

**Technology in response to the pandemic:  
A social network analysis of Qataris' attitudes towards the  
COVID-19 mandatory tracing app**

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**Abstract:**

**Purpose:** This study aims to explore Qatari public perception of EHTERAZ, a compulsory government-backed contact tracing application, by performing a sentiment analysis of tweets pertaining to this app.

**Methods:** The software NodeXL was used to conduct a social network analysis of 8061 tweets which were collected over the period of four weeks in May 2020. Further, we also conducted a sentiment and thematic analysis of the tweets using the MAXQDA software.

**Results:** Our results revealed that EHTERAZ conversation resembled a community cluster network as we found multiple smaller groups around a few hubs. The results, also, confirmed non-Qatari foreign polarized crowds that attempted to diffuse fake news concerning the EHTERAZ app. The study found that Qatari individuals' sentiments towards EHTERAZ were mostly neutral then negative.

**Conclusion:** Despite EHTERAZ was developed primarily to reduce the spread of COVID-19 virus, social network analysis of tweets revealed ethical, social, political and economic critical issues, including privacy concerns, foreign disinformation, and digital inequalities. Policy makers are strongly recommended to have a clear plan regarding combating foreign propaganda, disinformation, and fake news.

**Keywords:** COVID-19; Contact-tracing apps; Privacy; Digital inequalities; disinformation.

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## **1. Introduction: Digital health technologies as a COVID-19 global containment strategy**

The COVID-19 pandemic has brought on severe global social, economic and health crises, with governments around the world seeking to implement regulations to reduce the spread of COVID-19 pandemic through measures, such as, shutting down schools, restrictions on gatherings, emergency funds towards healthcare, travel limitations and the introduction of contact tracing (i.e., Hale et al., 2021; Kozyreva et al. 2021; Williams et al., 2021; Samuel et al. 2022; Chen et al., 2020; Moradzadeh, 2020; Salman et al., 2020).

As COVID-19 has caused a significant worldwide public health crisis, numerous countries have decided to use technology to reduce the spread of the COVID-19 virus by flattening the curve and reinforcing trust among citizens (Leite et al., 2020; Blasimme et al., 2021). i.e., Qatar (EHTERAZ), the US (HealthLynked COVID-19 Tracker), Singapore (TraceTogether), Bahrain (BeAware), Iceland (Ranking C-19), UAE (TraceCovid), Mexico (Covid Radar. MX) and Morocco (Wiqaytna) to track infected individuals as part of measures to prevent the spread of COVID-19 (Almalki & Giannicchi, 2021; Lee et al., 2021). Mostly these apps require consent on sharing Bluetooth and phone location with a second party (Azad et al., 2021; Lenert & McSwain, 2020). COVID-19 contact tracing technologies can “identify people or contacts who may have encountered infected people, trace the virus transmission chain by collecting data on people’s movements and contacts and give information on the pandemic” (Kurtaliqi et al., 2021, p.1).

COVID-19 has accelerated the rise of digital health technologies in the fight against the ongoing pandemic (Williams et al., 2021). The adoption of contact tracing applications has proved



beneficial, there have been plenty of setbacks, especially with regards to individuals. Yet, despite deploying mobile health applications to help in controlling and managing contagious diseases, these applications raise significant moral concerns and ethical challenges. Specifically, there is increasing concern that “the temporary restrictions that digital surveillance entails could lead to a more permanent suspension of rights and liberties and could have some unintended consequences” (Lucivero et al., 2020, p.2). On the other hand, digital automated contact-tracing apps have several advantages over traditional contact-tracking system in the case of the COVID-19 pandemic including, accuracy, speed and automating a labor-intensive practice in a situation where there is a scarcity of human contact tracers (Lucivero et al., 2020; Parker et al., 2020). Overall, most COVID-19 contact-tracing apps use Bluetooth proximity and Global Positioning Systems (GPS) technology (Oliver et al., 2020). Deploying Bluetooth technology signal strength assists to detect distance between smartphones and to define exposure status based on distance and duration of proximity to an infected individual (Kleinman and Merkel, 2020; Garrett et al., 2021). Alternatively, location-based tracing apps use Global Positioning System (GPS), mobile phone network data, Wi-Fi signals and mobile sensors to determine the geolocations of users and proximity to infected individuals (Kleinman and Merkel, 2020).

In Qatar, the first appearance of EHTERAZ as a contact tracing app on twitter was on April 9, 2020, when the Assistant Foreign Minister, Lolwah AlKhater tweeted: “Soon & after weeks of collaborative work @MOTC\_QA, @MOPHQatar, an Android & IOS compatible app #EHTERAZ (Means Precaution😊) will be launched. Helps you & medical teams better identify #COVID19 transmission chains & accelerates medical help”, (@Lolwah\_Alkhater, 2020). This tweet passed without much attention, until May 18, 2020, when the Qatari Cabinet issued a

decision requiring all citizens, residents, and visitors to activate EHTERAZ application whenever they leave their houses. The decision was effective from Friday, May 22, 2020 until further notice, a violation may result in imprisonment of up to three years and/or a fine of up to QR 200,000 (Varghese, 2021). At that time, interactions around the application intensified, especially through social networking sites.

