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| RESEARCH ARTICLE

COVID-19 Infographics in Saudi Arabia

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| ABSTRACT
This research aims to evaluate the usage of social media platforms and infographics during the COVID-19 pandemic in Saudi Arabia. The study focuses on the infographics posted on Twitter accounts, including the official Saudi Ministry of Health and other governmental and private healthcare sectors. The aim of the study is to assess the response to COVID-19 infographics by analyzing their engagement metrics and to explore the topics and contents of COVID-19 infographics. A total of 166 infographics posted between January and June 2022 were analyzed using a cross-sectional design. The study explores various variables, including infographic characteristics, stand-alone effectiveness, initiation of actions, direct references to COVID-19, graphic representations, and text density. Data analysis was performed using SPSS software, and frequencies and percentages were used to describe categorical variables. The mean and standard deviation were used for continuous quantitative variables. Chi-square and Fisher's exact tests were employed to compare outcomes between the official MOH account and other health sectors. The results showed that 77.7% of infographics mentioned references or sources, and 56% were text heavy. Graphics were present in 56% of infographics, and 31.3% were structured. The majority (86.8%) of infographics were stand-alone entities. Moreover, 83.1% included data or information, and 57.8% focused on COVID-19 prevention aspects, with vaccination being the predominant topic (69.8%). Infographics with quotes had a statistically significant association with the number of likes, retweets, and quotes. Graphic representation and text density were also significantly associated with the number of likes and retweets for the infographics. The study underscores the importance of social media platforms and infographics in effective crisis communication during the pandemic and highlights areas for improving information dissemination and engagement with the public.

| KEYWORDS

Cross-sectional; COVID-19; infographics; social media; Twitter; Saudi Arabia

| ARTICLE INFORMATION

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1. Introduction

Coronavirus 2 (SARS-CoV2), frequently abbreviated as COVID-19, succeeded the coronavirus outbreak that impacted the Middle East after the eruption of MERS-CoV, which was documented in Saudi Arabia in 2012 (Ameen et al., 2020). The coronaviruses represent the Coronaviridae family that causes neurological and respiratory diseases (Zhao et al., 2020). COVID-19 exhibits an incubation period that typically ranges from two to fourteen days. Human-to-human transmission, primarily through respiratory droplets, is a possible mode of COVID-19 infection spread (Lu et al., 2020).

Saudi Arabia, the second largest Arab country with a population of over 34 million (General Authority for Statistics, 2023), experienced a rapid surge in COVID-19 cases after the first case was announced on 2 March 2020. The Ministry of Health (MOH) in Saudi Arabia is the primary healthcare provider, offering approximately 60% of healthcare services nationwide, while the remaining is provided by other governmental and private facilities (Ministry of Health, 2019). In response to the outbreak, the country swiftly implemented preventive measures, including partial curfews, event suspensions, school closures, business

shutdowns, and even a general lockdown at one point (*The Official Saudi Press Agency,2020)*. To combat the outbreak effectively, Saudi Arabia launched a national campaign of mass screening, starting with an active screening phase targeting symptomatic and asymptomatic cases and their close contacts in densely populated neighborhoods. This initiative helped locate and contain local outbreaks, leading to intensified measures in heavily infected areas (Ministry of Health, 21 April 2020). Subsequently, a community screening phase targeted low-to-intermediate-risk groups identified using the "Mawid" screening tool (Ministry of Health, 24 April 2020). These comprehensive efforts aimed to control the COVID-19 pandemic effectively.

Effective communication during public health emergencies like the COVID-19 pandemic is essential to keep the public updated, motivate them to adopt preventive measures and provide reassurance that the government is managing the outbreak (Zhao et al., 2020). Traditionally, governments and public health authorities have relied on websites, print media, and television for disseminating outbreak-related information, but the rise of social media has facilitated increased information sharing for both authorities and the general public (Alhassan & AlDossary, 2021). Social media platforms allow two-way communication and direct engagement with audiences (Moorhead et al., 2013), with over 3.8 billion active users worldwide across various platforms (Kemp, 2020).

