, p = .02]. However, there is no significant relations found with "Conservation of visitors" and "Pregnant women" and "Everyone".

CHAPTER V – DISCUSSION

The results of this study put forward understanding into the avenue a national public health agency contact with the people to disseminate COVID-19 vaccination messages through social media based on the principles of dialogic theory of public relations all through the COVID-19 pandemic.

The first research question was designed to find what key themes surfaced most in the COVID-19 vaccination postings made on its official *Facebook* page by the CDC over the last two years. The major themes that prevail prominently have been mentioned as "Vaccine supportive", "Availability of vaccine", "Up to date information" and "Other themes".

The theme of "Vaccine supportive" emerged with statements related to protecting serious illness and saving lives, providing protection for immune system, preventing virus variants from spreading, ending the COVID-19 pandemic etc. Messages like "vaccine outweigh known or potential risks", "Getting vaccinated is safe, easy, and free!", "COVID-19 vaccines can help end the COVID-19 pandemic", "Get COVID-19 vaccinated promptly to save you and your family", "People fully vaccinated against COVID-19 are safe from severe illness and mortality, including from Delta versions., "People not vaccinated fully against COVID-19 remain at risk", "COVID-19 vaccines help prevent the Delta variant from spreading. Vaccines work. Vaccines can save lives. Get a vaccine.", "COVID-19 vaccinations boost immunity, according to research", indicated a theme of promoting vaccination.

The theme of "Availability of vaccine" has developed with messages like "Refer to this table to see which COVID-19 vaccines are suitable for a given age group", "Find

your vaccine: www.vaccines.gov.:=:https://www.vaccines.gov/", "Find your booster: www.vaccines.gov:=:https://www.vaccines.gov/", "Make it a priority to receive the COVID-19 vaccine as soon as it is made accessible to you", "Visit vaccines.gov to find vaccination providers near you.", etc.

"Up to date information" is another theme that has become prominent from CDC's COVID-19 vaccination messages published on the *Facebook* page during the last two years of the pandemic. Some of the significant examples of messages include, "As of February 2, 2022, more than 88 million individuals across the USA have taken COVID-19 booster doses.", "Everyone above18 years and older can get a COVID-19 booster shot", "After receiving the COVID-19 vaccine, some persons may experience temporary adverse effects.", "COVID-19 vaccination side effects are normal and a sign of immunity.", "FDA approved vaccines protect against Delta and other strains of the virus", "The Moderna vaccine reduced the risk of hospitalization by 93%, the Pfizer-BioNTech vaccine by 88%, and the Johnson & Johnson Janssen vaccine by 71% when administered at full dose.", "Some COVID-19 vaccinations need two doses. Pfizer-BioNTech and Moderna COVID-19 vaccines necessitate double doses for maximum protection.", etc.

Although posts having "Vaccine supportive" theme mostly appeared, the theme that has been emerged as the second highest of visibility of posts on CDC'S official *Facebook* page is "Other themes" which chiefly include COVID-19 health rules (e.g., "Wear a mask with multiple layers. Stay at least 6 ft apart. Avoid crowds & poorly ventilated spaces. Wash hands often.", etc.), misinformation regarding COVID-19 vaccination (e.g., "Help stop the spread of misinformation. Use reliable sources to dispel

COVID-19 vaccination misconceptions.", "Let's bust some common myths and learn facts regarding COVID-19 vaccination", etc.) (Lane et al., 2018 and Lazarus et al., 2021), vaccine safety concern, vaccine effectiveness (e.g., "It's safe and effective at helping prevent COVID-19", "The speedy development and production of the COVID-19 vaccines did not compromise the stringent safety and efficacy criteria demanded of all vaccines.", etc.), types of vaccines and how they work (e.g., "If you get an mRNA vaccine, be sure to get both doses", "2-dose mRNA vaccine is as safe as possible and well-tolerated"), vaccination records (e.g., "You receive a vaccination card at the time of your vaccination that details the COVID-19 vaccine you received as well as the location and date of your immunization."), statistics of daily new COVID-19 cases (e.g., "Rates of COVID-19 cases remain high, especially in parts of the Midwest and Northeast", "The COVID-19 infections keeps climbing across a large portion of the United States", Over 90% of current cases are caused by the Delta variant.", etc.), addressing the barriers to COVID-19 vaccination (e.g., "People in rural areas are less likely to have been vaccinated against COVID-19 than those in urban areas.", "Vaccine access for older people get delayed without a computer, living in poverty, without internet access, and living alone", etc.), and who will get the vaccine and when (e.g., "Frontline workers, healthcare professionals, other essential workers, people ages 75+ and residents of long-term care facilities were the first groups recommended for vaccination" etc.)?