Our research main objective is to explore Qatari public health views of using digital contact tracing app to support the ‘test, track and trace’ approach of reducing the spread of COVID-19. Specifically, how Qatari individuals viewed enforcing EHTERAZ during the first days when it became mandatory to download the app and failing to do so might result in a severe fine of up to \$55,000 and up to three years in jail. Further, while great effort can be seen in COVID-19 mobile apps and ethical concerns, less is known about what cause some individuals or organizations to share fake news about local and foreign COVID-19 mobile apps (i.e., Cheng et al., 2021). In contrast to previous research that focused on exploring views and experiences concerning adoption of COVID-19 mobile tracing apps, our research seeks a more nuanced understanding to what extent spreading disinformation impacts individuals’ willingness to use COVID-19 mobile tacking apps. In addition, this study aims to explore to what extent digital inequalities impact segments of the population that suffer from the access to digital services, including seniors, low-income migrants. The following section describes the context of this study and highlights ethical concerns people have about COVID-19 mobile tracing apps

## **2. Ethical Concerns with mobile tracing applications**

### **2.1. Privacy Concerns**

Despite mobile tracing applications having been leveraged in several ways to reduce the spread of COVID-19, there were serious ethical concerns about the privacy of such tracing apps, which undermines its acceptance among targeted population. (Kato et al., 2021; McCarthy et al., 2021; Nguyen et al., 2021; Trestian et al., 2021).

Using mobile phone tracing apps to force intelligent social distancing raises key ethical concerns (Parker et al., 2020; Williams et al., 2021 et al., 2021). The policy decisions made by governments around the world regarding the use of mobile apps in the context of COVID-19 to enable rapid contact tracing “have been inevitably varied as what is socially and culturally appropriate will differ across the globe” (Parker et al., 2020, p.428). For example, the main common characteristics of East Asian and Gulf countries’ COVID-19 tracing apps, include mandatory use, centralized protocols, and GPS and Bluetooth for location tracking. Such features are incompatible with several Western legal provisions and ethical standards due to the high value of individual privacy (Blasimme et al., 2021).

In the Middle East and North Africa region, the security issues of deploying contact tracing applications have been exceptionally troublesome where there was a “ notable lack of transparency in both their technical design and regulatory mechanisms” (Shea, 2021. p.4). Furthermore, these applications’ mandatory implementation has created a kind of discrimination issue due to the inaccessibility of technology amongst certain social groups, this inequality had been more apparent when the applications were not supported on older devices, which meant that low-wage immigrants had to either purchase new devices, or risk the possibility of fines and other legal implications (Shea, 2021).

Existing studies revealed that privacy concern is the main issue that prevents people from adopting digital contact tracing



applications (i.e., Trestian et al., 2021). Several studies have been conducted to examine the views and experiences concerning adoption of COVID-19 mobile tracing app amongst people in various countries. In Ireland, for instance, the Irish health service (HSE) conducted a study to assess the Irish public sentiment towards privacy regarding the HSE COVID-19 tracker app. The HSE tracking app came under significant criticism for failing to address privacy concerns. Further, the findings revealed a mostly positive attitude towards deploying technology to fight COVID-19. (Lohar et al., 2021). Samuel et al. (2022) aimed to analyze the British public sentiment towards privacy and COVID tracker app to support the ‘test, track and trace’ approach. The results showed British citizens’ range and degree of understandings, misconceptions, and ethical concerns of using tracing app. Some individuals were very supportive of using the tracking app. Alternatively, members of the British public were extremely cautious about using the contact tracing app (Samuel et al., 2022). Further, Kozyreva et al. (2021) explored the psychological factors that contribute to the German public adoption of digital contact tracing apps and found that trust in the security of COVID-19 tracing app plays a significant role in its uptake. In addition, Kurtaliqi et al. (2022) explored to what extent trust in a government impacts citizens’ acceptance of a mobile tracing app and concluded that having trust in the government can help to reassure people and make them feel that the government is doing its best to end the pandemic.

## **2.2. Disinformation and Social Media wars**

The Covid-19 pandemic has heightened the importance of developing effective tools to flag COVID-19 related disinformation and fake news (Hossain et al. 2020). Lazer et al. (2018) p. 1094 defined fake news as “fabricated information that mimics news media content in form but not in organizational

process or intent” and argued that fake news overlaps with “misinformation (false or misleading information) and disinformation (false information that is purposely spread to deceive people)”. Overall, the glut of information has caused greater confusion and inability to gain knowledge for the wider audience. This has raised serious doubts, requiring new novel approaches to understanding the process of fake news dissemination (Cheng et al., 2021). In the context of a global health crisis, such as, the COVID-19 pandemic, there are several key benefits of social media platforms (Pennycook et al., 2020). Specifically, these benefits include the distribution of new information, the rapid dissemination of information at low cost, and the ability to reach a much larger audience (Ferrara et al., 2020). Nonetheless, it is also crucial to consider some of the limitations of social media in health crisis settings. Perhaps one major consequence of information overload is difficulty with filtering information and disseminating fake news (Cuellar-Garcia et al., 2020).