The use of social media in health education and promotion has proven effective in providing access to information, delivering health campaigns, and offering social support (Alhassan & AlDossary, 2021). Notably, government agencies and public health organizations, including the WHO, CDC, and local health departments, have embraced social media to enhance communication with the public (World Health Organization, 2021). During the COVID-19 pandemic, social media has been an essential tool for disseminating outbreak-related updates and critical information to the public, influencing their decision-making and subsequent behaviors. However, few studies have explored the specific utilization of social media by the Ministry of Health (MOH) during disease outbreaks in Saudi Arabia (Alhassan & AlDossary, 2021). With millions of Twitter users in the country (Clement, 2018), Twitter presents an opportunity to examine the MOH's use of social media for crisis communication. According to a national survey, approximately 78% of respondents reported the MOH as their main source of information about COVID-19 (Aldarhami et al., 2020).

Infographics are visual tools that combine information and graphics to effectively communicate complex data through graphs, diagrams, and accompanying text (Scott et al., 2016; Wilkinson et al., 2016). They have been used in various fields, including knowledge translation, conveying economic and political information, teaching, and research dissemination (Murray et al., 2017; Provvidenza et al., 2019; Scott et al., 2016; Thoma et al., 2017). A well-designed infographic simplifies intricate information, making it understandable and accessible, especially for individuals with low health literacy (Arcia et al., 2015). They enable rapid communication of information to those with limited time to grasp more complicated concepts (McCrorie et al., 2016). Infographics can be disseminated through digital or print media for mass communication or displayed at healthcare facilities (McCrorie et al., 2016). Social media platforms like Twitter also utilize infographics for various purposes. Overall, infographics are valuable in health communication and help bridge the gap between complex information and its comprehension among diverse audiences.

Despite several investigations into the use of social media platforms during infectious disease outbreaks, there is currently a lack of studies evaluating the usage of these platforms and infographics in Saudi Arabia during the COVID-19 pandemic. Therefore, this study explores the community's response to COVID-19 infographics posted on the official Saudi Ministry of Health accounts and other private and governmental health care sectors. This research aims to evaluate the usage of social media platforms and infographics during the COVID-19 pandemic in Saudi Arabia. The study focuses on the infographics posted on Twitter accounts, including the official Saudi Ministry of Health and other governmental and private healthcare sectors. The aim of the study is to assess the response to COVID-19 infographics by analyzing their engagement metrics and to explore the topics and contents of the COVID-19 infographics.

2. Methodology

The study employed a cross-sectional design to review COVID-19 infographics posted during the pandemic. The study was conducted using Twitter accounts of major government and private healthcare institutions in Saudi Arabia, where COVID-19 related infographics were posted. A sample of 166 tweets containing infographics was collected and evaluated. The study focused on infographics shared on Twitter accounts, including the official account of the Saudi Ministry of Health and other private and governmental healthcare sectors in Saudi Arabia. Data regarding COVID-19 infographics were collected using a semi-structured data collection form. The study collected and included infographics from the Twitter accounts of the Saudi MOH and other governmental and private health sectors. These infographics were posted during the period from January 2022 to June 2022.

2.1 Eligibility Criteria

The study included original tweets or posts in Arabic or English related to COVID-19. However, retweets or shares were not included. Tweets in languages other than Arabic or English and those unrelated to COVID-19 were excluded after manual content

scanning. Additionally, content containing links to other sources of information, such as text, videos, infographics, or pictures, was also excluded.

2.2 Data Collection Form

The data collection form was designed by reviewing the published literature (Jahan et al., 2020; Pandya, 2021). For each tweet, including the infographic, information regarding the number of likes, number of retweets, and number of comments, was collected. Moreover, the category of the target audience, whether the infographic is 'text-light' (covering < 50% of the infographic) or text-heavy, and if the source/references are documented in the infographic, was also recorded on the data collection form. Other variables included the topic and main domain of the infographic; standalone entity (infographic effectively communicates information without the need for additional sources); initiating action (by using imperative and directive sentences to prompt readers to take preventive measures against COVID-19); and direct reference to COVID-19 (using terms like "coronavirus" and "COVID-19,"). Furthermore, the variables included 'beneficial interactions' (show positive actions in graphics like wearing masks and using sanitizers); 'detrimental interactions' (depict harmful activities like touching infected surfaces); 'structure of the infographic' (abstract or structured, with the latter having a clear flow and organization); 'introductory sentence' (providing an overview of the topic); and presence or absence of graphic representations of COVID-19 symptoms such as coughing, sneezing, and fever. All the above variables were recorded as 'Yes/No' categories.