Most of the communications about vaccinations seemed to have a tone that encouraged people to get the shots, which was interesting. The CDC was not only careful about spreading promotional messages, but it was also active about telling people where they could get vaccines in their area. During the first two years of the pandemic, the

world was exposed to different strains of COVID-19, such as delta, omicron, and others. Because of this, people had to take more doses of the vaccine and get booster shots. So, people were in need of getting up to date information on vaccinations. As a direct response, the CDC continued to post new information about the COVID-19 vaccination on its *Facebook* page. The majority of the information regarding COVID-19 vaccination includes debunking the myths surrounding vaccines, ensuring the safety and efficacy of various types and brands of vaccines, maintaining COVID-19 health protocols, regularly updating numbers of people who have been vaccinated across the country, focusing on achieving vaccine equity and reducing disparity among population, and distributing vaccines on a priority basis. This makes sense when one takes a conscious look at the messages that are contained within the "Other themes".

The prominent audience that are chiefly targeted by CDC's COVID-19 vaccine-related *Facebook* posts include "Everyone", "Other target audience", "Children" (e.g., "Children ages 5–11 are now eligible for a free COVID-19 vaccine", "By vaccinating children ages 5 & older, we can help protect them from getting COVID-19."), "Pregnant women" (e.g., "Getting the COVID-19 vaccine is an absolute necessity if you are pregnant, want to become pregnant, or are currently pregnant."), "Older persons" (e.g., "Older adults and people with disabilities can access statewide hotlines for help finding vaccine information."), "African American", and "White American". The CDC usually mentions people from all walks of life while posting a COVID-19 vaccination message on their *Facebook* page. Hence, audience under "Everyone" (i.e., people from all walks of like excluding "Other target audience) category has got most attention among the total posts. The healthcare professionals, students, educators, parents, younger adults,

adolescents, immunocompromised people, NFL players and fans are the significant audience that conclude the “Other target audience”. Apart from “Everyone” and “Other target audience”, the “Children” and “Pregnant women” got considerable attention from CDC followed by “Older persons”, “African American”, and “White American”.

The link, if any, that may have existed between the most prevalent themes and the major target audience is the subject of investigation for one of the research questions. There is no other audience category outside “Children” that is intended to receive promotional posts regarding the COVID-19 vaccination. Based on the number of anti-vax and neutral comments posted under CDC's COVID-19 vaccine postings, it appears that many parents are hesitant to vaccinate their children against COVID-19. This finding indicates CDC considered the children as an important group for vaccine uptake. The CDC kept its target audience updated about COVID-19 vaccination issues during the two years of COVID-19 pandemic. According to the findings, each and every target audience with the exception of children had been highlighted in the COVID-19 vaccination posts whenever there was an update on vaccines. Perhaps this is due to the fact that adult vaccination confidence is more challenging to the adults to achieve than that of children. Furthermore, if the children's parents or guardians give consent to have them vaccinated, the kids will take the COVID-19 vaccine. The major target audience such as “Everyone”, “Children”, “Pregnant women”, and “Other target audience” are not highly considered for delivering “Availability of vaccine” messages.

The study inquires as to the degree to which those who follow the CDC’s *Facebook* page responded to posts on the COVID-19 vaccine according to the number of comments, shares, and emotional reactions such as like, love, care, haha, wow, sad, and

angry expressions. The *Facebook* posts having vaccine promotional messages and up to date and/or latest information about vaccinations, received higher likes and loves reaction from users. However, *Facebook* posts that are intended to promote COVID-19 vaccination process and had updated information about vaccines obtained higher angry and haha reactions. Conversely, the posts with vaccine availability information got fewer haha reaction from users. This may indicate people did not show interests in pushing strategy for vaccine uptakes repeatedly. But, they were not reluctant to get information about vaccine availability. The findings also suggest that people who are positive to vaccination against COVID-19 are likely to put "like" and "love" reactions on the posts though they show opposite trend to the posts regarding "Availability of vaccine" theme. Based on the result from "angry" reactions, it seems that people want to get up to date information about COVID-19 vaccination regardless of their stand related to vaccination. Based on the "haha" reactions, it could be assumed that more people showed a sign of ridicule or scorn on the posts having "Vaccine supportive" and "Up to date information" regarding COVID-19 vaccination. However, people tend to have the information of vaccine availability because they put fewer "haha" reactions on the posts having "Availability of vaccine" theme.