Despite the spread of fake news on COVID-19 can lead to people being endangered, research is still lacking about the nexus between COVID-19 fake news and Twitter. According to Vosoughi et al. (2018), on Twitter false information is retweeted by many more users than true information. In fact, “falsehood diffused significantly farther, faster, deeper, and more broadly than the truth in all categories of information, and the effects were more pronounced for false political news than for false news about terrorism, natural disasters, science, urban legends, or financial information” (Vosoughi et al. 2018) p. 1146. There is little evidence, however, that researchers have approached fake news detection techniques on Twitter about COVID-19 (Hossain et al. 2020). Much of twitter’s fake news traffic is generated by non-human agents, known as social bots, to



deliberately misinform people and agitate online discussion (Nyilasy, 2019; Sayyadiharikandeh et al., 2020).

Deliberate disinformation campaigns managed by foreign countries and agencies on social media could cause threats to a country's institutions. For instance, the Social Media War in the Middle East was a main feature of “the Qatar diplomatic crisis” stated in 2017. The Arab quartet escalated political, economic, and social pressure on Qatar, and anti-Qatar social media campaigns were the result, not the cause, of this standoff. Quartet anti-Qatar propaganda and disinformation on Twitter was so rife that “Qataris simply did not know what was real and what was manufactured by the country’s rivals” (Byman, 2021) p.458.

### **2.3. Digital divide**

Digital exclusion is not a new phenomenon. The different forms of digital inequalities can deepen differences within societies as they can either limit or enhance citizens’ social and economic (Ragnedda and Muschert, 2013). The COVID-19 pandemic has clearly shown the digital gap and vulnerability of many citizens of developing countries. Generally, the digital divide can be defined as the difference between individuals regarding” technological tools and services such as mobile telephony, computers and the internet that generates an inequality of opportunities” (Esteban-Navarro et al., p. 54). Notably, despite digital inequalities existing before COVID-19 crisis, the pandemic is exacerbating the digital gap. The digital divide represents “a major risk factor of vulnerability for exposure to the virus itself, and for the non-sanitary consequences of the crisis” (Beaunoyer et al.,2020, p.1). Yet, the impact of digital gap on COVID-19 vulnerability should be central in the governmental policies and responses (Beaunoyer et al., 2020). It is also worth stressing that there are various types of digital gaps





concerning including, mental obstacles, material barriers, and usage difficulties (Cheshmehzangi et al. 2022). The factors affecting the digital divide can include “sociodemographic, socioeconomic, personal elements, social support, type of technology, digital training, rights, infrastructure, and large-scale events”. (Lythreatis et al.,2021, p.1).

The digital divide does not occur solely due to inaccessibility to digital mobiles and Internet. Rather, in rural areas of developing countries, digital gap is a key indicator to the lack of resources and social security, and contributes directly to less access to quality education, health, and social facilities for those living in these areas (Aziz et al., 2020). Overall, age, income, and education are the most influential factors that impact digital skills and knowledge (Song et al. 2021). Nonetheless, low socioeconomic status has been considered by researchers as the main source of digital divide (i.e., Aziz et al., 2020; Yoon et al., 2020; Song et al. 2021). Yet, in the wake of the COVID-19 crisis, the pandemic not only accelerated the pace of digital technology utilization but also deepened the age-related digital inequalities (Yoon et al., 2020). Specifically, older individuals, people from minorities, and individuals of low socioeconomic status have been disadvantaged in using digital technologies to seek health information, during the COVID-19 pandemic, compared to other segments of the society (Yoon et al.,2020).

Despite in resource-rich Gulf countries, digital infrastructures is well developed (Waqas et al., 2021), there are segments of the population that lack the access to digital services, including, seniors, women, low-income migrant workers (Whaibeh, 2022). For example, a gender-based digital gap was further exacerbated due to the pandemic as females in, Arab countries, have restricted digital access to health services and information (Waqas et al., 2021; Whaibeh, 2022).



### **3. Methods**

Twitter platform is one of the most used social media platform among the citizens of the Gulf States and has become a primarily social space for publicly expressing thoughts and feelings and interacting with friends and family in those countries' communities. Data extracted from Twitter have the potential to reveal public attitudes regarding mobile tracing apps in Qatar (Reyae, S. & Ahmed, A., 2015).

To achieve the research objectives, our study followed a mixed integrative approach that included both social network analysis and qualitative data analysis. Our data were extracted from Twitter and were analyzed using NodeXL and MAXQDA. Notably, NodeXL has been recently used by researchers to map, explore, and measure social media content during natural disasters in order to identify user interaction of communities. In fact, NodeXL is an efficient tool for collecting, analyzing, visualizing, and reporting on the patterns found in streams of social media, including, Twitter (Ahmed & Lugovic, 2019). On the other hand, MAXQDA is a computer-assisted software designed to explore and analyze qualitative findings, including text, video, and photo that assists in explaining social and cultural phenomena (Marjaei, Yazdi & Chandrashekar, 2019).