2.3 Data analysis

Data entry and other statistical analyses were performed with the statistical software SPSS (version 22). Frequencies and percentages were used to describe categorical variables, and the mean and standard deviation were used to describe continuous quantitative variables. Chi-square and Fishers-exact tests were employed for inferential statistics. P-value < 0.05 was considered significant.

2.4 Ethical considerations

The study did not involve any human subjects. All data analyzed in this study were publicly available and collected from governmental public MOH and other tweeter accounts from Saudi Arabia. Ethical approval for the study was obtained from the Qassim Regional Research Ethics Committee.

3. Results

A total of 166 infographics posted during the first 6 months of the year 2022 were reviewed. Table 1 shows the general characteristics of COVID-19 infographics. A total of 129 (77.7%) infographics mentioned references or sources, and 93 (56%) were text heavy. The graphics were included in 56% of the infographics, and only one-third (31.3%) of them were structured. The majority (86.8%) of the infographics were stand alone and did not need any supporting text or attachment to understand those infographics (Table 1).

Table 1. General characteristics of COVID-19 Infographics in Saudi Arabia, posted during the first 6 months of the year 2022. (n=166)

Variables	Number	Percentage
Month Posted		
- January	87	52.4
- February	50	30.1
- March	18	10.9
- April to June	11	6.6
Infographic affiliation		
- Ministry of Health	156	94.0
- Other Sectors	10	6.0
References/sources mentioned (Yes)	129	77.7
Text		
- Text light	73	44.0
- Text heavy	93	56.0
Have Graphics (Yes)	93	56.0

Have an introduction sentence (Yes)	156	94.0
Structure		
- Abstract	114	68.7
- Structured	52	31.3
Standalone (Yes)	144	86.8
The Tweet heads for		
- Initiate beneficial action	79	47.6
- Beneficial interaction	59	35.5
- Detrimental interaction	13	7.8
Target Audience*		
- Public	166	100.0
- Healthcare Workers (HCWs)	102	61.5

**All infographics targeted the public, 102 of them targeted both the public and healthcare workers.*

Table 2 displays the Infographics Domains. A total of 138 (83.1%) infographics included data or information, while 96 (57.8%) focused on the preventive aspects of Covid-19.

Table 2. Infographics Domains* (n=166)

Variables	Number	Percentage
- Data/Information	138	83.1
- Prevention	96	57.8
- Clinical Picture	14	8.4
- Treatment	5	3.0
- Transmission	1	0.6

**Some infographics had more than one domain*.

On analyzing the topics for prevention addressed by the infographics, the majority [67 (69.8%)] focused on vaccination (Table 3).

Table 3. Infographics included Prevention topics. (n=96)

Prevention (n=96)	Number	Percentage
- Vaccination	67	69.8
- Face Mask	13	13.5
- Social Distancing	9	9.4
- Hand Hygiene	7	7.3

**Some infographics related to the prevention domain included more than one prevention aspect.*

Table 4 details the engagement metrics of COVID-19 Infographics. The median (IQR) of the likes was 581.0 (261.0-1158.0), while the mean (SD) was 823.4 (771.4). For retweets, the median (IQR) and mean (SD) were 349.0 (166.0-796.0) and 558.2 (607.89) respectively.

Table 4. Engagement metrics of COVID-19 Infographics.

Engagement metrics	Statistics
Likes	
- Median (IQR)	581.0 (261.0-1158.0)
- Mean (SD)	823.4 (771.4)
- Range	88-7263
- Frequency (%)	
- ≤500	77 (46.7)
- 501-1000	25 (15.2)
- >1000	63 (38.2)
Retweet	
- Median (IQR)	349.0 (166.0-796.0)
- Mean (SD)	558.2 (607.89)
- Range	63-6163
- Frequency (%)	
- ≤500	92 (55.8)
- 501-1000	54 (32.7)
- >1000	19 (11.5)
Quotes	
- Median (IQR)	12 (4.0-36.0)
- Mean (SD)	47.7 (142.21)
- Range	0-1390
- Frequency (%)	
- ≤10	73 (46.2)
- 11-30	41 (25.9)
- >30	44 (27.8)

The tweets quotes had a statistically significant association with the number of likes and the number of retweets (Table 5).