In order to know audience response toward COVID-19 vaccination messages, this study examined comment sentiment obtained from each post. The outcomes of the study as a whole indicate that the percentage of comments with a positive sentiment is higher than the percentage of comments with a negative emotion regarding "Vaccine supportive" and "Up to date information" theme. Similar trend is found for the messages with the themes "Availability of vaccine", and "Other themes". This result validates

finding of previous study that investigates government agencies' *Facebook* posts having more positive sentiment content received relatively homogenous positive reactions (Rianto & Pratama, 2021). Moreover, the posts having the themes of "Vaccine supportive" and "Up to date information" are found getting more positive comment sentiment than that of posts having the theme of "Availability of vaccine" and "Other themes".

Comment sentiment of posts targeting pregnant women was found negative. Perhaps, most of the women commented under this type of post were not enough confident for having COVID-19 vaccines during pregnancy. However, the comment sentiment of the posts targeted to children was not identified. When the percentage of positive (e.g., "Time for my booster! Scheduled for tonight. Thanks for getting the word out! Going to get my flu vaccine too.") comment sentiment is more than that of negative (e.g., "I never questioned vaccines before but after the marketing of this "pandemic" it gives cause to speculate.") and neutral comment (e.g., "Thing is, the people who need to hear this don't care.") sentiment, then the post could be treated as positive sentiment and vice versa. This result warrants previous finding of Hu et al. (2021) that is, Twitter users showed an increasing positive attitude and a dropping negative sentiment regarding COVID-19 immunizations in most U.S. states, expressing "8 categories of emotion, including joy, trust, anticipation, trust, surprise, disgust, grief, and fear" (p. 9). However, the neutral comment sentiment may create vaccine hesitancy. Because, Lappeman et al. (2021) argue, if the public has a negative or ambivalent outlook about COVID-19 immunizations, it might reduce uptake throughout the rollout and have a smaller impact than expected. This result is almost similar to the finding of Hussain et al. (2020) which

can be used to make plans for getting reliable health information out there and for better communication to build trust and understanding.

The study also inquires of the extent to which the CDC employs dialogic principles while disseminating COVID-19 vaccine messages on its *Facebook* page. The exploitation of social networking site as an interactive medium to engage the public in a proactive manner during a global health crisis is a crucial non-pharmaceutical intervention method meant to safeguard and enlighten individuals (Han et al., 2020, as cited in Landi et al., 2021).

The national public health agency, CDC, does not seem to be acquiring complete benefit of the opportunities delivered by dialogic principles equally to provide public with COVID-19 vaccination messages through its official *Facebook* page though it has every potential resource to utilize the dialogic principles entirely. This very insight warrants findings from previous studies that organizations seemed to be curious to employ part of the principles (del Mar Gálvez-Rodríguez et al., 2018; McAllister-Spooner, 2009; Waters et al., 2011). Previous studies suggest, some government organizations focus on posting information in general (del Mar Gálvez-Rodríguez et al., 2018), while some other emphasize on posting catchy content to attract the users and get the followers remained staying on social networking sites (Haro-de-Rosario, 2018 and Kim et al., 2014). Consequently, The CDC mostly applies “Dialogic loop”, “Generation of return visit”, and “Ease of the interface” principle while publishing the COVID-19 vaccination posts. However, this result has brought some sort of opposite findings to several prior literatures where it is considered that “Generation of return visit” is the

hardest principle to achieve to the fullest of efficacy (McAllister-Greve, 2005; Seltzer and Mitrook, 2007; Taylor and Kent, 2004; as cited in Waters et al., 2011).