For the sake of social network analysis purposes data were collected by NodeXL over the period of four weeks in May 2020, corresponding to the time the Qatari mobile tracing app EHTERAZ announced to become a mandatory to download. In total, 8061 tweets included the Arabic and English spelling of EHTERAZ. Notably, NodeXL was used to identify the network structure, most influential users, top mentioned users, key hashtags, and top word pairs. Overall, crowds and conversations on Twitter can take many forms, however, the structures of twitter crowds and conversations can be classified into six different structures networks, namely, polarized crowd, tight

crowd network communities, brand clusters, community clusters, broadcast networks, support network (Smith et al., 2014).

Further, for the sake of conducting sentiment and thematic analysis, MAXQDA was used to analyze Qatari public health views towards EHTERAZ during the month of enforcing the COVID-19 tracker app.

Based on the most common sentiment labels, namely, positive, negative, and neutral; the tweets were labelled positively if they expressed positive feelings and thoughts, approved, and applauded the efficacy of the application and its mission. Tweets expressing negative feelings and thoughts, issues and difficulties faced annoyance and doubt about the application and its mandate, technical errors, problems and difficulties when using the application were given negative labels. Those tweets containing neutral feelings were labelled neutral, such as those asking questions or giving advice or suggestions.

To effectively explore individuals' views regarding EHTERAZ, two authors independently and blindly coded and categorized each Tweet into specific categories manually. It is also worth stressing that we used inductive thematic analysis inductively by getting familiar with the data, creating initial codes, identifying themes, examining themes, naming themes (Braun and Clarke 2006) to develop a comprehensive view that clearly shows what Qatari individuals think of EHTERAZ tracing app. Since the researchers are fluent in both languages, the Arabic tweets were directly analyzed by reading and assigning them the appropriate code in English.

## **4. Results**

### **4.1. Social Network Analysis**

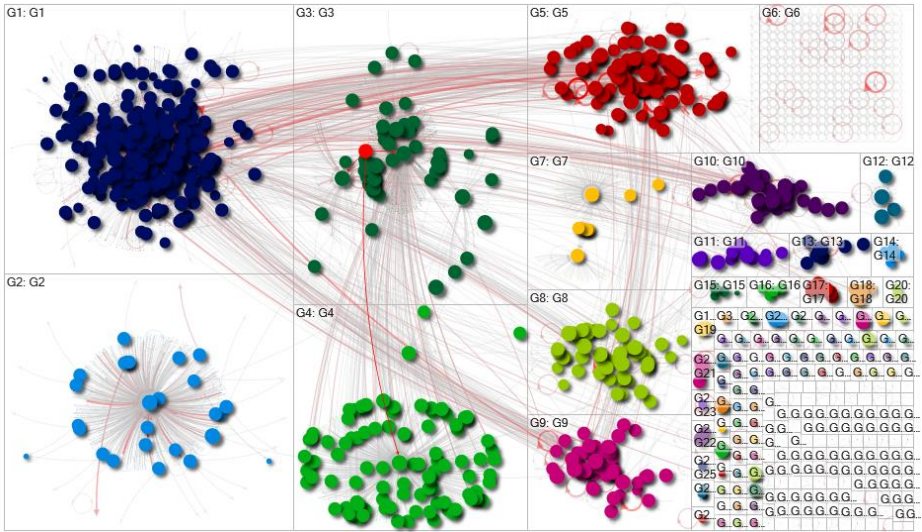
Social network analysis not only helps to extricate relationships and interchanges via visual mapping, but also assists in detecting



prominent and key players in a particular social media network. Figure 1 shows the users form communication networks by tweeting, commenting, and retweeting messages that contain the keyword “EHTERAZ” during four weeks in May 2020, the circles are representing individual users, and lines between them are visualizing relationships, including, mentioning, retweeting, and replying. Influential users were identified and anonymized by providing a description of their accounts. It also shows how people connect themselves on Twitter, and how they grouped themselves while tweeting, we can see big groups like from G1-G9 and other smaller ones, by digging deeper in these groups we will be able to decide what kind of groups they are, who formed them and for what reason? The graph's vertices were grouped by clusters, using the Clauset-Newman-Moore cluster algorithm. The edge widths are based on edge weight values. The vertex sizes are based on betweenness centrality values. (5397) Vertices formed the network, with (8059) Edges, and (921) Self-Loops.

Figure 1 shows that the network is

**Figure 1: Network graph of people, groups of clusters and the direction of cluster communication of EHTERAZ**



Source: NodeXL, May 2020

Table (1) illustrates Twitter accounts mentioned most about EHTERAZ, with the total number of their followers. These accounts can be categorized into three main account types, namely, government, media, and local influencers. Specifically, there were three governmental organizations (Qatar’s Ministry of Interior, Qatar’s Ministry of Public Health, Qatar’s Government Communication and Office) and one governmental figure (Lolwah Alkhater, the Assistant of Foreign Ministry of Qatar). Regarding media, our results showed that Qatar News Agency, Qatar National Television, Qatar Media Corporation, and a Qatari columnist were always involved in the discussion on EHTERAZ. As for locals, only two people were frequently



mentioned, one with 362.7K followers and another with a suspended account.