Table 5: Linear Regression of variables affecting Tweets Quotes

Variable	Coefficient	Std Error	F-test	P-Value
Likes	-0.153	0.044	11.8786	<0.001
Retweets	0.379	0.056	45.6126	<0.001
CONSTANT	-39.761	10.414	14.5774	<0.001

Correlation Coefficient: r^2=0.69

Graphic representation (p<0.0001) and text density (p=0.001) were statistically significantly associated with the number of likes for the infographics. Similarly, graphic representation and text density were statistically significantly associated with the number of retweets and number of quotes (Table 6).

Table 6. Adjusted multivariate logistic regression analyses for factors associated with high Likes, Retweet, and Quotes of the COVID-19 Infographics in Saudi Arabia.

Variable	aOR	95% CI	Coefficient	S. E.	Z-Statistic	P-Value
Model 1: Infographics attained higher Likes						
- Detrimental interaction **(Yes/No)**	5.92	1.28-27.32	1.778	0.78	2.2788	0.023
- Graphic representations **(Yes/No)**	0.13	0.04-0.37	-2.063	0.55	-3.7780	<0.001

- Source of the Infographic **(Others/MOH)**	0.08	0.01-0.89	-2.591	1.26	-2.0506	0.040
- Structure of the Infographic **(Structured/Abstract)**	0.47	0.17-1.30	-0.748	0.515	-1.4541	0.146
- Target Audience **(Public and HCWs/Public)**	3.50	1.33-9.24	1.253	0.496	2.5278	0.012
Text Density **(Light/Heavy)**	0.20	0.08-0.50	-1.604	0.460	-3.4862	0.001
Model 2: Infographics attained higher Retweets						
- Detrimental interaction **(Yes/No)**	3.18	0.76-13.33	1.156	0.7314	1.5808	0.114
- Graphic representations **(Yes/No)**	0.09	0.03-0.25	-2.425	0.5207	-4.6582	<0.001
- Source of the Infographic **(Others/MOH)**	0.06	0.01-0.65	-2.823	1.2219	-2.3106	0.021
- Target Audience **(Public and HCWs/Public)**	4.30	1.67-11.07	1.458	0.4827	3.0200	0.003
- Text Density **(Light/Heavy)**	0.26	0.11-0.64	-1.339	0.4585	-2.9206	0.004
Model 3: Infographics attained higher Quotes						
- Graphic representations **(Yes/No)**	0.35	0.14-0.85	-1.064	0.4588	-2.3186	0.020
- Source of the Infographic **(Others/MOH)**	0.11	0.01-1.11	-2.198	1.1745	-1.8717	0.061
- Target Audience **(Public and HCWs/Public)**	5.02	2.04-12.36	1.614	0.4597	3.5097	<0.001
- Text Density **(Light/Heavy)**	0.29	0.13-0.65	-1.246	0.4174	-2.9849	0.003

Abbreviations: aOR= adjusted odds ratio; SE= standard error; CI= confidence interval.

4. Discussion

In public health emergencies such as a pandemic, effective communication is vital to keep the public updated about the disease situation, motivating them to adopt preventive measures and reassuring them that the government is in control of the outbreak (Zhao et al., 2020). Timely dissemination of accurate and reliable information is essential for effective communication. The advancement of digital communication technologies, such as social media, has significantly facilitated the sharing of information among both public health authorities and the general public (Alhassan & AlDossary, 2021).

Social media has experienced rapid growth in recent years, becoming a prominent platform for both individuals and healthcare organizations to communicate and share information. This development has facilitated two-way communication and direct engagement with audiences (Moorhead et al., 2013). In the realm of health education and promotion, the effectiveness of social media has been well-established, providing access to information, delivering health campaigns, and offering social support (Korda & Itani, 2011). Notably, various government agencies and public health organizations, including the WHO, CDC, and local health departments, have embraced social media as a means to enhance their communication with the public (Tang et al., 2018).