Part of the reasons behind having the "Dialogic loop" and "Generation of return visit" mostly applied could be addressed as all 681 posts were enabled to get comments and replies from the followers and almost all the posts had additional link(s) to news, press releases, other websites, FAQs, etc. Although, CDC used "Dialogic loop" mostly, it is appeared that, it did not reply frequently to the questions posted from the followers. This outcome agrees with those of prior research where 59% of the health centers responded to the users' comments (Waters et al., 2011).

Almost all the posts were stamped with CDC's logo and/or photo(s) which enabled the posts successfully employing "Ease of the interface" principle. These findings support the previous results of using relevant images (Waters et al., 2011). Many of the posts had catchy headlines or captions or CDC's self- website link which enabled the visitors to stay more time and conserve return visits to the page. Finding from Waters et al. (2011) also support that university health centers often posted cartoon, mascots, and images aimed to their *Facebook* users. All the posts were not published with audio-visual voice or graphical presentation. Hence, "Usefulness of information" was the least applied principle. However, a deeper level of user involvement may result from combining "Usefulness of information" with "Dialogic loop" and "Generation of return visit" as found by del Mar Gálvez-Rodrguez et al. (2018).

The CDC designed its vaccination posts in such a way that mostly employed three principles (i.e., dialogic loop, generation of return visit, and ease of the interface) of dialogic theory to disseminate messages having all themes i.e., "Vaccine supportive",

"Availability of vaccine", "Up to date information", and "Other themes". This investigation hints that, though the rest of the two principles (i.e., conservation of visitors and usefulness of information) were applied partly by the CDC with the COVID-19 vaccination posts, the dialogic theory of public relations was found positively associated with the major themes found in the study. The CDC's vaccine posts aimed towards "Children" prominently included all aspects of dialogic theory with the exception of the "Dialogic loop". Perhaps the postings intended for youngsters might have included additional audio-visual content, graphics, images, and connections. However, youngsters may be more hesitant than adults to provide feedback (e.g., comments, etc.) under the posts. Posts targeted to children were also adorned with catchy headlines or captions, CDC's official logo that enabled the posts having considerable relationship with the "Ease of the interface" principle.

Practical Implication

The findings of this study would offer insights on government agencies' strategic communication efforts to support the COVID-19 immunization program and on stated public reactions to campaign. CDC could build an active "dialogic loop" by responding to users' comments as frequently as possible. By responding to users' comments as frequently as possible, CDC could build an active "dialogic loop" which eventually would be effective to make pregnant women confident enough for taking shots, to remove confusions of parents of children to get their kids vaccinated, and to get the questions from high-risk population answered. CDC may heighten the use of "Usefulness of information" principle of dialogic theory with graphics, audio-visual speech, and narratives which could add more interactive features to the COVID-19 vaccination

messages. Messages for vaccine uptakes should be circulated in a timely manner. While dealing with the pandemic, the result of this research would be helpful especially for the federal and state government agencies in crafting effective health message and undertaking equitable strategies and policies for the vaccination. This study's data can be utilized to better understand national concerns and reactions around COVID-19 vaccinations that might necessitate more targeted, tailored, and public acceptable *Facebook* content regulations in regard to vaccines. Especially, the results of this project could be useful to generate specific message design for individual groups (e.g., children, public, pregnant women, minorities etc.).

Limitations and Future Research

Despite several remarkable findings, the drawbacks here include a very small sample size in terms of comments. This research considered only five initial comments per post. In addition, future study would expand the sample size by incorporating additional social media to generate better results for other government entities. In addition, more substantial and generalizable findings may be achievable if future research is undertaken in conjunction with content analysis and in-depth interviews from public relations professionals.

Conclusion

Government and non-government organizations have been updating their websites with new content for years. Earlier research shows that many of them operate social networking sites as an extension of their websites, linking to relevant internal and external resources including news articles, press releases, documents, frequently asked questions, etc. (Kim et al., 2014 and Waters et al., 2011). Although these methods are

efficient at disseminating information in a one-way fashion, they do very minimum to spark conversation among the intended audience.