**Table 1: Top 10 accounts mentioned on Twitter # EHTERAZ**

Rank	Account type	Followers
1	Qatar's Ministry of Interior	937.0K
2	Qatar's Ministry of Public Health	377.7 K
3	Qatar's Government Communications Office (GCO)	213.0K
4	Qatari Citizen (@hamadlahdan)	362.7K
5	Qatar Television	329.7K
6	Qatari columnist	69.0K
7	Qatar Media Corporation's official account for awareness and updates regarding #COVID19	14.7K
8	Qatar News Agency	470.9K
9	The Assistant Foreign Minister of Qatar	235.5K
10	Qatari Citizen (@AbdulazizSay)	-

*Source: Analysis of data collected using NodeXL, May 2020*

Due to the increased amount of information passing through a user with higher betweenness centrality, it is more likely to control the network.

**Table 2: Top 10 users ranked by betweenness centrality extracted from the social network analysis**

Rank	Account type	Followers
1	Foreign social media influencer	1.4 M
2	Foreign government institution	617.5 K
3	Qatari columnist	69K
4	Qatari resident	8597
5	Qatari Public figure	30.3K
6	Unknown	<b>Account suspended</b>
7	Qatar News Agency	470.9K
8	Unknown	<b>Account suspended</b>
9	Qatari Media Personality	264.2K
10	Foreign Media & News Company	14 M

*Source: Analysis of data collected using NodeXL, May 2020*

Sorting by betweenness centrality yields a ranked list of the most influential and central people in this network. Due to their pattern of connections (and those of others), these users are strategically positioned within the network (Smith, M. A., et al., 2014). Our results showed that several twitter accounts that contributed extensively to the discussion about EHTERAZ were foreign (not Qatari) twitter accounts, We learned this by examining the names of the accounts, their locations, and looking into the contents of these accounts and the nature of their content; Many of them are displaying their locations, country names, flags, or pictures of their rulers, they also use similar language, or retweeting the same tweet. Table (2) extracted three main types of account users involved in arguing about EHTERAZ, namely, Qatari accounts, non-Qatari foreign accounts, and unknown accounts. Qatari local accounts include Qatar News Agency with 470.9K followers, Qatari Media Personality with 264.2K followers, Qatari columnist with 69K

followers, a Qatari public figure with 30.3K followers, and a Qatari resident with 8597 followers. Furthermore, foreign governmental institution, foreign media and news company, foreign social media influencer with followers of 617.5K, 14M, and 1.4M, respectively, and unknowns accounts (suspended later on) were also in the top 10 of those who participated in presenting views concerning EHTERAZ. The foreign non-Qatar accounts were perceived as accounts with a mission of spreading fake news and disinformation about EHTERAZ. This was evident in the nature of the posts submitted under the Ehteraz hashtag. In these accounts, rumors were spread regarding the application's purpose, which is to spy on users and access their private information. Overall, It should be acknowledged that our data were collected during the Qatar-Gulf crisis or what is known as Qatar blockade at that time that other Gulf countries extensively used social media platforms, including, Twitter to channel propaganda against Qatar. However, while writing this report, Qatar reconciled with the countries involved in the campaign to defame the application, so the research team was reluctant to reveal the names of these countries.

Many Local citizens and residents of Qatar were participating in the discussion but they are not ranked in the top 10 lists, their points of view and attitude toward the app will be presented and discussed in the following parts.

#### **4.2 Content and Sentiment Analysis**

In Figure (1), the layout of the sociogram is presented as groups. The results clearly show that G2, G3, and G4 have no connections with other groups, by checking their content, we found that they are foreign groups are spreading fake news and disinformation and using EHTERAZ app debate for foreign political agenda (Qatar political crisis). The top word pairs used



in these groups are (malicious, espionage\_project), (spy, app), (EHTERAZ, spy), (force, fine), (malignant, citizens).

Table 3 shows the most popular word pairs used by G1 (Qatari local accounts) during the study period. The highest top word pairs in Tweet were App and EHTERAZ, with 716, followed by outing and home that appeared 184 times. The third top word pairs were smart and phones, with 174 times.

**Table 3: Top word pairs extracted from Qatari local twitter accounts**

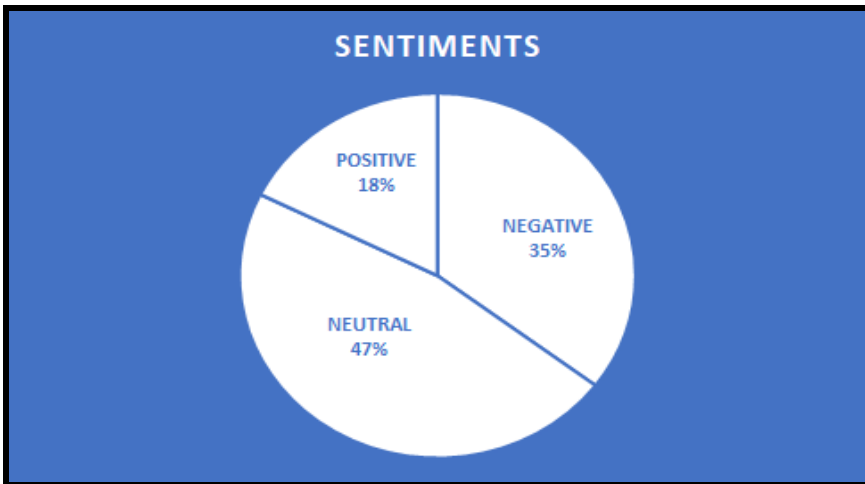
No	Top Word Pairs	Top Word Pairs (Translated to English)	Count
1	تطبيق, احترام	app, EHTERAZ	716
2	الخروج, المنزل	outing, home	184
3	الهواتف, الذكية	smart, phones	174
4	الذكية, الخروج	smart, outing	167
5	تطبيق, #احتراز	app, # EHTERAZ	162
6	المواطنين, والمقيمين	locals, residents	159
7	بتثبيت, تطبيق	installation, app	153
8	والمقيمين, بتثبيت	installation, residents	150
9	برنامج, احترام	program, EHTERAZ	141