Social media presents a valuable tool for effectively disseminating outbreak-related updates and critical information to the public. Research indicates that people frequently rely on social media for information during infectious disease outbreaks, which can

influence their decision-making and subsequent behaviors (Alhassan & AlDossary, 2021). The WHO calls for more proactive use of social media to disseminate health messages to journalists, physicians, and the general public, particularly to counteract misinformation regarding infectious diseases (World Health Organization, 2021).

With over 15 million Twitter users in Saudi Arabia (Clement, 2018), the social media platform Twitter offers a chance to investigate how the Saudi MOH utilizes social media for crisis communication during pandemics. Therefore, in our study, we compared their use between the Saudi Ministry of Health and other private health care sectors in Saudi Arabia.

Our study provides insights into the distribution and characteristics of tweets related to COVID-19 infographics and their features. The majority (94%) of the infographics included in our study belonged to the Saudi Ministry of Health. Thus, the Ministry of Health was the main contributor to COVID- 19 related infographics, while other institutions had very few infographics on the topic. This can be explained by the fact that the Ministry of Health is the main health care provider and was alone managing the COVID-19 pandemic throughout the Kingdom. A recent study conducted in 2018 focused on the assessment and evaluation of health education infographics posted on the Twitter accounts of major health care institutions in Saudi Arabia (Jahan et al., 2020). In this study, a total of 297 infographics were evaluated. The highest re-tweets (524), likes (605), and replies (226) were received by government organizations. Government hospitals had the highest percentage (93%) of 'high-quality' infographics. Government institutions were assessed as having better quality infographics than private hospitals (Jahan et al., 2020).

Our study showed a decreasing number of infographics with the passage of time. This can be attributed to the control of the pandemic and the lifting of precautionary restrictions by the government.

Over half (56%) of the infographics examined in our study were deemed text-heavy, containing more than 50% of the content as text. This dense text arrangement might result in a crowded infographic, potentially making it challenging for the target audience to comprehend. Our inferential analysis further indicates a correlation between text density and the number of likes, retweets, and quotes received by the infographics.

In the current study, the majority of the infographics focused on vaccination which can be explained by the fact that currently, the focus of prevention for COVID-19 is vaccination.

Our study encountered several limitations. Firstly, due to restricted access to infographics before January 2022, our sample size remained moderate. Additionally, the study was conducted after the control of the COVID-19 pandemic, which limits the representation of topics addressed throughout the entire pandemic period. Another constraint is the absence of an assessment of the quality of the infographic contents.

Further research is required to evaluate the content of infographics and their influence on the knowledge, attitudes, and behaviors of the target audience. Additionally, there is a need to involve institutions beyond the Ministry of Health in health education activities, particularly on social media. Furthermore, continuous reminders about COVID-19 preventive measures like hand hygiene and face mask usage should be posted for the general population.

5. Conclusion

In conclusion, there is a lack of studies evaluating the usage of social media platforms and infographics in Saudi Arabia during the COVID-19 pandemic. This study aimed to assess the community's response to COVID-19 infographics posted on the official Saudi Ministry of Health accounts and other private and governmental health care sectors. The study employed a cross-sectional design, collecting and analyzing COVID-19 infographics from major government and private healthcare institutions in Saudi Arabia through their Twitter accounts. A total of 166 infographics were reviewed, and the majority (94%) belonged to the Saudi Ministry of Health, which played a significant role in managing the pandemic.

The study found that over half of the infographics were text-heavy, potentially making them less understandable to the target audience. The inferential analysis showed a correlation between text density and the number of likes, retweets, and quotes received by the infographics. Most infographics focused on vaccination, reflecting its importance as the main preventive measure for COVID-19.

However, the study had limitations, including a moderate sample size due to restricted access to infographics before January 2022 and being conducted after the pandemic was controlled. Additionally, the study did not assess the quality of infographic content.

Further research is needed to evaluate the content of infographics and their impact on the target audience's knowledge, attitudes, and behaviors. It is also important to involve institutions beyond the Ministry of Health in health education activities, particularly on social media, and continue posting reminders about COVID-19 preventive measures for the general population.

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