However, this study concludes that the national public health agency of the United States continues to refrain from making the full use of Facebook's dialogic potentials, though it is attempting to make use of certain dialogic characteristics (e.g., dialogic loop, generation of return visit, ease of the interface) of this social media platform. The empirical results of this study recommend CDC to give more emphasis on "Usefulness of information" (e.g., audio-visual speech, narratives, graphics, etc.) principle while crafting messages aimed at target audience. On one hand it is found that, most of the people are not reluctant to get vaccine promotional messages regularly. On the other hand, people mostly reacted angrily to the repeatedly posted vaccine promotional messages. Drawing attention from this contradictory finding, the study suggests for a timely balanced promotional message for COVID-19 vaccination. Furthermore, two years have passed with the pandemic, still people are not confident enough for taking COVID-19 vaccines during pregnancy though most of them are confident in taking other vaccines. Parents are confused about children's vaccine uptakes. Questions about children's vaccination are found prevailed on the comment threads. Therefore, this study suggests the government agency to respond frequently to the questions or concerns (e.g., side effects and misinformation regarding vaccination etc.) made by the users under each *Facebook* post which will eventually make the platform more interactive and productive as well.

APPENDIX A - Coding Instrument

General Instructions for Coders

Categories are labeled according to their corresponding column in the Excel spreadsheet (e.g., coder number is labeled "1" in accordance with its position in the spreadsheet). Coders should categorize evolving themes of the posts first, then target audience of the CDC's posts second. After that, coders should categorize the five principles of dialogic theory using sub-categories. Previously entered data should not be altered.

1. Please enter your coder number. Before coding, please record your coder number in each row of the excel file.

Coder A = 1

Coder B = 2

Research question 1: Which themes were most prevalent in CDC's COVID-19 vaccine-related *Facebook* posts?

Evolving themes

Posts may be accessed by viewing the message box or by the post URL (i.e., the link provided in the Excel file). The following 4 categories address the evolving themes of CDC's COVID-19 vaccination related *Facebook* posts. Each post can be coded for multiple themes. These categories require an assessment of latent features.

2. Vaccine supportive (Elkin et al., 2020)**.** The post describes COVID-19 Vaccine supportive idea. As a few examples, "Getting vaccinated against COVID-19 could protect you and your family members" and "I have taken COVID-19 vaccine during my pregnancy, and it is completely safe". This category will stress on motivational and

advocating factors for taking COVID-19 vaccine (e.g., COVID-19 vaccine helps to protect friends and family, free of cost). This theme should be coded as "1" if present. Otherwise, code "0".

3. Availability of vaccine (Park et al., 2011). The post includes information that indicate COVID-19 vaccines are easily attainable and accessible. For example, "Get a vaccine when it's available to you", "Visit vaccines.gov to locate a provider of immunization services in your area.", "Find a vaccine near you", "COVID-19 vaccines are now available in all the public health centers", "Find walk-in COVID-19 vaccine centers near you" and "disable individuals may be able to get an in-home vaccination service"**.** This should be coded as "1" if present. Otherwise, code "0".

4. Up to date information (Park et al., 2011). The post includes latest and updated information about COVID-19 vaccinations (e.g., new vaccine brand, number of vaccinated individuals, booster doses, novel side effects etc.). For example, "Approximately 75 percent of the U.S. population, have taken at least one dose of COVID-19 vaccine", and "Pfizer-BioNTech is going to release their second booster doses soon". This should be coded as "1" if present. Otherwise, code "0".

5. Other themes. If the post does not refer to the previous 6 categories and indicate anything else other than those 6 categories (e.g., COVID-19 health rules, vaccine ingredients, how COVID-19 vaccine works, notes against anti-vaccination groups) code "1" otherwise code "0". As examples, "Like other successful vaccines, COVID-19 vaccine also has several success stories" and "Mississippians are slowly getting COVID-19 vaccines compared to the Texans".

Research question 2a: Which groups appeared mostly as the target audience of CDC's COVID-19 vaccine-related *Facebook* posts?

Research question 2b: Does any relationship exist between the major themes and target audience of CDC's COVID-19 vaccination posts?

Target audience

The following categories concern the target audience of CDC's COVID-19 vaccination post on their *Facebook* page. The post may target one or more group of people for COVID-19 vaccination information and thus each should be coded independently. If a group is not clearly targeted, that group should not be coded. For each present group, code "1". Otherwise, code "0".

6. African American (Aleem, 2020; Yancy, 2020). If the post is entirely targeted to the African American community or individuals (e.g., "African Americans are greatly encouraged to take COVID-19 vaccines and booster", "An increasing rate of getting vaccination in black communities are being observed in southern regions", and "A priest of a black church plead for getting vaccination in Alabama" etc.), code "1" otherwise code "0".