Determining the polarity of twitter data about EHTERAZ and classifying them into one of three categories such as positive, negative, and neutral, should help to understand the Qatari public sentiment towards EHTERAZ COVID-19 tracker app. The results show that Qatari individuals' sentiments towards

EHTERAZ were generally neutral in nature. Specifically, Figure 2 shows that 47% of the sentiments shared on Twitter were neutral, while negative sentiments were rated as the second highest with 35%. Further, positive sentiments were the least shared at only 18%.

The relatively predominant positive emotions could be attributed to the lack of knowledge about mobile tracing apps at that time. Negative emotions Qatari individuals expressed were mainly related to privacy concerns. In addition, a significant criticism towards the app was related to mobile phone devices' requirements to download EHTERAZ. In contrast, few segments of Qatari individuals expressed positive emotions towards EHTERAZ as a way of saving lives and reducing the spread of COVID-19 pandemic.

**Figure 2: Percentage of tweets in positive, negative, and neutral classes**

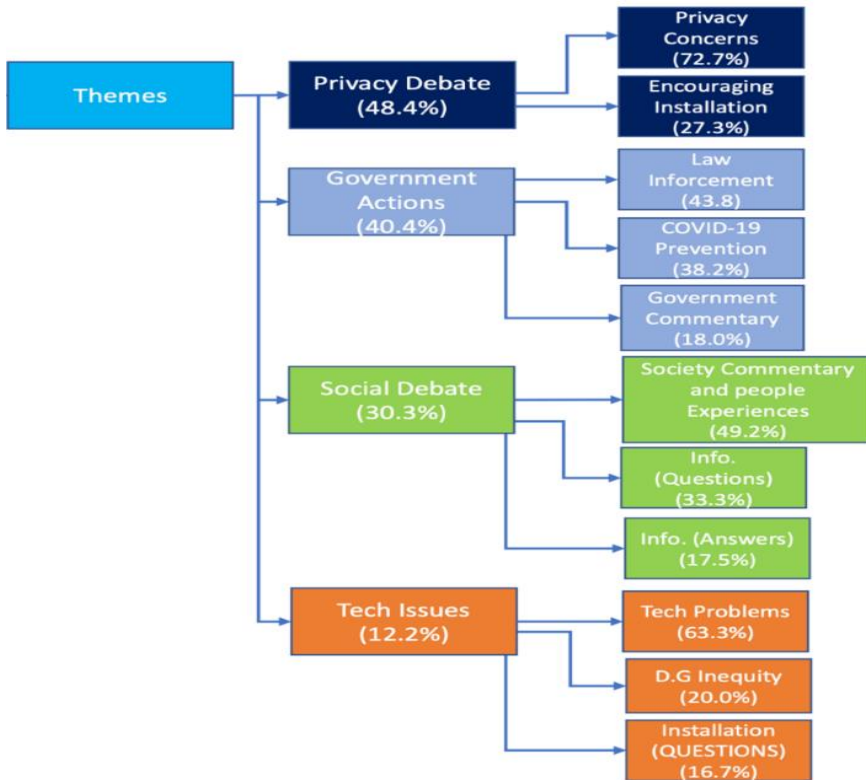


*Source: Adapted from MAXQDA analysis*

### 4.3. Thematic Analysis Results

Thematic analysis was conducted using MAXQDA software to get more insight into the themes emerging from the users' tweets on # EHTERAZ. The coding and clustering of users' tweets about EHTERAZ yielded four main themes (Figure 3). The most popular theme was "Privacy debate," with 48.4% of the sample expressed a significant criticism towards the app due to privacy concerns. Further, discussion about "Government actions," comprised about 40 % from total online conversation about EHTERAZ. Moreover, almost one-third of Qatari individuals' twitter debate about EHTERAZ was related to "Social issues,". Finally, "Technical issues," with only 12.2%, entailing the general mention of technology, its functions, and other tech-savvy information regarding using EHTERAZ.

**Figure 3: Illustration of the four extracted themes using the thematic analysis method**



*Source: Adapted from MAXQDA analysis*

The privacy debate represents the main discussion and debate theme concerning EHTERAZ enforcement. On this issue, a significant criticism raised by Qatari individuals indicated that the app could not be downloaded without giving EHTERAZ the permission to access to the mobile device files and photos. Figure 4 shows also that less than one-third of debating

regarding the privacy issue includes encouraging installation tweets and ensuing that EHTEARZ is a secure app.

“Government Actions” theme was the second topic Twitter users’ debate about concerning EHTEARZ. Figure 4 shows that the “Law Enforcement” sub-theme was the most mentioned topic within this category with almost 44% of the total discussion. Other sub-themes with the “Government Actions” include law enforcement, general law procedures regarding COVID-19, and EHTEARZ application. Discussions about the fine of up to \$55,000 or 3 years in prison as a penalty when not downloading the app and police inspections to confirm that all residents in Qatar are downloading EHTEARZ App were of the main topics within this category. The following sub-theme with 38.2% of the discussion was “COVID-19 Prevention”, were talking about government announcements and procedures concerning reducing the spread of COVID-19. The results show that “Government Commentary” was the third most discussed topic within this category. Within this topic, some Qatari officials interfered to clarify issues or reply to public debate such as when Amnesty’s security lab discovered of a critical weakness in the configuration of Qatar’s EHTEARZ contact tracing app. On this issue, according to Amnesty, the international non-governmental organization focused on human rights, Qatari authorities were quick to fix the configuration issue. Also, within this theme, almost 50 of the codes were related to “Society Commentary and People Experiences”. For instance, Qatari individuals shared within this theme some tricks to avoid allegations of privacy intrusion of the application. They also, shared some personal stories regarding the app when it comes to get to public places, such as, malls shops, and government buildings. The second sub-theme within this category was related to addressing individuals’ queries about technical, legal, and social aspects of EHTEARZ. The third sub-theme was related to individuals’ answers to technical, legal, and social queries raised by many local Qataris.

The results in Figure 4 clarify that technical issues were the fourth main topic Twitter users raised concerning EHTERAZ. Within this category, approximately 63% of the issues people debated about were related to technical issues. For instance, people were wondering about the technical requirements of mobile devices to download EHTERAZ, including, the device ability to support Android 6 and iOS 13.5 and later versions. The second and third sub-themes within this category were related to the digital gap and difficulties faced low-income workers and elderly people to install and download EHTERAZ.

## **5. Discussion**

Overall, we draw on insights from Qatari individuals' comments on twitter to explore how the Qatari public viewed EHTERAZ during the first days of enforcing the COVID-19 tracing app. We analyzed a total of 8061 original tweets reacting to EHTREAZ app over the period of four weeks in May 2020. Further, a sentiment and thematic analysis was conducted.

The Network appeared by discussing EHTERAZ on Twitter representing a “community cluster” structure. Nonetheless, “polarized crowds” can be clearly noticed.

Surprisingly, by examining the most influential users concerning EHTERAZ conversation, we found that foreign governmental accounts in the Gulf region were of most influential and highly mentioned accounts regarding discussion about EHTERAZ<sup>1</sup>. This shows how political propaganda and spreading fake news to influence other governments' internal decisions become a clear

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<sup>1</sup> Since the State of Qatar reached reconciliation with the countries that support the defamation campaign during the writing of this report, the research team was reluctant to reveal their names.

issue in politics. Finally, privacy debate, government's actions, social debate, and technical issues were the four main themes that were extracted. While concerns about privacy and technical issues regarding downloading and activating EHTERAZ were the most discussed topics.

Most people's sentiments about the app were primarily neutral, followed by negative, and a few were positive, meaning that people were in a state of anxiety, hesitation, and unable to determine their attitude toward the app. On the one hand, there are official assurances that the application is safe and does not threaten the privacy of users, and that it is necessary to confront the disease, and on the other hand, there are campaigns of skepticism and spreading rumors issued by parties outside the country, so positive feelings about the application were minimal.

Our study found that most views concerning EHTERAZ were neutral. Negative views towards the app represent almost one-third of the total view. Further, positive views towards EHTERAZ were the least with only 18% of the sentiments expressed positive towards the app mandatory action. On this issue, our study results confirm the findings of Lohar et al. (2021) who found that, in Ireland, sentiment analysis showed significant criticism towards the COVID-19 tracing app due to privacy concerns associated with using the app. The high negative sentiments towards the app could be reacted to the timing interval for collecting our data. We have collected our data during the first weeks the app became mandatory to download and activate EHTERAZ to get access to shopping malls and to government services. On this issue, Kozyreva et al. (2021) concluded that public acceptance of privacy-encroaching measures, in Germany, concerning COVID-19 tracing app decreased over the course of the pandemic. Similarly, Trestian et al. (2021) revealed that there has been a dramatic shift in the

attitude of the people in Ireland toward privacy during the pandemic and there was a significant increase in the willingness to share personal data for the sake of saving lives from 14% pre-pandemic to 61% during the pandemic.

Based on our thematic analysis, we found that almost half of the comments concerning EHTERAZ raised privacy concerns which is consistent with the result of Azad et al. (2021) who found that individuals all around the world showed significant concerns regarding the privacy-encroaching issues of track and trace apps, taking into considerations that some of these apps request permissions that may not be required for the successful operation of the app's function, including, getting access to storage media, camera, and microphone. Regarding the privacy issue, our study found that Qatar Government actions represented the second most discussed theme. This result contrasts several previous studies (e.g, Mayor, 2020; Yap & Xie, 2020; Zhang et al., 2021). The relatively high number of daily cases in Qatar during the early months of the pandemic necessities the government to have an action and make the digital tracing app (ALJAZEERA, 2020). Further, we believe that the large presence of Qatari government accounts and their participation in tweeting about EHTERAZ App indicates an indirect response to the rumors and false information that were broadcast by external accounts, the aim of which is to spread reassurance among the population and assure them that the application is safe and necessary to eliminate the pandemic.