7. White American (Aleem, 2020; Yancy, 2020). The post will indicate COVID-19 vaccine information for white American people or communities. As examples, "White Americans are ahead in vaccine uptakes, recent data shows", and "More than 60% Caucasian students took booster shot in a southern university". If the post indicates this group as their target audience, code "1" otherwise, code "0".

8. Older persons (Huo et al., 2019)**.** The post will be directed towards senior citizens or older persons. Code "1" if the group is targeted by the post otherwise code

"0". As examples, "People over 65 years old would receive COVID-19 vaccines first" and "Fully vaccinated 65 years old people are less likely to go to hospital than who are not vaccinated in this group". If the post indicates this group as their target audience, code "1" otherwise, code "0".

9. Pregnant women **(**Du et al., 2017; Martin et al., 2020)**.** When the post targets the pregnant women in regard to COVID-19 vaccination information, Code "1" otherwise code "0". For examples, "COVID-19 vaccines are safe for pregnant women", and "COVID-19 vaccines help keep pregnant women away from getting severe illness". If the post indicates this group as their target audience, code "1" otherwise, code "0".

10. Children (Aucejo et al., 2020; Duong et al., 2020; Loades et al., 2020)**.** The post will target kids or children (e.g., newborns, infants, school-going children) in COVID-19 vaccination information. For examples, "Every kid of 5-year-old and above should be vaccinated against COVID-19, "Get you children vaccinated and help them doing their favorite activities". Code "1" if children are targeted otherwise code "0".

11. Everyone. (when these 5 categories of people are addressed then code "1", otherwise code "0".)

12. Other target audience. If the post targets any other groups (e.g., Asians, indigenous people, tribals) except the previous 5 identified groups, code "1" otherwise code "0". For examples, "Red Indians or other ethnic minorities are responding greatly to take COVID-19 vaccines in 2022", "Wes Studi (actor, Oscar recipient) offers COVID-19 vaccine guidance to tribal communities"

Research question 4: To what extent does CDC employ the dialogic principles on its *Facebook* page?

Five principles of dialogic theory

The following categories are associated with Kent and Taylor's (1998) five principles of dialogic theory of public relations— "dialogic loop", "usefulness of information", "generation of return visits", "ease of interface", and "conservation of visitors". Each post will be evaluated by one or more principles of the dialogic theory and thus should be coded independently. For each present principle, code "1". Otherwise, code "0".

13. Dialogic loop. If the post provides opportunity for users to comment, vote (e.g., online poll), Provision of surveys (e.g., one or more links for any official surveys) code "1" otherwise code "0".

14. Usefulness of information. If the post contains speeches (e.g., A speech from the director of CDC, Rochelle Walensky or a video speech on COVID-19 vaccination for pregnant women from Dr. Jacqueline Walters, MD, OBGYN etc.), audio-visual posts (audio/video files, links, graphics etc.), Links to press release code "1" otherwise code "0".

15. Generation of return visit. If the post contains Links to other websites (e.g., fda.gov, who.int, hhs.gov), Links to news (e.g., shares news reports related to vaccine information, published in print, electronic, and online media), FAQs (e.g., a post replies to common vaccine related questions of the users), code "1" otherwise code "0".

16. Ease of the interface. If the post contains Logo (e.g., CDC's logo), and/or picture code "1" otherwise code "0".

17. Conservation of visitors. If the post contains Catchy titles (e.g., "Pregnant? COVID-19 vaccines may protect babies"), Cartoons, Link to the self-website (e.g.,

CDC's official website), Recent update within 24 hours (e.g., updating the number of vaccinated individuals within 24 hours in a certain county) code "1" otherwise code "0".

Research Question 3a: To what extent did followers of CDC's *Facebook* page respond to its COVID-19 vaccine related posts in regard to the amount of comments, shares, and emotive reactions such as like, love, care, ha ha, wow, sad, and angry?

Research Question 3b: To what extent post themes and target audience affect comment sentiment?

18. Comment Sentiment

18.1 Positive. Code "1" if the user's comment is positive.

18.2. Negative. Code "-1" if the user's comment is negative.

18.3. Neutral. Code "0" if the user's comment is neutral.

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