Generally, our results confirmed that social debate theme was one of the main conversation topics among Qatari individuals. Qataris discussed on this theme various issues, including, community interactions, sentiments, and question-answer conversations concerning EHTERAZ issues such as seniors' struggle with technology and low-income workers ability to own



a mobile device that able to install EHTERAZ app were of the main conversation topics. Finally, the technical issues were the fourth main topic Qatari individuals' debate about. People were debating about older mobile devices that lack appropriate technology to run EHTERAZ. Further, EHTERAZ requesting permissions to access files and photos that might be necessary to the successful operation of the app also was an issue of debating on this theme. Moreover, people were debating about the possibility of outsourcing data to a third party. Our study findings agree the conclusion of Azad (2021) that despite there have been significant technological advancements to reduce the spread of COVID-19; mobile tracing apps require more technological enhancements to achieve its main goal in a privacy-aware manner. Overall, our study provides policymakers with significant insights concerning public views regarding digital mobile tracing technology usage to reduce the spread of COVID-19.

## **6. Conclusions, Limitations and Future Research**

Existing literature on Covid-19 tracing apps grappled with privacy issues (i.e., Kleinman & Merkel, 2020; Lucivero et al., 2020; Parker et al., 2020; Blasimme et al., 2021; Lohar et al., 2021; Samuel et al., 2022); public attitudes (i.e., Williams et al., 2021; Huang et al., 2022); psychological reassurance (i.e., Kurtaliqi et al., 2022); technical issues (i.e, Hernández-Orallo et al., 2020; Matt et al., 2022). This study contributes to the existing literature by exploring how disinformation and digital divide impact the adoption of COVID-19 tracing apps. Further, despite a growing body of research on COVID-19 tracing apps in Western societies, there is a lack of research regarding COVID-19 tracing apps in the Middle East and North Africa, including the Gulf countries.

Our result found that the Qatari public health views of using digital mobile technology to support the 'test, track and trace'

approach of reducing the spread of COVID-19 were not positive at the early stage that EHTREAZ was enforced. Specifically, our results showed a significant criticism expressed by Qatari people towards EHTREAZ mainly due to privacy concerns. Further, our study concluded that spreading fake news becomes a common issue within the global political ecosystem. Yet, understanding the fake news phenomenon and disinformation help policymakers to better plan how to combat fake news and disinformation.

Social media platforms should represent opportunities for governments to better contact and deliver public services. Our study revealed that when it comes to major events, the public go back to government social media accounts to get information and give feedback about governments' decisions. Government officials can obtain public feedback on what they decide. Perhaps the most influential role of using social media in government is to share critical information and to test public perception.

Generally, our study concluded that large inequalities of wealth within societies might create more problems than expected. In fact, the digital divide and inequality in access to technology, including smart phone devices, appear as a serious problem in many societies and countries. High economic inequality leads lower-income individuals not to own smartphones that support such Apps. The digital divide should motivate governments to take into consideration this segment of people while issuing orders necessitates individuals to own smartphones to get access to some of basic services such as food delivery or getting access to shops.



Despite the study providing interesting insights for researchers and public health officials, similar to any other research endeavor, it does suffer from certain limitations. Our findings should thus be interpreted in light of such limitations. Due to the sample's limited time frame, it may not be representative of the entire population, social networking platform Twitter is most popular social platform among citizens of the Arab Gulf states, including, Qatar. Exploring people's views using other platforms such as Facebook and Instagram might be useful. We collected our data about EHTERAZ during the very early stage when it became compulsory to download and install the app on smartphone devices. Finally, according to survey researchers, opinions are more difficult to measure than behavior because opinions include not just actions, but what people think. For the near future, it is unclear whether sentiment analysis or simple volume metrics (like retweets and mentions) are stronger indicators (Reveilhac, M., et al., 2022). Despite these limitation, our study provides policy makers and public health researchers with some insights regarding how to address people concerns, including privacy issues, and difficulties faced elderly people and low-income individuals while launching contact tracing applications. Technological literacy and difficulties facing elderly people while dealing with health digital mobile apps should be given more attention from researchers and health policy makers. Furthermore, enhancing transparency and data protection literacy should assist governments to motivate the public to use services that are offered through governmental apps.

We suggest that future research should explore how Qatari individuals perceive EHTERAZ after more than two years of its adoption. In addition, for comparison purposes future researchers should explore public sentiments towards mobile tracing apps in other Gulf states including, Saudi Arabia and United Arab Emirates. Future research also should attempt to understand to

which extent people trust in their governments and to examine how individuals perceive the privacy issue regarding digital tracing apps. Overall, our study contributes to the existing literature and provides official and policy makers with empirical insights towards the Qatari COVID-19 tracing app.

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